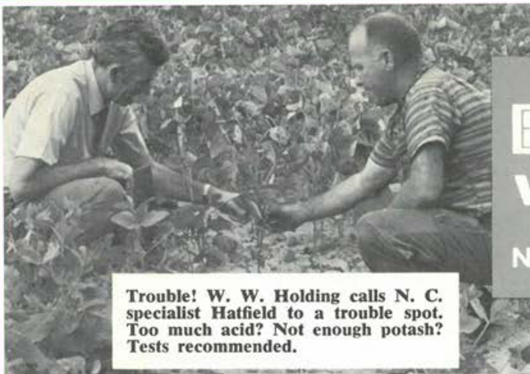
Better Crops WITH PLANT FOOD

NUMBER 1—1970 25 CENTS



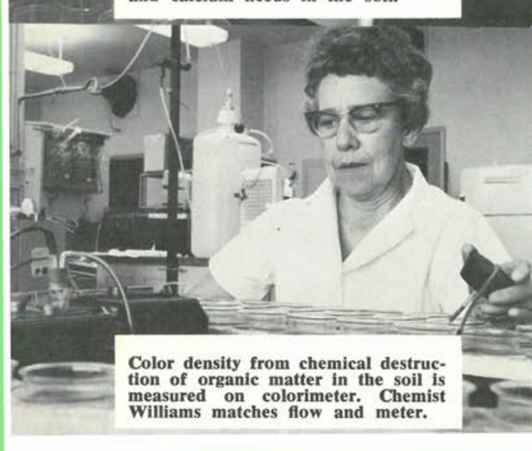
Trouble! W. W. Holding calls N. C. specialist Hatfield to a trouble spot. Too much acid? Not enough potash? Tests recommended.

A pH meter tells Chemist Bowling if the soil is too acid, below 7 value. Or too alkaline, above 7 value. The pH scale runs from 0 to 14.

Soil samples are given numbers and matched with your information. Technicians Wilder and Humphries start them on their way "by the numbers."

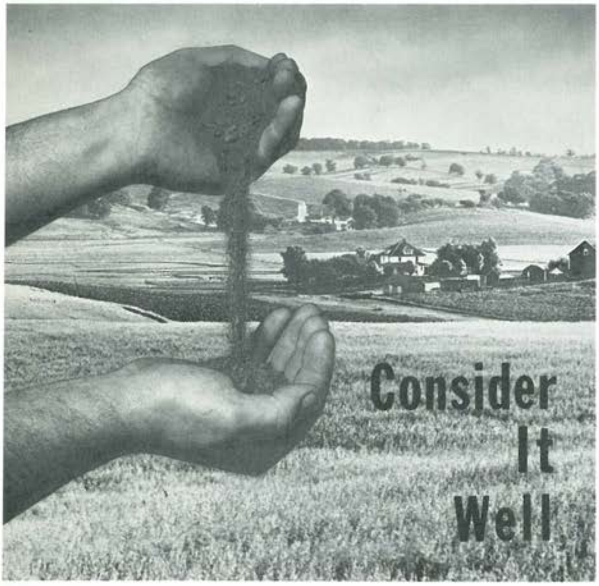
An electronic marvel of the lab—the atomic absorption spectro-photometer—uncovers magnesium, manganese, and calcium needs in the soil.

Chemist Johnson pours 12 of 36 samples into filters. Extract from this soil-acid mixture tells availability of 5 mineral elements in soil.



Color density from chemical destruction of organic matter in the soil is measured on colorimeter. Chemist Williams matches flow and meter.

The electronic farmhand must be checked out occasionally. Systems Analyst Thomason checks report with Soil Test Director Eaddy.



Consider It Well

AMERICA'S EYES have been on the "glamour sciences" in recent years. The wonders of medicine . . . of electronics . . . of moon landings . . . etc. And they are wonders!

But, down to earth, on hundreds of plots in many different kinds of soils, scientists who call themselves agronomists have also been at work. What they have done to keep these soils from wearing out equals any moon landing man will ever make!

The Soil Testing Division of North Carolina's Department of Agriculture (in action on the cover) symbolizes man's quiet mission not only to get most profitable return from his soil, but also to conserve its life-giving fertility.

Agronomist A. L. Hatfield tells the story of this trouble shooting program, starting on page 2. Similar programs operate out of university and industry labs across the land.

They don't make the headlines. CBS News Roundup never mentions them. The New York Times rarely gives them an inch. And agronomic research money is often cut to support more "popular" programs.

But they keep plodding—thank goodness! And out in America's pulselands, small newspapers still talk about soil with the reverence the National Association of Soil Conservation Districts has long displayed:

"Consider this soil. It lies as far as the eye can see. It covers millions upon millions of acres around the globe, yet it is a rare thing and cannot be replaced.

"This soil is a living thing, yet it can be destroyed.

"This soil is God's gift to mankind, given unto our stewardship, yet it can be despoiled and wasted.

"This soil is fruitful, yet it can become sterile.

"This soil produces crops and verdant grass and trees. It cannot be duplicated by chemistry or physics.

"This soil is an intricate house of myriad elements. Yet it is so commonplace as to be known as dirt.

"It fills the flowerpots in Baltimore, serves as a garden in Minnesota, and produces an orchard in California—this thing called soil.

"It is the spectacle of the Grand Canyon, the flatness of the plains, and the rolling convolutions of the Shenandoah Valley—this thing called soil.

"It is the source of our nourishment, it provides the means of our protection. God has willed we can live with it; we cannot live without it.

"Consider this soil. Consider it well."

Better Crops
WITH PLANT FOOD

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David Warren says:

"I usually apply the lime and fertilizer soil tests suggested—then add more nitrogen and potash as needed."

This Hoke County, N.C., farmer averaged 65 bushels per acre on his corn in 1968. Such a statement won't cause reporters to stampede the telephone. But ears will perk up when they learn many of Warren's neighbors were harvesting 10-15 bushels per acre in a county declared "disaster area" 3 out of the last 4 years.

David Warren's farm is located in what we call "The Sandhills" of North Carolina. The sandy, droughty soils have low exchange capacity and leach N and K severely. We asked Warren how he used soil tests.

He explained, "I get a soil test to find out where to start. I usually apply the lime and fertilizer treatment suggested and then add additional nitrogen and potash as needed. You know, farming this soil is almost as difficult as hydroponics."

He's right, with one exception—there's usually more put than take in Sandhill farming. For example, Warren used 120 lbs. N per acre on his tobacco in 1969, while in a year of normal rainfall, 60 lbs. per acre would do the job.

Warren grew 35 acres of tobacco, 40 acres of sweet potatoes, and 25 acres of corn this year. He records leaching rainfall and watches the crop for signs of N and K hunger. But he isn't satisfied with such methods. He is seriously considering tissue testing as an alternative.

"If you wait until you can see deficiency symptoms," Warren said, "damage and yield decline has already started. I would like to prevent this."

We would suggest a good Pembroke silt loam soil, but Warren has already bought this one. Besides, where else could he grow the beautifully smooth sweet potatoes that we hope he waxed and packaged nicely for your Sunday dinner.

Incidentally, that ham may be from one of the six or seven hundred feeder pigs he produces each year.

DIAGNOSTIC Farming Pays

A. L. HATFIELD
N. C. DEPARTMENT OF AGRICULTURE

A SIMPLE REQUEST and a soil sample will get you seven tests, a permanent record, and a suggested lime and fertilizer treatment to feed your plants right.

The Soil Testing Division of the North Carolina Department of Agriculture will test more than 105,000 samples from 16,000 people in an average year.

What happens when a soil sample reaches the laboratory?

Each sample receives a permanent identification number, written on your information sheet and on the box containing the sample. The sample is dried in a warm air drier before it is crushed and sieved in a soil grinder.

An experienced technician determines texture by rubbing soil between fingers and color by observing the tint. Only this part of the test relies on human judgment and experience. Texture and color are recorded for future reference. The sample is then ready for the more sophisticated tests which determine down-to-earth needs.

THE pH TEST measures soil acidity or alkalinity. It probably tells more about the soil's fertility status than any single measurement.

For this test, a small measure of soil is placed in a plastic cup. An exact amount of distilled water is added. After about an hour, electrodes are immersed in it and pH value is read from a complicated pH meter while the mixture is stirred.

Charles Smith says:

". . . I can show you as I get the soil test levels up and the the acidity corrected, crop yields go up."

This Scotland Neck, N.C., farmer quit guessing in 1965. That year he started using North Carolina's soil testing service. He keeps excellent working records on his total business. This table, from detailed records on each field, shows how Smith uses soil tests:

	SOIL TEST INDEX			SOIL TREATMENT, LBS/A		CROP YIELD	
Yr.	P	K	pH	Lime	$N-P_2O_5-K_2O$	Bu/A	
'65	L	M	4.5	6000	0–200–160	Soyb.	35
'66	10	30	6.3	0	0–170– 90	Soyb.	30
'67	20	30	6.3	0	185–170–120	Corn	120
'68	36	42	6.3	0	60– 60– 60	Wheat	50
					0– 0– 0	Soyb.	20
'69	54	43	6.0	0	185– 60–110	Corn	90

Lab reports were rather ambiguous until an index rating (0-100) system of reporting was adopted in 1966. Since then Smith has kept one eye on his soil test index while adjusting fertilizer rates.

In 1969, the P and K tests showed a medium to high fertility level. So, the phosphorus rates were geared to maintenance levels. Smith quickly cites excess water and drowning for the low 1969 corn yield. All yields are calculated from grain bin totals from each field.

When Smith bought additional land in 1966, he soon had soil tests made. The records of two fields tell the tale. This man is building a profit-making level of fertility into his soil. Weatherwise, 1967 and 69 were comparable, but 1968 was a drought year.

FIELD	YEAR	SOIL TEST INDEX			SOIL TREATMENT, LBS./A		CROP YIELD	
No.		P	K	pH	Lime	$N-P_2O_5-K_2O$	bu/A	
A	'67	6	16	6.5	0	185–190–160	Corn	100
	'68	20	40	6.3	0	0–240– 70	Soybean	30
	'69	28	30	6.7	0	185–120–240	Corn	130
B	'67	2	14	5.7	3000	0–180–120	Soybean	25
	'68	12	32	5.6	2000	185–240– 75	Corn	95
	'69	22	32	6.2	0	0–190–100	Soybean	35

We asked Smith if his records would pinpoint a dollars-and-cents value of soil testing.

"No," he replied, "but I can show you that as I get the soil test levels up and the acidity corrected, crop yields go up."

A hasty balance sheet shows that, after lime and fertilizer costs, the "other factors" could have squabbled over at least $70.00 per acre per year from Field A and about $50.00 per acre per year from Field B.

The icing on the cake is the rising fertility levels already attained. It takes a touch of genius and a confident banker to turn this sawbriar land into highly productive soil—and at a profit.

ORGANIC MATTER is subject to active change. It contributes to or participates in many chemical changes in the soil. It is used along with the pH, texture, location and crop requirements to determine the amount of lime needed.

The organic matter test is made by chemically burning a measure of soil with a strong acid and an amber colored chemical. Distilled water is then added to make a definite volume.

The burning organic matter forms a green colored solution which is hidden by the amber color of the chemical. The density of the green color is measured on a small machine called a colorimeter which ignores the amber color and measures the green.

The more color developed, the more organic matter. The green color produced by the organic matter in the soil is compared with that produced when known amounts of organic matter are burned. This comparison tells how much organic matter was in the soil.

MINERAL NUTRIENTS—calcium, phosphorus, potassium, magnesium, and manganese—are determined by measuring the amount of each that can be dissolved out of the soil.

An extract is prepared by adding a dilute mixture of hydrochloric and sulfuric acids to a measure of soil. The soil-acid mixture is put on a mechanical shaker and shaken for exactly 5 minutes. Then the acid is filtered out of the soil.

From this one extract, the usual 5 elements are measured and assigned an index value.

The phosphorus content is determined by adding a complex mixture of chemicals to a small portion of the soil extract. These go by the names of Antimony Potassium Tartrate, Ammonium Molybdate, Sulfuric Acid, and Ascorbic Acid. Reaction with the phosphorus turns the solution blue. The colorimeter is again used to assign a relative value or index number to the amount of phosphorus extracted.

An index or relative value for the other elements in the extract is determined by electronic machines which by comparison make Tinker Toy chemistry out of the older methods.

The potassium content is determined with a flame photometer.

The calcium, magnesium and manganese contents are each determined with atomic absorption spectrophotometers.

Both these machines—the photometer and spectrophotometer—operate on the principle that a different wave length or color of light is produced by each mineral element when it is burned in a standard gas flame.

A quantitative measure or index value is calculated from the results obtained by burning a small amount of the diluted soil extract solution in comparison with standard solutions of known content.

To avoid errors, one out of every 36 samples in the line is a check sample with known test reading. If the analysis of the check sample doesn't agree with the known value, all the samples are tested again after the trouble has been located.

THE ELECTRONIC FARMHAND is now ready to go to work. Your name, address and the information you supplied with each sample are now combined with the laboratory test results and recorded on key-punch data cards.

The cards are run through the laboratory's electronic farmhand, the computer, programmed to weigh the importance of each bit of information. When all factors are weighed and judged, the computer becomes a Wisenheimer, a babbling know-it-all.

It prints out everything it was told and more. It figures the amount of lime and fertilizer needed to grow as many as two crops as well as a reference to certain printed literature that might be of interest.

In final disdain for bumbling humans, it prints out a mailing sticker. All at the rate of 6,000 samples per hour.

Usually within a week after your soil sample arrives at the laboratory, your soil test report and recommendations are on their way to you.

TROUBLE SHOOTING is both a science and an art. The N. C. Soil Testing Division provides a trouble shooting service second to none.

Each year many farmers get into trouble with nutrient deficiencies or other problems that lead them to suspect crop nutrition. When this happens, many send in soil samples accompanied by all the pertinent information listed on special salmon-colored information sheets provided by the laboratory.

Samples accompanied by these special sheets receive red-carpet treatment. They get two or three tests performed in addition to the standard tests. Each case is then handled by an experienced agronomist.

Some problems are easily diagnosed. Some prove very difficult. The agronomists are always happy to solve a farmer's problem, to help him salvage a threatened crop.

The most unrewarding situations are those that can't be helped. It taxes the most practiced bedside manner to tell a man he is losing 50 acres of corn because he didn't apply limestone. It's like a doctor telling a patient he has a terminal illness that might have been prevented if he had only heeded advice.

SO WHAT, you may ask—what do all these test tube shenanigans have to do with the way a corn plant or a vegetable garden grows?

In some cases the thing measured may not directly affect the growth of the plant. For example, pH may control other factors of vital importance. In most cases, the actual numbers used serve only as a standard or index much as a yardstick serves as a standard measure of distance.

Agronomists associate these index numbers with good and bad results on the farm. This is sometimes referred to as correlation with plant growth. It doesn't stretch the imagination much to see that it is a vast improvement over the old guessing-game method of farming.

WHO CAN GET A TEST? Any resident of North Carolina may use the services without charge. The farmer or a representative of the farmer or homeowner must collect the soil samples and send them to the laboratory.

The agent or representative may request a copy of the test results and the suggested lime and fertilizer needed for specific crops, but the farmer or homeowner must receive the original report.

The Soil Testing Division furnishes boxes for individual soil samples, mailing cartons, information sheets which must accompany samples, and instructions for collecting the sample.

These are distributed through the County Extension offices, Vocational Agriculture departments, lime and fertilizer dealers, and other agencies serving the farmer.

This laboratory does not provide nematode or disease assays. Soil samples collected for this purpose must be treated in a special manner. So, nematode assays could not be performed on the same sample.

An experimental nematode advisory service for certain crops in North Carolina is available through the North Carolina Agricultural Extension Service of North Carolina State University. **THE END**

TOWARD QUANTITY & QUALITY

PRODUCTION OF MORE forage of higher quality will be the principal objective of the Alabama Soil Fertility Society's program for 1970, it was agreed at a recent meeting of the board of directors and advisors.

"Much progress has been made in the use of fertilizer and lime in right amounts on row crops, but production practices on hay and grazing crops fall far short of meeting both the quantity and quality needed for a growing livestock industry," says Hugh Crawford, President of the Society.

The Society will cooperate with the Land Grant University, Cattleman's Association and other groups in working toward this objective.

SOIL FERTILITY LETTER, Alabama Soil Fertility Society

CROP COMBINATIONS . . .

PRODUCE Feed More EFFICIENTLY

A. MORRIS DECKER
UNIVERSITY OF MARYLAND

ASK A FARMER WHAT his cash crop is worth and he can give you a relatively simple answer, based on the going price of a bushel of corn or soybeans.

But ask a forage farmer what his forages are worth and you won't get a generally simple answer. The value of forages must often wait until livestock products are sold. This may take one or more years and, in most cases, requires greater capital outlay than for the cash crop farmer.

The feed-producing capacity of our forage crops can and must be increased. But as this is done the management and utilization must also change if the full potential is to be realized. A combination of pasture and harvested forages may be needed in many cases.

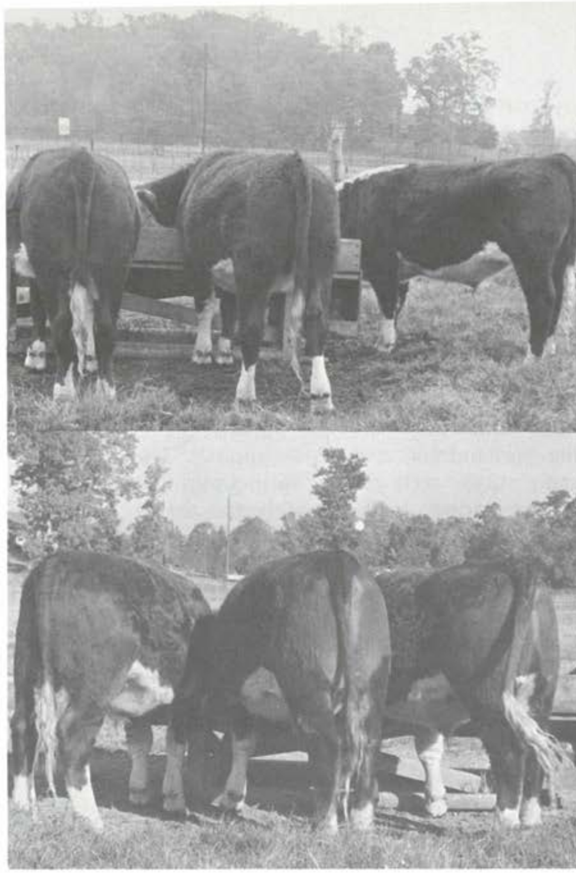
Several years of University of Maryland work prove this point. This work also shows forages can produce competitively and cannot be ignored in our search for a more profitable livestock enterprise.

AS CROP YIELDS INCREASE, problems of feed quality and animal utilization increase more rapidly with forages than with a crop like corn. This complicates the forage picture and creates new challenges.

Maryland has tested many species and combinations of species for pasture over the past 20 years. Hereford or Angus steers, weighing about 500 lbs. at the start of the

TABLE 1. Range in beef production per acre obtained from eight different pastures utilized alone and in combination.

	Pounds Beef per acre			
Pastures	**lowest**	**highest**	**av.**	**Years tested**
Midland bermudagrass	402	402	402	1
Orchard-ladino	353	440	398	7
Tall Fescue-ladino	370	432	401	2
Reed canary-ladino	312	432	394	5
Bluegrass-white clover	366	386	375	6
Sudangrass	177	187	182	2
Pearl millet	166	317	242	2
Lespedeza	120	135	128	2
Pasture Combinations				
Midland+sod-seeded cereals	436	750	572	7
Midland+bluegrass+sod-seeded cereals	433	596	500	3
Orchard+summer annual grasses	216	356	271	2
Orchard+Lespedeza	200	255	228	2
Tall Fescue+summer annual grasses	207	307	241	2
Tall Fescue+Lespedeza	190	205	198	2
Bluegrass+summer annual grasses	246	318	267	2
Bluegrass+Lespedeza	215	230	222	2
Cereal rye+orchard+sudangrass	313	439	376	2



PASTURE ALONE (200 lbs N/A)

FIGURE 1

PASTURE + GRAIN (200 lbs N/A)

grazing season, were used as test animals. Although this type animal may not be economical to pasture, the data do a good job of measuring productivity.

TABLE 1 summarizes a few of the findings. The tall-growing cool-season perennial pastures produced about the same amount of beef. But reed canary grass-ladino clover varied more from year to year than either orchardgrass or tall fescue. The animals performed very poorly on reed canary when clover stands were weak.

Bluegrass, considered poor pasture by many, produced only 25 lbs. less than the taller species. The secret of this bluegrass production is complete utilization during spring when three-fourths of bluegrass production occurs. Only bluegrass acreage that can be completely used in spring should be maintained in a livestock system.

For a more uniform feed supply, bluegrass or other cool-season perennials can be supplemented with warm-season annuals. Involving more total acres may pull overall production per acre a little below a single pasture. **TABLE 1** shows production of these summer annuals alone and in combination with the cool-season perennials. Bluegrass plus summer annual grasses produced as well as taller growing species. Adding cereal rye to orchard-sudangrass boosted production 90 lbs. per acre. It not only got more return from the land, but also increased grazing season.

THE MOST PRODUCTIVE PASTURE combination was Midland bermudagrass sod-seeded each fall with small grain. This averaged 572 lbs. per acre production over 7 years, with a 750-lbs. high.

When bluegrass acres were added to the Midland-small grain system, production per acre declined slightly. But such a system is so flexible it may be more desirable in some farm situations.

Although bluegrass can be used only

as pasture, excess Midland-small grain could be harvested for hay or silage. Also, the heavy bermuda sod in the Midland-small grain team provides solid footing for grazing animal or harvesting equipment both summer and winter, rain or shine. Plowing and seeding to summer or winter annual species does not allow this.

Coastal Plain Maryland, on the north edge of the nation's bermudagrass region, suits the Midland-small grain team well. Seasons change abruptly enough to minimize competition between summer-growing Midland and cool-season annuals. The same might well prevail throughout the northern fringe of the bermudagrass region where moisture stress does not exist.

ALL MIDLAND-SMALL GRAIN studies mentioned so far were fertilized with 200 lbs. N per acre yearly. In small-plot studies on the same farm, Midland forage yields kept rising until the nitrogen was doubled.

A four-year study sought answers to two big questions: **(1) Can grazing animals use such production levels? (2) How valuable is light grain feeding on pasture—0.7 lbs. of ground corn/day/100 lbs. body weight?**

TABLE 2 shows high N fertilization increased daily gain and pasture carrying capacity, producing 130 lbs. more beef with the second 200 lbs. N. When grain was fed on pasture, response was similar except daily gains were more uniform, nearly doubling the beef production realized from added nitrogen.

The effects of nitrogen and grain were essentially additive with a high yield in 1968 of over 1000 pounds of beef per acre. The influence of grain was slightly greater at the low nitrogen rate.

Slaughter grades at the end of the grazing season tended to be slightly higher at high N with grades of medium to high good for both nitrogen levels. Light grain feeding on pasture increased the grade from medium good to low choice regardless of nitrogen fertilization. **FIGURE 1** shows effect of grain feeding on animal grade.

Doubling nitrogen and feeding grain on pasture boosted production significantly, but the highest yield did not produce greatest net return. **TABLE 2** shows no advantage in doubling the 200 lbs. nitrogen rate. Perhaps a value between 200 and 400 lbs. N would be better.

In any event, 400 lbs. N per acre did not increase production enough to offset added expense. In less favorable years the advantage of 200 lbs. N was greatest.

Two things contributed to this leveling off at 200 lbs. N per acre: (1) Much N was returned to the soil by the grazing animal. (2) Additional animals needed to consume the forage produced by high nitrogen fertilization caused considerable fouling damage and wastage.

With high-producing forages, it is absolutely necessary to combine mechanical harvesting with grazing to obtain desired production and utilization.

FORAGE YIELDS AND DOLLARS from Midland bermudagrass grown alone and with a sod-seeded crop at three nitrogen

TABLE 2. Performance of Midland bermudagrass pastures sod-seeded with a rye-wheat mixture with and without supplemental grain feeding (four-year study).

Treatment (Lbs N/A)	Average Daily Gain lowest	highest	av.	Pounds Beef per Acre lowest	highest	av.	Net return over grain, Seeding & Fertilizer costs lowest	highest	av.
200	1.11	1.54	1.34	436	582	500	$79.39**	104.14	88.89
200+corn*	1.76	2.11	1.93	650	925	776	88.06	122.37	101.33
400	1.24	1.64	1.47	516	741	629	73.56	104.81	86.31
400+corn*	1.70	2.06	1.87	644	1062	876	71.67	108.80	87.25

* Ground corn fed to animals on pasture at the rate of 0.7 lb. per day per 100 lbs. body weight (valued at $1.34/bu.).

** Beef valued at $0.25 per pound.

TABLE 3. How nitrogen fertilization influenced forage production and net dollars return per acre from Midland bermudagrass and Midland plus sod-seeded cool-season annuals (1962-64).

Lbs. N/A	Sod-seeded Crop	Tons 12% moisture Hay			Net return over seeding and fertilizer costs		
		lowest	highest	av.	lowest	highest	av.
200	none	2.94	4.92	4.01	$ 54.37	$109.95	$ 82.04
200	rye	2.99	5.06	4.35	50.31	100.95	83.19
200	rye+Hairy vetch	4.78	5.38	5.02	95.61	115.41	107.32
400	none	4.75	7.87	6.77	85.38	193.69	148.80
400	rye	4.85	8.61	6.95	53.99	198.87	135.75
400	rye+Hairy vetch	5.98	8.76	7.54	123.85	205.93	167.27
800	none	5.04	9.20	7.67	25.94	176.43	119.77
800	rye	7.29	10.38	9.01	93.90	218.12	156.49

levels are given in **TABLE 3.**

Yields and net return per acre were lowest at 200 lbs. N per acre in contrast to the grazing study where returns were highest at this level.

Yields were always better from sod-seeding with high nitrogen fertilization up to 800 lbs. N per acre. There was no real yield advantage with less than 400 lbs. N per acre. At the lower nitrogen levels, hairy vetch seeded with rye added both yields and quality.

Net returns were calculated by valuing the hay at the price Maryland farmers received for alfalfa and red clover hay for the six-year period 1961-66 less 15%. The cost of the sod-seeder, lime, fertilizer, seed, and the seeding and fertilizer operations were deducted to give net return.

At least 400 lbs. nitrogen was needed to produce maximum net return. There was no advantage for the sod-seeded crop with only 200 lbs. nitrogen and highest return at 800 lbs.

Adding hairy vetch increased forage yields, nitrogen content of the forage, and net return per acre. Hairy vetch increased forage quality. Vetch is especially important if the forage is to be cut for silage. In late spring following flush growth of rye but before bermudagrass starts fast growth, pasturage is often low. Hairy vetch fills this gap.

With over 9 tons bermudagrass hay and an additional ton or two from a sod-seeded crop, Midland can help keep the livestock industry healthy. Such high yields do not just happen. They come from adequate fertilization and management. When properly managed, Midland bermudagrass will give an economical return from 400 lbs. nitrogen per acre per year. If a sod-seeded crop is planted in the fall, an additional 200 to 300 lbs. can be effectively used.

To reach and maintain such high yields, be sure to follow a balanced fertility program. Although not as sensitive to pH as many crops, Midland performs best at values around 6.5. When high N rates are used, adequate potash must be applied to maintain yields. We believe a 4-1-2 fertilizer ratio will get best yields under most conditions.

TABLE 4 shows how potash boosted yields through this ratio. Adequate potash fertilization also reduced leaf spot and improved winter survival.

In Maryland animal studies, nitrogen fertilization and early harvesting increased forage intake of Midland hay. The early harvesting also improved digestibility. The early cut forage resembles digestibility and intake values of alfalfa hay.

THE END

TABLE 4. Potash boosts Midland Bermudagrass yields with 400 lbs. N per acre.

Rate of K_2O	Tons Hay at 12% moisture
0	5.80
50	6.50 (1,400 lbs MORE)
100	6.58 (1,560 lbs MORE)
200	**7.20 (2,800 lbs MORE)**
400	7.01 (2,420 lbs MORE)

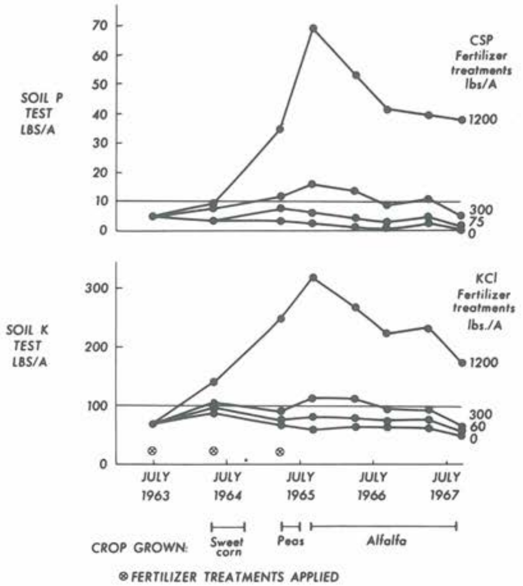


FIGURE 1—How concentrated superphosphate and potassium chloride treatments and crop removal changed soil test levels.

ALFALFA RESPONSE

to Concentrated Superphosphate (CSP)

and

Potassium Chloride (KCl)

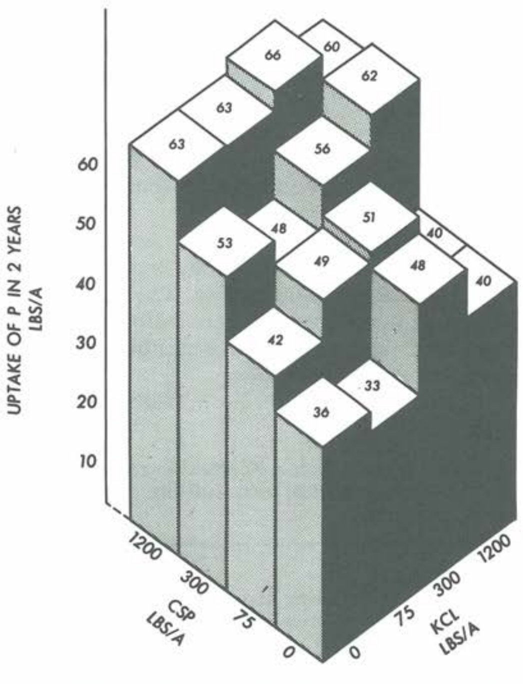


FIGURE 2—Alfalfa removes large amounts of P during 1966-67.

ALFALFA WAS GROWN for 2 years without fertilization as an interim rotation crop in a vegetable-fertilizer study at Geneva, New York.

Soil P and K test levels, which had accumulated from 3 previous applications of concentrated superphosphate (CSP) and potassium chloride (KCl) treatments, declined rapidly. **FIGURE 1** shows this drop. **FIGURES 2** and **3** show the large amounts of P and K the alfalfa removed in 2 years.

FIGURE 4 shows total yields ranged from 15,000 to 22,000 lbs. of oven dry alfalfa per acre. But changes in yield were not as great as changes in amounts of P and K removed due to the previous fertilizer treatments.

Four rates of concentrated superphosphate (0, 75, 300, and 1,200 lbs. per acre) and four rates of potassium chloride (0, 60, 240, and 960 lbs. per acre) were applied. These rates represented commercial fields which normally receive (1) none or very low and irregular, (2) low, (3) high, and (4) very high or excessive rates of fertilizers.

The experiment was designed as a factorial combination of the 4 rates of con-

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NEW YORK STATE AGRICULTURAL
EXPERIMENT STATION

CORNELL UNIVERSITY
GENEVA, NEW YORK

First In
A Series

Future Article Will Feature
Pear, Cabbage, Table Beets

centrated superphosphate and 4 rates of potassium chloride treatments. Both the CSP and KCl rates are randomized in a Latin square design, covering a half field each. The soil is a productive Honeoye fine sandy loam testing medium to high K.

The alfalfa was preceded by sweet corn and peas and was followed in succeeding years by cabbage and table beets. Snap beans will be grown in 1970. The entire experiment is studying how applied concentrated superphosphate and potassium chloride relate to:

(1) Available soil P and K as measured by soil tests.

(2) Crop uptake of P and K as measured by tissue analysis.

(3) Response of different crops to P and K as measured by vegetative growth and development, and yield and quality of the portions of the crops used for processing.

The alfalfa and pea data in detail are already available in New York State Agricultural Experiment Station (Geneva) Bulletins 829 and 825, respectively.

Articles on the four vegetables and on nutrient interrelationships will follow in future issues of Better Crops with Plant Food.

The emphasis of this article: Alfalfa removes large amounts of nutrients and these removals should be evaluated when considering alfalfa as a "soil builder" in a vegetable crop rotation.

THE END

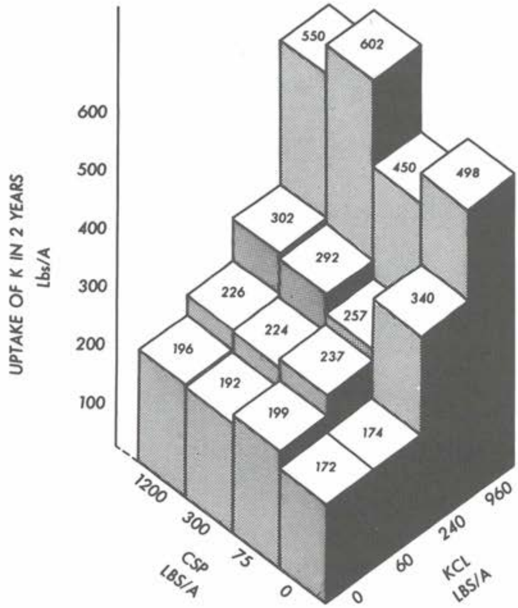


FIGURE 3—Alfalfa removes large amounts of K during 1966-67.

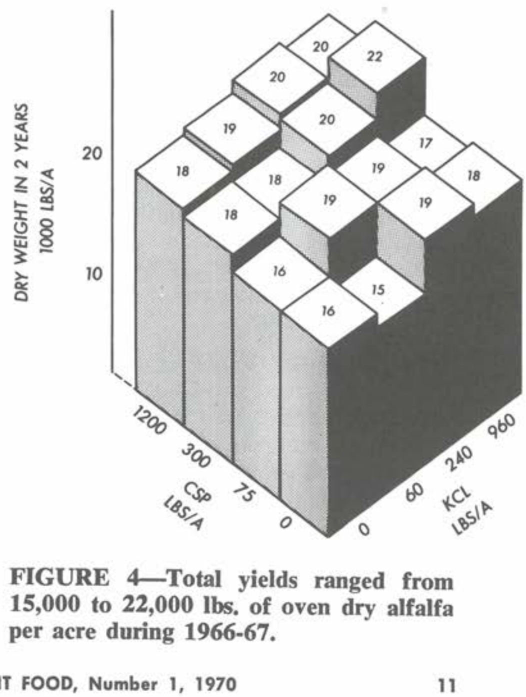


FIGURE 4—Total yields ranged from 15,000 to 22,000 lbs. of oven dry alfalfa per acre during 1966-67.

Some CHALLENGES In Agronomy

Discussing no stop at 300 bu. corn or 100 bu. soybeans . . . effective systems approach . . . cooperation across state lines . . . determination of nutritional value . . . growth in teaching load.

CONDENSED FROM D. G. HANWAY TALK, UNIVERSITY OF NEBRASKA

SOIL AND WATER do not assure a productive agriculture.

We now know it is the technology that can be applied that really determines the agricultural productivity of an area. Soils and climate set the limits. Irrigation water offsets a big limiting element of our climate, challenging us to apply higher technology to crop production.

Should we stop at 300-bushel corn and sorghum, at 100-bushel soybeans? These goals really challenge us, don't they—as much as sending astronauts to the moon!

THE PRIMARY ROLE of agronomy is production of food and feed. A few years ago many scientists said yields were on a plateau, opportunities for further advancement might be slow and limited.

Phenomenal advances in biological science have changed that outlook. We see opportunities for improving crop production by large amounts. We do not yet know what factors will set the ultimate limit.

We are beginning to get tools for analyzing metabolic systems of crops and the nature of their genetic control.

We now know we must use the systems approach to get high-level crop production, to do top-level research. Most agronomy departments have had plant breeders and soil fertility specialists carrying relatively restricted research projects on their primary commodities for some time.

Most departments should add physiology and nutritional value. The primary products of crop production are food and feed. We know different varieties vary widely in nutritional value. Yet, we release variety after variety without running an amino acid profile on them.

Adding physiology and nutritional value to our commodity improvement programs will increase our research capabilities. This calls for new scientists and new laboratories to build a systems approach.

NOT EVERY STATE will need to or can afford to put together an adequate program on each of its important commodities. Agronomists, more than any other group, are tied to diversity of soils and climate. So, they should lead the way toward cooperation across state lines. Let us lay aside personal biases and seek ways to plan and develop programs for the general public interest. Each state has much in common with its neighbors.

Suppose strong commodity research centers were developed to serve a region of states? How could each state be assured of pertinent benefits? Each state should have an applied research capability that could evaluate, develop, and adapt the center's findings to its specific needs. I believe the approach we are developing in Nebraska has this potential.

FIVE SUPERVISORY DISTRICTS have been created to serve Nebraska. Each will have its Experiment Station Center with an appropriate staff of specialists, mostly on joint research-extension appointments. A single administrator directs the total research and extension program, including county agent activities, in each district.

The regional specialists are also considered members of their subject-matter departments. The District Administrator and the Department Chairman both sign appointments, promotions, and salary recommendations.

Our State Specialists integrate both extension and applied research activities into a statewide program. They serve as liaison with our Lincoln staff to assure that all our scientific expertise is appropriately brought to bear on problems and program planning.

The area program approach is not yet fully implemented, but it is developing. It can effectively relate to the kind of research centers I have proposed, even if they are in other states, to assure the direct benefits for each area of Nebraska.

WHAT ABOUT AGRI-BUSINESS? We often hear today's farmer can feed himself and 40 other people. In one sense, this salutes the job agricultural technology has done. In another, it is misleading.

The average farmer spends 70% of his gross income on purchased inputs. This 70% goes to the fertilizer company, the chemical company, the machinery dealer, the petroleum dealer, and other suppliers of inputs to the production enterprise. Without these inputs, the farmer would not be an efficient producer.

The agri-business concerns supplying these products are an integral part of our production system. They are growing in their research capabilities, in their extension capabilities, and in their recognition of social responsibilities.

They are a part of the clientele of public universities. We must serve them and work with them and continue to adjust our programs so our role complements their increasing capabilities.

At the same time, they must support programs of the public agencies and experiment stations. They cannot represent the major percentage of inputs to production without assuming this responsibility, although they have been slow to do so. Perhaps institution personnel have been slow to give them opportunities. In any event, a strong working relation should be built between agribusiness and agronomists.

THE TEACHING LOAD in agronomy at the University of Nebraska has been growing year by year—45% more student credit hours in 1968-69 than in 1965-66.

Students coming to us from high schools are better prepared in science and general information than ever before. Biological science and our own agronomic science have advanced so rapidly that we are constantly pushed to keep up with what is known. We have had to add additional courses in physiology, pesticides, radioisotopes, and many other areas.

Students can relate our production role to the food problems of the mushrooming world population. Demands of agribusiness and opportunities in agriculture exceed the number of people being trained in our agricultural colleges today.

We feel young men and women coming from farms and rural backgrounds still have some advantages when given good training leading to careers in agriculture or related areas. Such students demand good teaching.

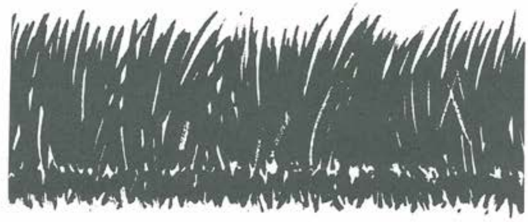
The number of professors and the support for teaching programs has not kept pace with this increased enrollment. So we face the challenge of trying to serve adequately under the circumstances.

We believe agribusiness will begin to recognize their responsibilities to support our teaching programs even before governing bodies and legislatures in order to train future leaders for agriculture.

No other group duplicates agronomy's primary job. In its broadest and deepest meaning, that job is to serve as the information base for crop production.

THE END

Grow SUCCESSFUL Lawns



1—My neighbor is a whiz. Puts my lawn in the shade. Why?
Maybe he watches "the basics" more carefully. Properly prepares his soil and seedbed. Applies enough complete fertilizer. Sows a top quality seed or seed mixture. Then waters wisely, mows properly, and feeds fully to keep it vigorous. A HEALTHY turf can take a lot of bad weather, traffic, and pest attacks—and a lot less of your time.

2—Is seedbed preparation as important as some folk say it is?
Very important, whether seeding or sodding. All good lawns begin with a firm seedbed in soil of good physical condition. Spade, plow, or rototill so fertilizer can be worked deep—8 inches, if possible, not less than 4 inches—throughout the soil layer. Disk or rake clean. Level unclean places. Slope away from the house. A good drainage grade is one foot in 50 linear feet. Don't work soil when it is too wet. Work it when it crumbles readily.

3—What is the best way to fertilize a new seedbed?
The secret is to get enough nutrition *throughout the soil area.* A good rule-of-thumb for rapid growth and firm turf the first season is 1 lb. of nitrogen (N), 4 lbs. of phosphorus (P_2O_5), and 4 lbs. of potassium (K_2O) *for each 1,000 square feet of lawn area.* This will help give the new grass seedlings strong roots for a tough, attractive lawn. Lime, if needed. About 50 lbs. of agricultural limestone per 1,000 square feet will serve most acid soil conditions.

4—How do I get my seed in the seedbed for best results?
You can sow seed by hand or applicator. Mix in some topsoil, sand, or sawdust

for more uniform coverage. Sow half in one direction, half crosswise to the first sowing. Cover by raking lightly or rolling. Avoid smooth surface. Some experts believe the best seedbed has shallow, uniform depressions (rows) about ½″ deep and 2″ apart as a corrugated roller might make. All agree seeding soil surface without incorporating the seed into the soil will cause inferior turf establishment. Be sure to mulch with straw, excelsior, processed wood chips, or pine needles. This does three important things: Helps reduce erosion, conserve soil moisture, and insure more uniform germination. Sprinkle daily at midday until established. Don't over-water. But keep moist enough to combat warm, dry, windy weather.

5—What's the best fertilizer program for maintaining a vigorous lawn?

That depends on local soil, variety, etc. A postcard to your county agricultural advisors or state agricultural university will bring latest tips. Scientists estimate most grasses remove anywhere from 5 to 8 lbs. of nitrogen, 1.5 to 2 lbs. of phosphate, and 3 to 4 lbs. of potash **from each 1,000 sq. ft. of your lawn each year.** The numbers on your fertilizer bag—15-5-10, 18-6-12, whatever they may be—represent the amount of nitrogen, phosphate, and potash in 100 lbs. So, a 50-lb. bag of 15-5-10 contains 7.5% (or lbs.) of nitrogen, 2.5 lbs. of phosphate, and 5 lbs. of potash—about what scientists estimate every 1,000 sq. ft. of your lawn removes each year.

The top lawnmaker does not return just the nutrients his lawn removes, but more than it removes **to insure extra vigor in his turf.**

6—How frequently should I water my established lawn?

Only when necessary . . . when wilting first shows . . . when the grass shows a bluish haze . . . when it doesn't spring back to throw off footprints. Soak it deep, 6 to 8 inches, to encourage deep rooting. A good sprinkler operating 4 to 5 hours per set will do the job most efficiently and economically. Don't drown roots. They must breathe soil oxygen. Heavy (loamy) soils demand longer, heavier watering than sandy soils, but retain water longer. Light (sandy) soils demand more frequent watering than loamy soils, but less watering at one time. You can use a probe to check how far down the soil is dry or soaked. **Avoid frequent light watering.** It encourages shallow roots, weeds, and diseases.

7—I heard a fellow say something about the "science" of mowing. Is it a science?

It's more than just cutting grass. Good mowing involves timing and mechanics. Mow frequently enough to cut only ⅓ of the plant at a time. Mow cool season grasses (bluegrasses, fescues, etc.) between 1½ to 2 inches high. Mow warm season grasses (bermudas, zoysias, etc.) between ¾ to 1 inch. If you let it grow too long, mow only ⅓ its total height at a single mowing until you get it down. Frequent mowing leaves short clippings that don't have to be removed. But during flush spring growth, clippings can pile up, sometimes spreading disease and smothering grass. Remove them to reduce thatch layer on your soil surface.

A complete set of these lawn tips (15 answers to key questions) are available in a kit offered on cover 4.

Maybe Thoreau was right: "If a man has anything to say, it drops from him simply and directly like a stone to the ground." One morning we may all wake up to find that the great lecture Dr. Fogmost delivered at the last convention-of-colleagues was not so profound, after all.

He had droned on about "the extremal response being pursued subject to a minimal level of a product quantity factor . . . in order to observe the extremal value at the perimeter of the experimental data range. . . ."

It sounded "extremally" important, all right. And Dr. Fogmost later beamed in the hotel lobby as a court of colleagues surrounded him with respectful smiles and ears for further news from the summit.

It makes this writer wonder what modern fog is doing to agricultural research understanding and support by the public. Maybe bright brains can penetrate the fog and champion whatever is in it or beyond it.

Maybe Dr. Fogmost is a figment of my imagination. I don't deny it. But have any of you readers ever felt fogged in?

Such questions bring two Wisconsin men to mind:

Dynamic little Emil Truog, University of Wisconsin soils professor, staring with hypnotic interest at the particles in a soil sample, oblivious of students around him in the late afternoon lab on the green hills of Madison.

Wisconsin Extension specialist, C. J. Chapman, preaching his gospel to farmers from the rear of a manure spreader: "For what shall it profit a man to gain the finest buildings, machinery, and livestock in the world and lose his crop to poor soil?"

Truog died just before last Christmas. Chapman lives in retirement close to his alma mater. Both men, I am sure, would not understand all of what the Dr. Fogmosts are sayings these days.

After all, neither of them held a Doctor's degree. Truog did have a Master's degree. And when a smart young soils doctor once asked him why he didn't "go off" to earn his doctorate, Truog snapped, "Under whom?"

That was a very legitimate question. Who could teach the man who developed the first practical soils test that could be made without extensive lab equipment . . . who guided nearly 100 students to their doctorates, nearly 90 to their masters . . . who was one of only three Americans ever named honorary member of the International Society of Soil Science . . . who reported his research work in more than 100 publications, three books, and countless popular articles . . . who proved protein-rich alfalfa could be grown in the acid soil areas of Wisconsin through extensive liming and use of potash?

TRUOG

Chapman was not a researcher. He was the teacher-on-the-go, applying the findings of the Truogs. He blanketed the state's pastures with signs that said, very simply: "Fertilizer Pays."

And he proved it—sometimes with whole-farm demonstrations that literally lifted the farmer's standard of living right before his eyes. He proved it with hundreds of single-pasture demonstrations that showed Wisconson's soil bank balances running low in nitrogen and potash.

At countless crossroads, in hundreds of radio talks and newspaper-magazine articles, he preached the idea of "cutting down unit cost of production by tilling fewer well fertilized acres at a profit than more and more unfertilized acres at a loss." He preached it long before Dr. Fogmost started talking about something called "maximum economic returns from minimal risks of input efficiencies."

Sure, Dr. Fogmost may be my own creation. But the memory of sitting between Truog and Chapman at a banquet some years ago is no creation. A green, town-raised journalism boy caught between such scientists for 3 hours in a hall full of their peers—what a predicament! I would never have made the grade with Dr. Fogmost.

CHAPMAN

But Truog and Chapman were different. They geared themselves to *my* limitations. They did not expect me to gear myself to their knowledge and vast agricultural backgrounds.

They used brilliantly simple vocabularies. They could run in everyday substitutes for technical (pompous) terms and not lose an ounce of meaning or accuracy or dignity so precious to the Fogmosts.

Above all, they did not sneer or laugh at my ignorance. They did not giggle under the breath, like adolescents, at a naive question now and then.

Instead, they seemed to sense that here's a guy who works with words . . . and words are what people use to communicate ideas . . . and we're in the business of uncovering new ideas for farmers to use . . . and, by gosh, we'll make 'em clear to this word merchant . . . clear enough for him to build up enthusiasm to spread the word.

And they did. They made it crystal clear. Chappie was the big talker, the personality, the crusader, and somewhat of an idealist. His voice flowed into one's ear with evangelistic convictions: "It's the old story . . . soil fertility is the key to profitable farming . . . fertilizers applied to good land more frequently will return a profit than those applied to poor land . . . we gotta keep telling it . . . the old, old story, t'will be my theme in glory. . . ."

Truog was the thinker, the cautious, somewhat cool, but inspiringly honest, searcher. His voice came almost in mumbles: "Why must corn have plenty of potash? Well, the outside wall and inside pith (guts) of a cornstalk consist largely of a carbohydrate we call cellulose, structural material needed for strong stalks that resist lodging and stalk break. The starting process in the manufacture of cellulose by a plant is the manufacture of starch. We know a plant needs plenty of potassium in its system to manufacture a satisfactory rate of starch. So—that's one reason corn needs plenty of potash."

No Fogmost there!

NO MONUMENTS NEEDED

Probably no buildings will ever be named after Truog or Chapman, no monuments erected on the Madison slopes.

After all, their careers ended not in the chair of a university president or dean—nor some alumnus talented at building possessions.

After all, the two old teachers stayed at about the same work they started out in, some 80 years at the same university, with a few years of department chairmanship for Truog.

After all, they did not need higher-office glories—for power of title, for security of money, for need of prestige. They may well have craved all three: More title, more money, more prestige.

But apparently they craved something else a little more: A soul-deep sense of contribution, not of money but of ideas, to bring to the end of their lives. Ideas that create mature leaders out of very green students. Ideas that improve the everyday lives of Wisconsin's people.

These two men—a probing little German and a preaching Scotsman—must have had instincts that told them:

You stick with your talent. You plant it in one place on God's earth, deep as rich alfalfa roots, and you stay there. Stay on the job, through all the nitty-gritty of campus toil and politics, disappointments and broken hopes.

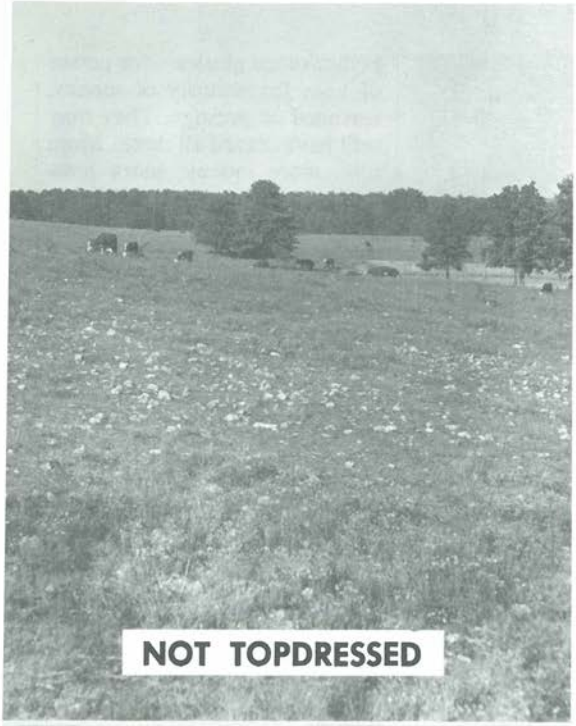
You stay there! Long after the glamour has faded, the applause has died . . . you stay there!

And you tell it like it is in your field . . . tell it to your laboratory students in the same language you tell it to your people in the pastures . . . tell it like all science is, basically simple, when pompous men get out of the way and let nature talk.

You stick to your talent. You stay there . . . and build one layer on another . . . up, up, up . . . until the mysteries you uncover, the methods you create, the ideas you offer become your monument.

Emil Truog and C. J. Chapman need no buildings to make Wisconsin people remember them—gratefully.

THE END



Wanta DOUBLE Your Forage Production?

NORMAN RISNER
UNIVERSITY OF MISSOURI

ANYONE WOULD JUMP at the chance to double their forage yields. Howell County folks, in the heart of Missouri's Ozarks, give a workable recipe:

Take some optimistic farmers, mix with some interested local businessmen, stir with Extension leadership, and add fertility.

Would a "12-month" pasture system help beef producers? Several good farmers in the Ozarks are using good fertility practices with fescue, a cool season grass, to approach this goal.

It all started in the fall of 1961 when University of Missouri Agronomist Alva Preston was discussing pasture and hay shortages with local Extension Agents, John Harper and Norman Risner.

Soils in this part of the Ozarks are low in fertility and very drouthy. Most counties produce less than 5,000 acres of corn per year. (See soil test report in **TABLE NO. 1**) This means grasses and legumes provide most of the feed for the beef and dairy industry.

Preston advised local agents Howell County farmers were sending more than

TABLE 1—SOIL TEST REPORT FOR HOWELL COUNTY SOILS *

%O.M.	P_2O_5	K	Mg	Ca	Neutralizable Acidity	pH	Exchange Capacity
1.6	13	180	260	1500	4000	4.5	9

* Fairly typical except "average" Exchange Capacity slightly lower.

TABLE 2—"AVERAGE" FIGURES FOR FIRST HAY MAKERS CONTEST

Topdress lb/A	1st Cut Yield, Dry Matter Fertilized lb/A	1st Cut Yield, Dry Matter No Treatment lb/A	Feed Analysis % Crude Protein	Feed Analysis % T.D.N.
75-50-80	5285	2584	11.2	57

"THIS APPROACH caused a typical Ozark County to more than double fertilizer sales and increase beef cattle numbers 130% in the past 10 years."

TABLE 3—AVERAGE PRODUCTION FIGURES FOR SECOND HAY MAKERS CONTEST

	Rate of Topdress	First Cut Yield		Yield For Year*	
		Fertilized	No Treatment	Fertilized	No Treatment
	lb/A	lb/A	lb/A	lb/A	lb/A
Orchard-grass Alfalfa	60-42-111	4,727	2,667	10,579	5,730
Orchard-grass	83-50-88	3,790	1,322	5,785	1,888

* Does not include all participants as some topdressed "no treatment" areas after they saw results of first cutting.

a "half million" dollars out of the county each year to pay for hay. Another problem was losing pasture stands after they had been seeded only three to four years. Bromesedge and other undesirables moved in to drag down production, calling for reseeding and more expense.

Local agents and Preston presented this information to the Agricultural Committee of the West Plains Chamber of Commerce. And they listened! They said, "O.K., set up a program to help improve the situation and we'll sponsor it."

Someone said, "Everyone likes a contest." So the first "Howell County Hay Maker Contest" was set up. Its job? To show grass or grass-legume yields could be increased by fertilizer AND such fields would stay more than 3 or 4 years if treated right.

Contest rules directed each farmer to treat at least 5 acres with a minimum of 60-30-60 per acre, leaving a quarter acre check strip. The 8 contest farmers agreed to leave livestock out of their field from January 1 until yields were checked.

WHAT ABOUT YIELDS? Forage production exceeded expectations. Just as important was the fine cooperation between local businessmen and farmers. Just before harvesting, a two-day tour featured the results. And people really came to see! Businessmen saw farmers "keeping" more Howell County money in the area. Yields were measured in a way farmers understand—cut, raked, baled, and weighed!

One participant summed up: "I've been here 10 years and never had enough hay. This year I have enough hay in the barn after the first cutting." **TABLE 2** tells the story.

WHAT ABOUT QUALITY? Many farmers asked the question, "How does our hay compare to hay produced in other areas?" Chamber of Commerce committee assisted local Extension Agents in checking yields and pulling samples of hay for feed analysis. **TABLE 2** shows we can produce good quality hay in South Missouri.

The businessmen were so pleased with the results they said, "Let's have a banquet for all the participating families and all persons cooperating in the program." The Howell County Hay Makers Contest closed in style! First and second place prizes were presented to farmers producing the most hay at the first cutting.

THE PROGRAM DEMONSTRATED benefits of topdressing pasture and hay fields. Questions rolled in to Extension Agents. Dealers soon had their work cut out keeping up with new demands for topdress fertilizer. And the Chamber of Commerce thought enough of the results to pledge an additional $500 for a similar program two years later.

This second contest, involving 12 farmers scattered over the County, was even more successful than the first! It differed from the first in a couple of ways: minimum fertilizer application was 60-40-80 per acre and prizes were given for "largest increase in production" plus "largest total production per acre." **TABLE 3** gives results of the second Hay Makers Contest.

The minimum fertilizer was not exactly the fertility each field needed, but results sold local farmers on topdressing pasture and hay fields. The nitrogen application on the grass-legume mixtures is questionable. But it did show production could be increased with topdressing AND hay barns could be filled before the annual summer drouth. **TABLE 3** shows how farmers applied over 100 lbs. K_2O per acre on alfalfa mixtures, with present day applications running over 150 lbs. K_2O per acre.

Results continue to pour in as farmers report higher and higher hay yields and more and more pasture per acre.

One purebred breeder reports feeding "no hay" to his 55-cow herd during the past three winters. Fertilizer sales continue to climb—127% increase since the first "Hay Makers Contest"—and educational meetings on forage production are drawing more and more people.

DAIRY CATTLE NUMBERS have followed the national trend, declining slightly, but milk production is up. And many beef producers have more than doubled their cattle numbers on the same acres of grass. Some even handle *three times* more cattle than before they started "annual topdressings."

Top cow men are doing a good job with a cow-calf unit on 2½ acres with two acres their goal!

The number of beef cattle has risen from 13,250 in 1958 to 30,562 in late 1968.

Some of the management behind this is a pasture program of topdressing fescue in August—from 50 to 90 lbs. N, 30 to 50 lbs. P_2O_5, and 40 to 60 lbs. K_2O per acre, PLUS late winter topdressings of grass-legume mixtures ranging from 0 to 40 lbs. N, 40 to 60 lbs. P_2O_5, and 60 to 100 lbs. of K_2O per acre. Managing August topdressed fescue includes no grazing until October or later as needed. This helps beef farmers get through most of the winter with little or no hay feeding.

GOOD NEWS TRAVELS FAST. About 5000 acres of pasture and hay fields were topdressed in 1961. Fertilizer dealers estimate at least 37,000 acres of these crops have been topdressed during the past year.

Many people have commented on the job Howell County farmers are doing with their forage production. Dr. Ronald George, formerly with the American Potash Institute, visited the area early in 1969 and made the statement, "I've seen some fine forage programs across the country, but considering the soil types Howell County farmers have to work with, I've never seen a better program."

THE END

IN DEVELOPING NATIONS . . .

What Hinders Fertilization?

Technical Problems
Low-Profit Problems
Attitude Problems
Land-Holding Problems

TECHNICAL OBSTACLES are manifested by a disappointing increase of yield after applying fertilizer at the recommended rate. Such a result can follow from:

Recommendation of manurial formulae or techniques not really suited to the particular case.

Use of farmyard manure of poor quality.

Fertilizing treatment not well enough adapted to the locality.

Treatment unbalanced (single or binary fertilizers where the soils call for complete formulae).

Failure to master the associated techniques such as water management in rice growing, mechanized weed control, and so on.

ECONOMIC OBSTACLES may arise from unprofitability of the technique—the in-crease in value of crop does not cover the costs involved. This can happen in different ways:

When there is neither an external trade in the commodity nor a considerable local market for it.

Where long distances make the fertilizers dear and the crop difficult to dispose of.

Where the prices of agricultural products suffer violent fluctuations.

Economic difficulties of a different kind may be caused by the absence of an agricultural credit scheme, where the growers' own financial resources will not permit them to pay cash . . . and by the absence of developed commercial channels (banks and so on).

PSYCHO-SOCIAL OBSTACLES start when the cultivators may meet proposals for new techniques with great inertia.

This can be caused by many things:

An inadequate grasp of the practice recommended.

A failure to understand the technical effects and the economic promise of the technique.

A speculative outlook, leading people into practices that cannot be sustained: growing successive crops on the same ground (extractive agriculture; soil exhaustion).

A negative attitude towards credit in general.

Absence of motivation towards economic advance, in groups that do not see any strong need to change their traditional methods.

AGRARIAN OBSTACLES include holdings that are too small, so that even with fertilizers they can produce no more than the cultivator and his family will consume. Such conditions do not stimulate the use of fertilizers.

Share-cropping does not encourage investment. In a more general way, the agrarian structure may put obstacles in the way of adoption of intensive techniques, by:

Not affording the grower the use of his land long enough for him to enjoy the benefits of his improvements and investments.

Saddling the grower, who is not the owner of the land, with such charges and dues that he cannot obtain adequate benefit from better harvests (inequitable rents, share-cropping).

Preventing farm families from having sufficient cultivable area for their needs, the breaking up of holdings and scattering of plots, making it hard to keep in mind what has to be done in maintaining a suitable rotation. **Condensed from International Fertilizer Correspondent**

RELATIONSHIPS OF . . .

Potassium in ARID Region SOILS

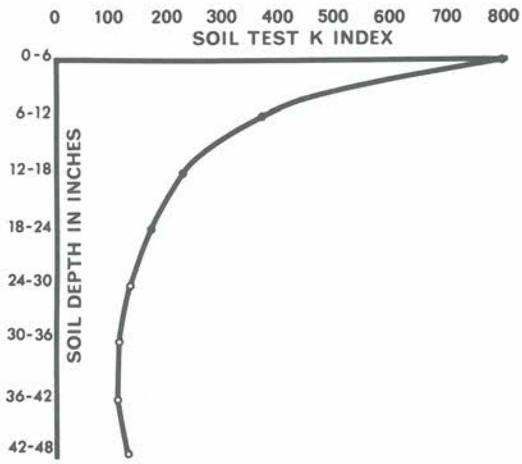


FIGURE 1 shows much K in surface layer but sharp decline with depth in this profile of Shano silt loam soil. The solid points represent non-calcareous soil. The open circles represent the presence of free lime (up to 5% $CaCO_3$ equivalent). The soil test K index is literally the amount of K, in terms of pp2m, removed from soil by a 1:10 soil solution ratio of one-half normal sodium bicarbonate.

POTASSIUM IN PLANTS AND SOILS has long been studied in humid and subhumid areas, but relatively little attention has been given to arid or semi-arid regions.

The reason is simple: Soils in low rainfall areas are less weathered and usually better supplied with potassium and other nutrient elements than soils in higher rainfall.

In recent years, irrigated crops have been responding to K fertilization in the soils of arid central Washington. Soon after research began, we saw how rapidly yields from irrigation farming can change soil K availability.

WHAT IS ARID REGION SOIL LIKE? Shano silt loam typifies many soils in central Washington. It lies within the rain shadow of the Cascade mountains—an area receiving from 7 to 9 inches of rainfall annually.

The parent material of Shano soil is loess of rather recent origin, containing various amounts of volcanic ash (glass). Due to time and weathering factors, the parent material has been modified only slightly since it was deposited. The particle size shows this.

One sample of Shano soil contained 29% sand, 67% silt and 4% clay. The clay fraction apparently included decomposition products of the volcanic glass (non-crystalline material), so the clay contained less than 4% crystalline. So, most of the K activity of Shano silt loam soil arises from the silt fraction, we assume.

Though Shano silt loam is non-calcareous in the surface, free lime starts at about 24 inches. The amount of lime varies up to about 5% $CaCO_3$ equivalent, continuing down to 48-56 inches. The soil is underlaid by caliche.

HOW IS SOIL TEST K DISTRIBUTED in a profile of Shano silt loam? **FIGURE 1** shows abundant K in the surface layer but a very sharp decline with depth.

Desert vegetation influences this soil K pattern. Presumably potassium is absorbed from whatever depth the roots may penetrate and then it is deposited on the surface as plants die or shed leaves. This enriches the surface soil and depletes the subsoil of K.

A SHANO SILT LOAM SITE, smoothed to facilitate furrow irrigation, produced its first irrigated crop in 1961. The land smoothing exposed the subsoil unevenly, causing soil test K of the new land surface to vary widely.

In 1961 and 62, treatments ranging from 0 to 664 lbs. K per acre (as KCl) were applied in randomized complete block designs and superimposed over the natural soil variations. The land smoothing and randomized K treatments resulted in a soil test K range of 140 to 850 by 1963.

Beginning in 1964, the experiment was altered and soil test K *per se* became the basic variable with plots grouped according to soil test categories in a completely randomized design. Some of these plots received K fertilizer and some did not.

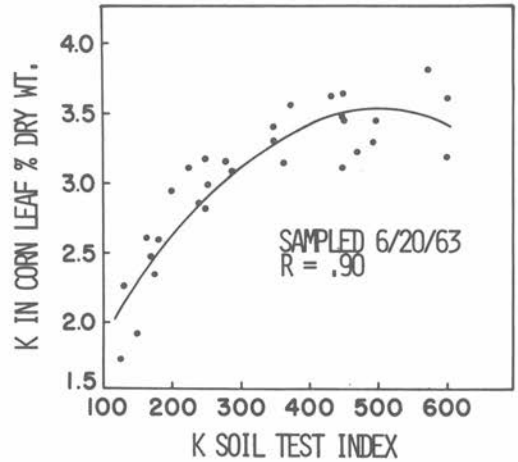


FIGURE 2 shows the relationship between K in corn leaf and soil test K index. Leaf sampled was opposite and below the ear node. The solid line fits the equation $Y = 0.973 + 0.0102X - 0.0000103X^2$ where Y is the predicted level of leaf K obtained at any soil test value X.

D. W. JAMES WASHINGTON STATE UNIVERSITY

SOIL TEST CORRELATION from these corn and potato experiments are given in **FIGURES 2 AND 3.** They show a close association between soil test K and plant composition. Corn yield declined below soil test 200, potato yield declined below 400. When soil K was inadequate, potassium fertilizer increased crop yields. Dry edible field beans, sudangrass, alfalfa, and sugarbeets have also responded to K fertilizer on other soils in this area. All but sugarbeets resemble corn's response patterns. Sugarbeets fit the pattern if available sodium in the soil also is very low.

SOIL TESTS CHANGE WITH TIME. In 1961 soil test values on individual plots in the Shano soil experiment ranged up to 900-1000. By 1963, soil K was changing so rapidly that field experimental design was changed.

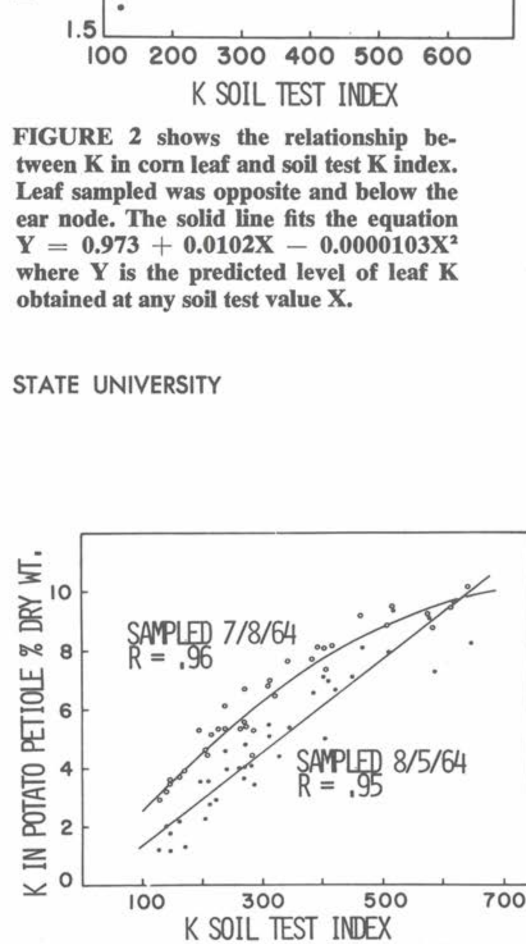
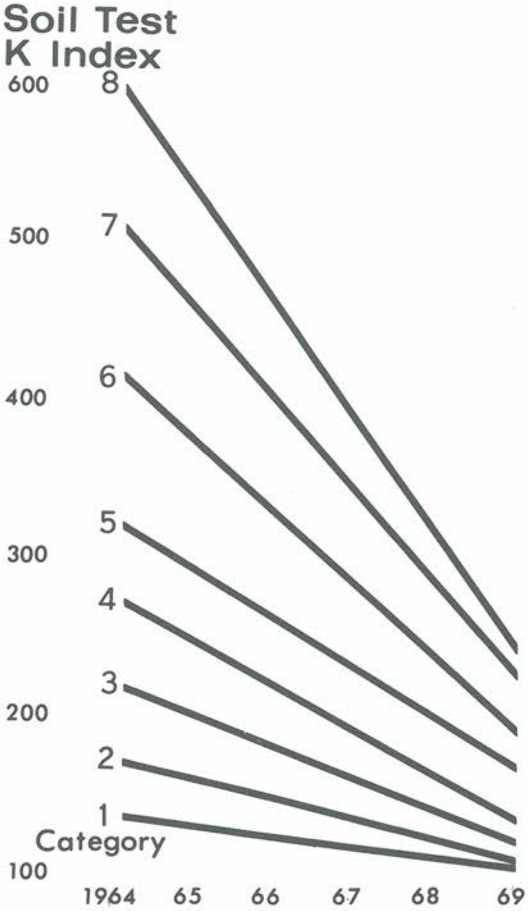


FIGURE 3 shows relationship between K in potato petiole (1964) and soil test K index. The lines for the respective sampling times fit the equations: $Y = 0.211 + 0.0249X - 0.0000155X^2$ and $Y = -0.31 + 0.0159X$.



Crops were grown regularly and the plots were soil sampled annually in February or March. **FIGURE 4** shows what happened to plots not receiving K fertilizer from 1964 to 1969. Presenting only data for those two years simplifies the figures somewhat.

FIGURE 4 shows soil test K declining with time. The higher initial soil test levels the greater the decline. Some plots had ranged up to 900-1000 in 1961, to around 600 in 1964, to about 250 highest value in 1969.

K changes in the lowest soil test category were very slight. All the lines appear to converge on the lowest one.

Originally, the plots were categorized into groups whose means were separated by at least 50 soil test units. On this basis the original 8 categories had coalesced into 3 categories by 1969—1, 2, 3, & 4; 5 & 6; 7 & 8.

Extrapolation of the data indicate there will be only one category by 1970. This category will then average between 100 and 150.

FIGURE 4 shows change in soil test with time. Each point is the mean of at least four replications. No K fertilizer was applied to these plots. Crops grown during the period included field corn, potatoes, Gaines wheat, and orchardgrass.

Make "DEAD SOIL" Live

DEEPER PLOWING can open a larger volume of soil for root development--and higher yields when enough nutrients are available to the plant. It can also lower fertility of upper soil layer by mixing topsoil with "dead soil" from greater depths--soil relatively poor in nutrients, humus, and microorganisms. That's why deeper plowing requires more fertilizer and lime. The International Fertilizer Correspondent put it clearly: 1/3 more soil PLUS 1/3 more fertilizer EQUALS 1/3 more yield. It may or may not average that, but this is certain: Deeper reaching roots must have a good diet waiting for them.

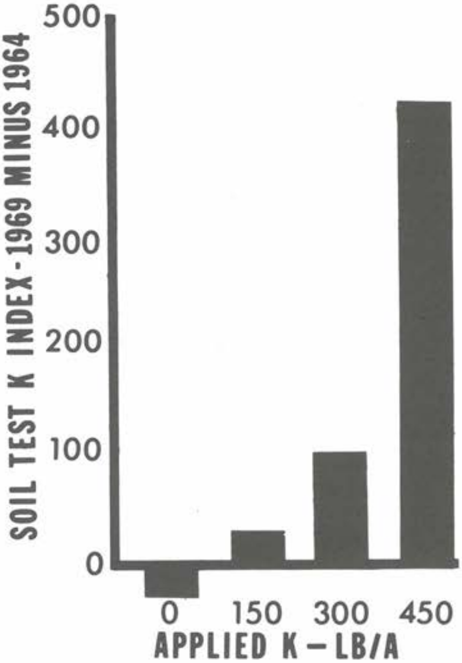


FIGURE 5 shows how K fertilizer changed soil test K index. All plots were initially in the 175 soil test category. The indicated K rates were applied four times during the six seasons.

FIGURE 5 shows what happened where K fertilizer was applied. All plots were originally in the 175 soil test category. Various crops were grown during the period and the indicated fertilizer rates were applied in four of the six seasons.

Soil test K declined at the zero fertilizer rate. Plots receiving K increased in soil test. Somewhere between zero and 150 lbs. K per acre soil test K did not change. Apparently it takes between 100 and 200 lbs. K per acre to halt or reverse declining soil test trend.

The specific amount depends on crop grown and crop residue use. For example, corn harvested for grain has a different effect on soil K reserves than corn harvested for silage.

IN CONCLUSION, available soil K declines rapidly under intensive irrigation farming in central Washington.

Greater use of potassium fertilizer will help maintain high crop yields typical of newly developed lands. And the soils should be tested regularly (with proper attention to the problem of sampling highly variable soils) to keep on top of the soil's K needs.

THE END

Fertilize To OutGUESS STRESS

CONRAD KRESGE
MONSANTO COMPANY

TABLE 1—K_2O ON CORN—LB/A (OHIO)

Broadcast		Row 0	Row 10	Row 30
0	yield (bu)	112	130	132
	% lodged	35	36	14
180	yield (bu)	117	135	140
	% lodged	27	23	19
360	yield (bu)	129	142	142
	% lodged	19	17	11

CROPS ARE EXPOSED to stress periods every year. Most plants do not produce well during these times—they need help! You can fertilize to outguess stress. How? By maintaining high soil fertility year-round. And you can apply most of the fertilizer when it puts least stress on you, your time, your pocketbook: Late Summer, Fall, Winter!

When does crop stress happen . . .

1—During "STROUTH," when moisture is limiting for ideal crop production. Stress from drouth occurs many times in most years. Other weather extremes—excess moisture, low or high temperatures, cloudy weather, high winds—also create stress.

2—During growth right after emergence, when root systems are very limited and often soil nutrients are not immediately available.

3—During fastest growth period, when soil nutrients are most demanded.

4—During late summer for forages, when perennial legumes and grasses are weary from producing all spring and summer. Unless this stress is relieved, the plants may not survive the winter.

TABLE 2—TOTAL NPK REQUIREMENT TAKEN UP BY CORN (OHIO)

	1st Month	2nd Month	3rd Month	4th Month
Nitrogen	3%	38%	48%	11%
Phosphorus	1%	27%	46%	26%
Potassium	4%	66%	30%	−14%·

5—During disease-favoring conditions, when high humidity and moderate to high temperatures encourage many crop diseases. Plants must be very vigorous at these times to resist attack.

6—During high-yield pushing, when crops and soils are under great stress and soils are expected to be on call for large quantities of water, air, and nutrients. How does fertilizing help?

A YOUNG PLANT JUST emerging from the soil with a very limited root system strains hard for needed nutrients. This is very serious with early planting in cool soils. A fast start demands a good supply of fertility in the vicinity of the young root system.

Starter fertilizer placed with or near the seed meets the need. And don't forget to use starter fertilizer on forages. They need a fast start, too.

Starter fertilizers are usually highest in P because it moves least in the soil. But N and K are needed too. The influence of starter K is often longer-term than that of either N or P. **TABLE 1** shows how strongly row K affects yield and lodging.

There comes a time in the life of every plant when it grows most vigorously. For alfalfa, this occurs 3, 4, or 5 times during a growing season. Fast recovery of alfalfa under a frequent cutting system depends greatly on a high level of available nutrients. **TABLE 2** shows how corn demands greatest amounts of nutrients during the 2nd or 3rd months of growth.

SUCH FAST-GROWTH PERIODS not only produce immediate stress, but they can influence the severity of later stress. In recent years farmers and agronomists have been concerned about getting ENOUGH K into the plant. Although "large" quantities are being applied, not enough K is present in the corn plant to keep the corn from lodging. Why?

K does not move very far in the soil—less than ¼ inch. A high concentration of K must be available near active roots during greatest demand.

This is during the second month of growth for corn. If surface is dry during this period, most of the K taken up will be by roots in that part of the soil profile where available water is present.

So, much K should be placed as deep in the profile as practical. Deep plowdown is an answer. **TABLE 3** shows that drouth reduces nutrient uptake but that fertilization helps control drouth-induced deficiency.

TABLE 3—CORN LEAF CONTENT—% (IOWA)

N+P+K—lb/A	No Stress	Maximum Stress
0+70+42	N 2.0	1.5
160+70+42	N 2.9	2.2
160+ 0+42	P .26	.12
160+70+42	P .32	.18
160+35+ 0	K 1.1	0.7
160+35+83	K 1.6	1.2

$P \times 2.3 = P_2O_5$
$K \times 1.2 = K_2O$

WHAT IS A "HIGH" SOIL TEST for available K? What does it take to be sure "high" K exists in the presence of active roots at time of greatest demand?

Ohio found added K is needed for corn and alfalfa on soils testing as high as 400 pounds of available K per acre (Ohio Bu. 472).

North Dakota results **(TABLE 4)** point to the fact that early seeded barley responds to applications of row K on soils testing very high in exchangeable K (300 and 400 lb/A) when applied in combination with N and P.

The first level of N and K produced an apparent positive N-K interaction. Imbalance of nutrients places plants under stress and they cannot fully respond.

Numerous trials have demonstrated the value of lime, P, and especially K in winter survival and maintenance of legume stands. Cornell recently raised K recommendations for alfalfa in N.Y. as much on the basis of stand maintenance as for yield benefits.

HIGH FERTILITY INCREASES flexibility of application time. It reduces chance of nutrient stress. Recent Maine alfalfa research showed 320 lbs. K_2O per acre applied in early season equaled 300 lbs. split into 3 applications for maintaining sure K level in the plant into the critical late summer period.

Why skimp on fertilizer when you can be sure with a little more than "just enough."

High fertility helps make healthy, vigorous crops. To harm such plants is no breeze for disease. Numerous examples are featured in the Autumn, 1966, issue of this magazine—including the role of K in reducing stalk rot problems in corn, dollar spot disease in lawns.

Today's theme is clear: "We've got good plant material that can produce under high populations, etc.—let's exploit it for all it is worth."

High fertility is a big management factor. Keep soil fertility at a sure level from start to finish.

THE END

TABLE 4—ROW P—17 LB/A (N. DAKOTA)

Broadcast N Lb./A	Row K—LB/A 0	12.5	25
		Bu. Barley	
0	35.6	35.0	39.9
30	40.6	47.1	44.0
60	44.6	47.7	47.9

Grass Beauty

NATIONALLY KNOWN grass authority, R. E. Wagner, of Maryland University rounded up findings on the role of potash in turfgrass metabolism. It documents the importance of K in lawn and turfgrasses. Dr. Wagner delivered it sometime ago to his agronomic colleagues, but it's insight and thoroughness are timeless.

It covers enzyme activity, photosynthesis and carbohydrates, nitrogen metabolism, drouth and heat resistance, winterhardiness, disease resistance, and balanced fertilization. This condensation features some key authorities Dr. Wagner cites in his report, one of the most comprehensive ever made on this topic.

A free copy of the whole report can be secured by writing this journal or quantity supplies at 5¢ each.

G. J. Sorger and colleagues found one of the major roles of potassium is in protein configuration, while **S. B. Hendricks** suggested K helps protect plant proteins against degradation.

G. A. Cummings and M. R. Teel found higher K content caused orchardgrass herbage and higher levels of true protein, less nonprotein nitrogen, and less malate.

L. B. MacLeod and R. B. Carson found potassium increased the use of NH_4 nitrogen in bromegrass, orchardgrass, and timothy.

A. V. Barker and colleagues found potassium doing the same thing with tomatoes. The plants developed severe necrotic stem lesions when grown under high NH_4-N and low K nutrition . . . causing "a disruption of the protein, such as uncoiling, enough to enhance proteolytic action."

A. G. Hampton found potassium-hungry turf to be "soft and lush . . . leaves lacking in turgor . . . blades neither erect enough nor stiff enough for good putting surface . . . easily bruised by traffic."

Iowa State University work showed bluegrass supplied with relatively low nitrogen and phosphorus and high potassium withstanding hot weather better than when all three were high or when potassium was low.

Auburn University plots showed the role of potassium in winterhardiness. Both bermudagrass and zoysia were almost completely killed with low potassium . . . but held full stands with adequate K.

Michigan State University researchers applied 5 nitrogen levels and 5 potassium levels in all combination to Kentucky bluegrass turf. They got maximum survival in low temperature under any one nitrogen level when potassium rate was half the nitrogen . . . on very high-K soils not expected to respond to added K. They emphasized a balanced nutrient relationship.

J. V. Juska and colleagues have shown potassium to stimulate root growth more than top growth . . . making potassium a very valuable tool for the turf manager and lawn maker. Many workers have found this K influence on roots. Nitrogen usually has its greatest effect on the above ground parts of the plant.

Britain's Radiobiological Laboratory has uncovered new evidence of how K influences early root development, especially lateral branching. In barley, lateral roots went 30 meters under full nutrition, 16 meters with low phosphorus, 6.3 meters with low potassium. Potassium deficiency was devastating to secondary laterals. At four weeks, there were none to be measured. With short phosphorus, they reached 1.6 meters. With full nutrition, they measured 2.9 meters long.

W. M. Laughlin practically eliminated leafspot on timothy with adequate K in Alaska. On low K plots in Maine, timothy showed severe leafspot, while plots receiving 200 lbs. K_2O per acre appeared normal.

W. L. Pritchett and G. C. Horn found less dollar spot on turf with potash than on adjacent plots without potassium. Sulphur is also believed to be a factor in the better resistance shown in these plots.

E. M. Evans and colleagues found the severity of leafspot on bermudagrass di-

Is More Than Blade Deep

rectly related to degree of potassium hunger. Spots averaged 13.5 per leaf in plots receiving balanced nutrition (NPKL), but 147.5 spots per leaf where potash was omitted.

University of Colorado biochemists, searching for the mechanism or mechanisms of plant diseases, feel that polysaccharides in the plant cell wall might hold the key to disease resistance. If this proves to be true, then the question of association with potassium arises because K is known to be important in forming and transporting polysaccharides.

University of Wisconsin biochemist, **Mark Stahmann,** says invasion of a disease organism sets up a chemical battle within a plant. The invader secretes enzymes outside of the cell that break down the plant tissue, giving the invading parasite an easy pathway to penetrate deeper into the plant. Secretions of the enzymes set up a counterattack by the plant. The plant cells secrete other enzymes which form chemicals that combine with protein and neutralize the enzymes of the invader. The chemicals that neutralize the invading disease enzymes work in much the same way as antibodies in the blood stream of animals. With potassium's known effect on enzymes, could it be that its influence on disease resistance is brought about by aiding the activity of the counteracting enzymes?

O. J. Noer of the Milwaukee Sewerage Commission reported 4.83 lbs. N, 1.8 lbs. P_2O_5, and 3.24 lbs. K_2O per 1,000 square feet were removed in the clippings of a bent-grass green during a six-month season.

W. R. Pritchett calculated 10.8 lbs. N, 2.3 lbs. P_2O_5, and 4.6 lbs. K_2O per 1,000 square feet per year were removed in clippings from a vigorous bermudagrass lawn.

E. C. Roberts has shown the ratio of N-P_2O_5-K_2O to be to 10-2-5 in Kentucky bluegrass foliage. He says, "On soils naturally low in potassium, a 3-1-2 ratio of nutrients may serve well. Many turf specialists recommend 4-1-2 or 3-1-2 ratio fertilizers for repeated use under these conditions. On irrigated lawns and golf greens, extra potassium is especially needed to offset leaching, fixation, and plant absorption."

Roy L. Goss advises, "A vigorous turf will respond to management and resist disease attacks. For average Northwest conditions, a fertilizer with about 3-1-2 ratio of nitrogen, phosphorus, and potassium will give health and vigor if the level is kept high enough and no serious deficiencies were apparent initially."

Elywyn E. Deal reasons, "From the knowledge we have accumulated to date about fertility requirements for turf, a ratio of 3-1-2 or 4-1-2 appears best for turf in the Northeast where clippings are removed regularly and watering is heavy. A 2-1-1 ratio seems satisfactory for ordinary turf when clippings are not removed and water availability depends largely on natural rainfall."

As its role in the metabolism of turfgrass continues to unfold, potassium will be a more powerful weapon in the turf manager's arsenal.

THE END

Fertilizers IMPROVE Tree Planting Stock

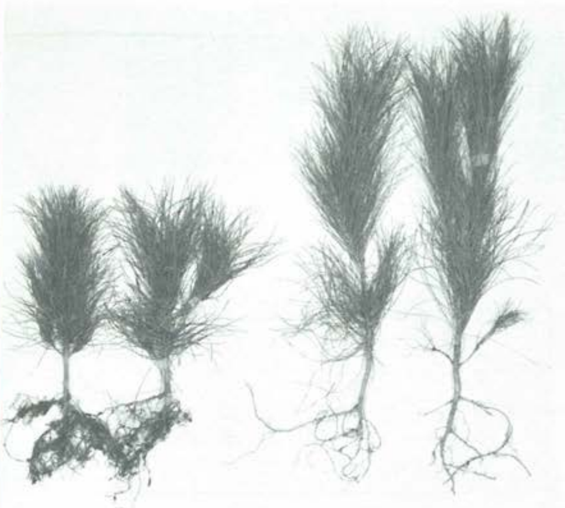


FIG. 1—When the pine seedlings (right) received 60 lb/A Vapam (SMDC) biocide, top growth shot up abnormally while root length and adsorbing surface declined. Left seedlings grew on control beds.

1—Top-root and height-diameter ratios
2—Specific gravity
3—Root adsorbing surface

JAYA G. IYER
UNIVERSITY OF WISCONSIN

SOME OF THE widely used organic eradicants abnormally stimulate top growth of tree nursery stock and reduce length and adsorbing surface of roots, as shown in FIGURE 1.

These changes are often accompanied by a drastic decline in specific gravity of lignified parts of seedlings. These unfavorable changes come largely from retarded uptake of phosphorus and potassium by plants. Retarded P-K uptake is caused by biocidic suppression of mycorrhiza-forming fungi and other rhizospheric symbionts, even when P and K are abundant in the soil.

To the tree planter, biocide-inflicted changes mean abnormally high top-root and stem-diameter ratios, traits that predispose planted trees to drought, frost, and snow-press damage. The problem of restoring external and internal make-up of planting stock produced on biocide-treated soils challenges today's nursery stock production.

The morphological balance of tree seedlings was greatly improved by materials decreasing the availability of nitrogen: raw sawdust, acid moss, peat, and aluminum sulfate. the efficiency of mycotrophic mechanism and the normal uptake of phosphorus and potassium were restored by using allyl alcohol and acidified fermented sawdust compost sprayed with humate suspension.

The present study revealed a somewhat paradoxical relationship: improvement of biocide-stimulated plants by the use of growth-promoting fertilizers. This reestablished the normal NPK nutrition of plants.

POT CULTURE trials conducted in a greenhouse, used sub-humus horizon (Bir) of Plainfield sand as growing medium and Monterey pine, *Pinus radiata*, as test plant. The series included untreated soils, soils treated with Mylone at rates of 800 lbs. 50-D and 600 lbs. 85-W per acre, and similarly Mylone-treated soils with addition of 1,000 lbs/A of 2-6-15 fertilizer, composed of 11-48 monoammonium phos-

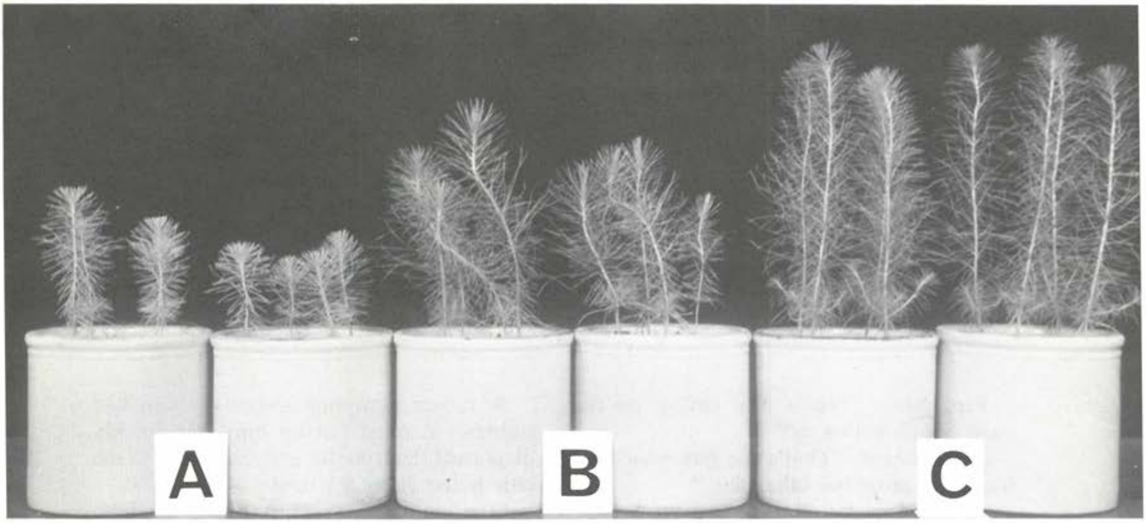


FIG. 2—Fertilizers improve crown structure. Seedlings A grew on untreated sand. Seedlings B, very succulent with partly deformed stems, grew on similar soil treated with Mylone at 800 lbs. 50-D and 600 lbs. 85-W per acre. Seedlings C, with nearly normal specific gravity of stems, grew on eradicant-treated soil that received 1,000 lb/A of 2-6-15 fertilizer.

phate, 20% superphosphate, and 50% potassium sulfate.

One gallon jars were planted to 12 seeds. Two months later, the growing stock was reduced to 4 plants. The content of moisture was maintained at field capacity of 12% by weight. When eleven months old, the cultures conspicuously demonstrated the succulence-producing effect of the eradicant and reinforcement of tissues by fertilizers, shown in FIGURE 2. Seedlings were harvested and subjected to analysis following the methods described by Wilde *et al* in 1964.

TABLE 1 clearly shows the beneficial effect of fertilizers. In spite of stimulated growth seedlings improved remarkably in top-root and height-diameter ratios, specific gravity, and root adsorbing surface as titration values infer. Such improvement came from greater uptake of phosphorus and potassium and reestablishment of a normal nutrient ratio disrupted by excess nitrogen.

Regardless of the apparent paradox, fertilizer use in forest nurseries, and probably elsewhere, must form an integral part of biocide treatment. **THE END**

TABLE 1. Effect of 1,000 lbs/a of 2-6-15 fertilizer, on morpho-anatomical properties of one-year-old Monterey pine seedlings raised on Plainfield sand treated with Mylone herbicide at 800 lbs. 50-D and 600 lbs 85-W per acre (Results per average seedling).

Soil treatments	Height cm.	Diameter mm.	H:D ratio	Weight of plants g.	Top: root ratio	Specific gravity	Root titration ml NaOH
Control	14.8	1.2	12.3	0.62	1.6	0.354	0.268
Mylone	25.5	1.4	18.2	0.96	3.4	0.310	0.112
Mylone plus fertilizer	**27.8**	**2.5**	**11.1**	**1.38**	**2.0**	**0.332**	**0.345**

First bird: "Who's that sitting on the park bench below us?"

Second bird: "That's the guy who fired buckshot at us the other day."

Third bird: "Well, wot are we waitin' for?"

She was young and attractive and spending her vacation in the country.

Walking in the woods one hot summer's evening she came to a beautiful lake. It looked so cool and inviting, and so isolated from the village that she decided to take a chance and go for a swim.

Presently a rustling was heard in the bushes along the bank. "Who's there?", she called nervously. "Willie Smith," came back the reply in a high pitched voice. "How old are you, Willie?" she asked.

"Eighty, demmit!" the voice replied.

"Some people are funny," an office worker told his co-worker.

"You just found that out? What happened?"

"Well, I know a guy who hasn't kissed his wife for 10 years. Then he goes out and shoots a guy who did!"

"Was he surprised when you said you wanted to marry his daughter?"

"I'll say he was. The gun nearly went off in his hand."

People who know the least always use big words to express it.

WARNING! Opinions expressed in this house by the husband are not necessarily those of the management.

A rather pompous motorist's car had suddenly conked out on him. He quickly diagnosed the troubles and then went to the only house along the road.

"Pardon me," he said to the old lady who answered the knock, "do you by chance have any lubricating oil?"

The old lady shook her head.

"Any oil will do," said the motorist, hopefully—"castor oil, if you have any."

"I ain't got it," said the old lady regretfully, "but I could fix you up with a dose of salts."

Thieves who ransacked a golf club took away every bottle of whiskey and beer in the place. The other 18 holes were not touched.

At a party in Hollywood, one of the stunts was to ask each guest to write his or her own epitaph and, when called upon, to get up and read what they had written. A much-married movie actress sitting beside Will Rogers said she didn't know what to write. Will said, "If you will read it just as I write it, I will do it for you." This is what she read: "At last she sleeps alone."

"No," said the cereal-eating husband, "I don't know where my wife is. But wherever she is, she has a cigarette in one hand and a weak no-trump in the other."

WE INVITE CRITICISM
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CYNIC: A person who knows the price of everything, but the value of nothing.
—Oscar Wilde

Know Your Lawngrass

THAT DEPENDS ON LOCAL CONDITIONS—shade, slope, soil, care, and general climate. Some grasses tolerate shade and drought better than others. Use only adapted grass—seed of high germination and purity or vegetative material that is pure, weed-free, and fresh. Most "cheap seed" is expensive. For example, you'll average 2 MILLION bluegrass seeds to the pound, but only 250,000 rye grass seeds. So, plant for plant bluegrass is cheaper, more permanent, and able to spread by underground stems. Here are some traits in WARM SEASON and COOL SEASON grasses:

WARM SEASON LAWNGRASSES

BERMUDAGRASSES: Common, Tifway, Tiflawns, U-3, Floraturf, Ormond, and Tifgreen. Good for South, Southwest, Southern California, Arizona. Fine-textured. Dark green. Rapid coverer. Deep, dense sod. Drought-hardy. Traffic-tough. Heavy maintenance. No shade growth.

ZOYSIAS: Emerald (fine-textured), Matrella (fine-textured), Meyer (medium-textured), and Midwest (coarse-textured). Good for South and lower part of Northeast and Midwest. Good shade grower. Dense sod. Good wear and color. Slow spreader after planting. All but *Zoysia japonica* must be established vegetatively.

ST. AUGUSTINE: Good for deep South . . . on shady and sunny lawns. Rapid spreader after planting. Good color. Coarse-textured. High tolerance to ocean salt spray. Established vegetatively. Subject to chinch bug, gray leaf spot, brown patch diseases, etc.

CENTIPEDE: Good for deep South. Coarse-textured. Established by seed or vegetatively. Moderate maintenance demands on slightly acid soils. (Other warm season grasses for the South include bahia and carpet grass.)

COOL SEASON LAWNGRASSES

KENTUCKY BLUEGRASSES: Merion, Windsor, Park, Newport, Delta, Flyking. Good for North, Midwest, higher southern elevations. Usually seed established. Sodding in some areas. Fine-textured. Shade grower. Drought-hardy. Blends suggested for problem areas.

TALL FESCUE: Good for North and higher southern elevations, especially Piedmont plateau from north Georgia to Washington, D.C. Coarse-textured. Dark green. Drought-hardy. Good shade growth. Traffic-tough. Kentucky 31 is a very popular tall fescue.

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