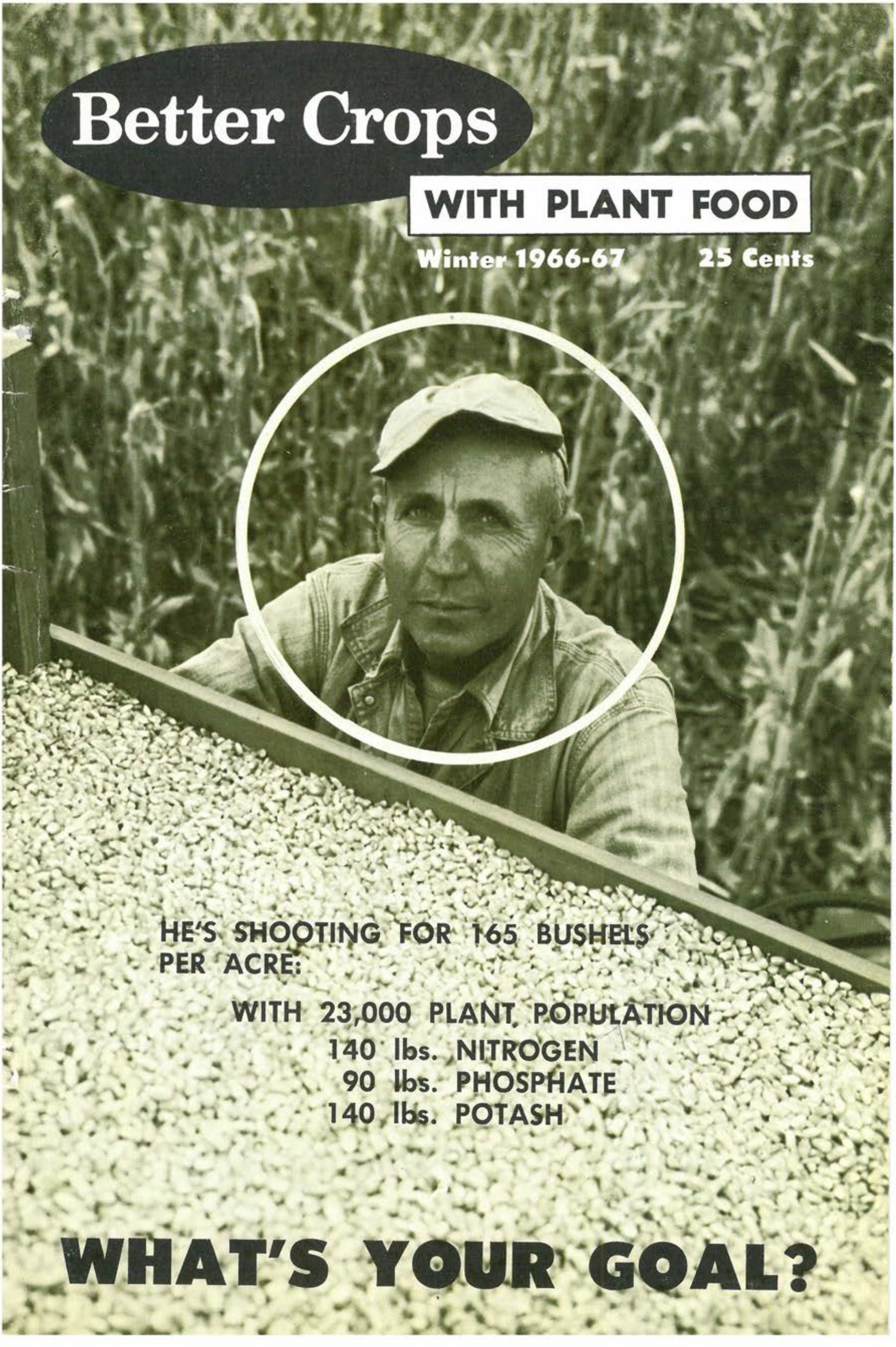
Better Crops
WITH PLANT FOOD

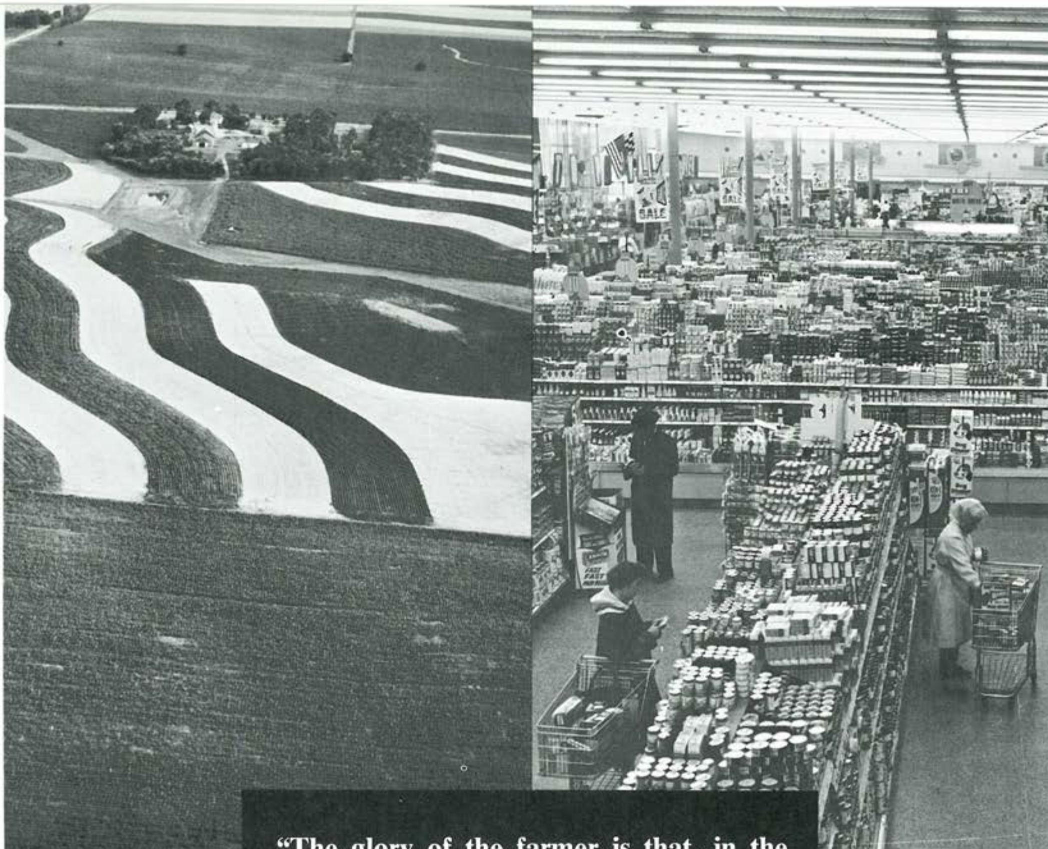
Winter 1966-67 25 Cents



HE'S SHOOTING FOR 165 BUSHELS PER ACRE:

WITH 23,000 PLANT POPULATION
140 lbs. NITROGEN
90 lbs. PHOSPHATE
140 lbs. POTASH

WHAT'S YOUR GOAL?



"The glory of the farmer is that, in the divisions of labor, it is his part to create. All trade rests at last on his activity."
R. W. Emerson

ON THE COVER—Without men like Kenneth Adams of Dana, Indiana, we wouldn't have the well-stocked supermarkets we take for granted today.

Standing by some of his corn yield, Adams symbolizes what Emerson meant by all trade beginning with the grower. Mr. Emerson may be out of date in this nuclear age. But suppose every farmer in America decided not to grow anything this year?

Of one thing we are certain: growers like Adams lead the way today. He is typical of America's best corn growers just surveyed by George D. Johnson of the E. H. Brown Company in Chicago. Adams grows 235 acres of corn marketed as cash grain. This year he's shooting for 165 bushels per acre, with 23,000 plant population and 140 lbs. actual N, 90 lbs. P_2O_5, and 140 lbs. K_2O.

It'll pay you to see what the other top growers do to lead the nation. The survey starts on page 38.

Better Crops WITH PLANT FOOD

The Whole Truth—Not Selected Truth

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FERTILIZE MALTING BARLEY

LESS LODGING

MORE YIELDS

PRODUCING high-yield, high-quality malting barley demands the best management practices—variety selection, early seeding, and enough plant nutrients, among others.

High quality in malting barley means a high test weight, a high percentage of plump kernels and a low protein content—less than 13.5 percent protein.

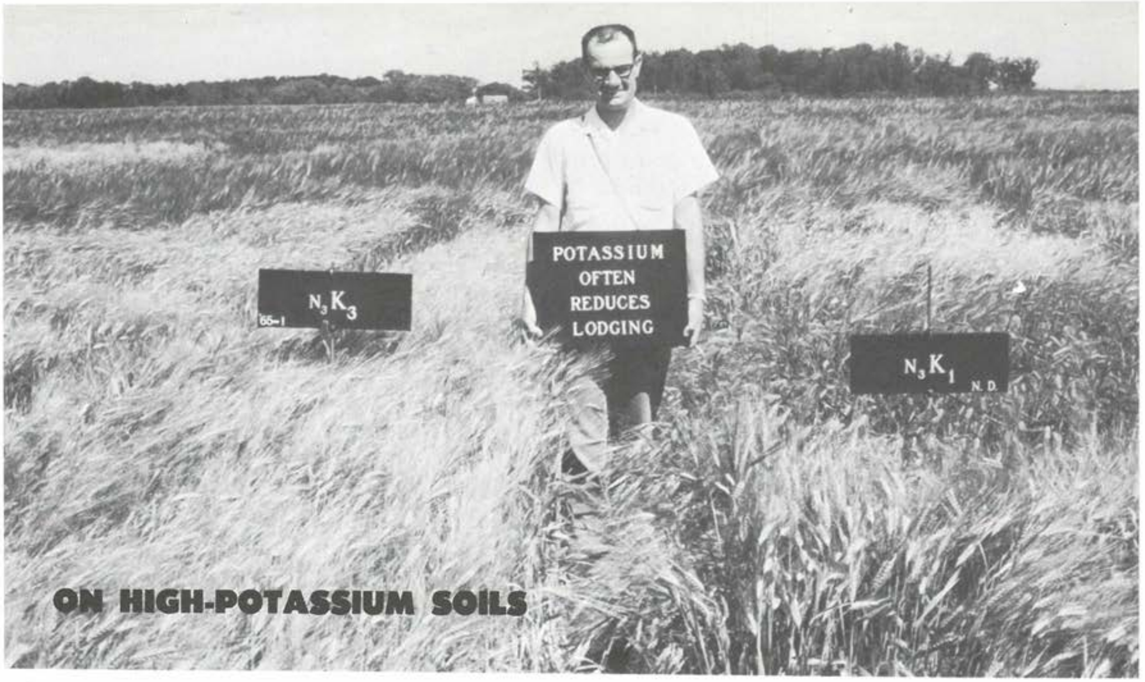
Barley in North Dakota and Manitoba is grown on both summerfallow and nonfallow land. The summerfallow usually responds well to applications of phosphorus (P) and possibly potassium (K), while nonfallow often responds to nitrogen (N), phosphorus (P) and possibly K.

Recent trials in North Dakota and Manitoba indicate the particular importance of seeding date and proper fertilization of malting barley.

EARLY SEEDING IS IMPORTANT

Data from recent North Dakota trials have shown a delay in seeding date usually reduces both yield and quality of malting barley. Late April and early May have been the best. A likely reason is that the later seedings fill and mature under climatic conditions less suitable for small grain.

Table 1 shows the benefits of early seeding—(1) the extreme and average yield increases, (2) increased percent plump kernels (on a $\frac{6}{64}$ in. screen), (3) decreased percent protein (%Nx6.25) obtained in twelve trials during 1962 to 1965.



THE ROAD TO TOP-PROFIT MALTING BARLEY includes right variety, early seeding, and adequate plant nutrients—nitrogen, phosphorus, and potassium. Barley has responded to potassium fertilization not only on low-potassium soils (shown by Manitoba trials on left), but also on high-potassium soils (shown by North Dakota trials above). Both the barley quality and yield were influenced.

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NORTH DAKOTA
STATE UNIVERSITY

R. J. SOPER
UNIVERSITY OF
MANITOBA

Early seeding for quality barley is a must.

FERTILIZATION BOOSTS YIELDS

Response To Nitrogen (N)

Malting barley grown on nitrogen-deficient soils will respond well to applied fertilizer N, both North Dakota and Manitoba trials show. Figures 1 and 2 show yield response to N when row P has been applied.

Note how N fertilization can often double yields on non-fallow land without increasing the protein content to the undesirable 13.5 percent level. For feed barley on these fields, well over 100 pounds N per acre might have been profitable.

But malting barley growers hesitate to use enough N fertilizer for fear of lowering their grain quality by increasing the protein content. Table 3 shows relation between seeding time and N rates on yield and protein content. When substantial yield increases occur, effect on grain protein content will not usually be serious, particularly with early seeding.

Earlier seeded barley fertilized with N responded better and the increase in grain protein content was less serious than on later seeded grain. This may mean higher soil temperature at later seeding causes greater respiration and less efficient plants. Critical growth stages more likely occur at higher temperatures for the later seeding, often resulting in lower yields of higher grain protein content, even where fertilizer N is not applied.

These tests show that early seeding along with adequate N levels should be a part of any sound management system for malting barley.

Response to Phosphorus (P)

Malting barley grown on summerfallow or nitrogen-fertilized nonfallow land responds well to applied fertilizer P on soils testing low and medium in available P. One can expect yield benefits from applying P by drill to a deficient soil, as Table 2 shows. The P soil test is a good predictor of P fertilizer needs.

Response to Potassium (K)

In dealing with K, we will look at the benefit of applying fertilizer K on low testing soils in Manitoba and on soils testing high to very high in exchangeable K in Manitoba and North Dakota.

Response to K On Low Testing Soils

On low K soils in Manitoba (26-55 p.p.m. exchangeable K), malting barley responded markedly to applied fertilizer K. In fact, good yields were not obtained without fertilizer K, as shown in Figure 3. On such soils, adding fertilizer N and P was only part of the answer to good yields. Applied K not only benefitted yield, but also affected kernel plumpness and protein content of grain. Quality improved even when yield was not increased at the highest K_2O rate.

Table 4 compares broadcast and drill-applied K in these Manitoba trials. Drilling K with the seed was much more effective than broadcasting it on these soils containing low levels of exchangeable K.

Response To K With High To Very High K Soil Tests

North Dakota and Manitoba researchers have also conducted rate of fertilizer K trials with malting barley on soils testing from 100 to 400 p.p.m. of exchangeable K. Most of these soils, testing 150 to 250 p.p.m. exchangeable K, would usually be considered adequately supplied with available potassium. But applied K brought profitable yield response, shown in Table 5, even though the soils tested high in exchangeable potassium.

On high testing soils, 15 pounds of K_2O per acre was usually adequate. Yield response to the second 15 pound increment has only shown up on one of twelve trials in North Dakota. This occurred in the experiment on Fargo clay shown in the table.

Experimental work in North Dakota has sometimes shown effects of applied fertilizer potassium on the standing ability of malting barley.

The soil at one site was a silty clay loam testing 260 p.p.m. of exchangeable potassium. The average hand harvested yield for treatment N_3K_1 (40 pounds broadcast nitrogen, 40 pounds available P_2O_5 drilled in with seed and no K_2O), was 64.4 bushels per acre and for treatment N_3K_3 (same rates of nitrogen and phosphate plus 30 pounds per acre of K_2O (potash) drilled in with the seed) the yield was 67.0 bushels per acre.

If harvest had been done by a mechanical system such as a farmer would use, the yield differences might have been greater.

Other North Dakota trials have also shown malting barley standing better during unfavorable weather when fertilizer K had been applied.

POTASSIUM RESPONSE AS RELATED TO EARLY SEEDING

In the twelve North Dakota trials, yield and quality response of malting barley to 15 pounds of applied K_2O has been **more consistent at the**

TABLE 1—EARLY SEEDING INFLUENCES BARLEY YIELD AND QUALITY ON TWELVE NORTH DAKOTA TRIALS.

Yield Increase Extreme	Yield Increase Average	Test Weight Increase Extreme	Test Weight Increase Average	Increase % Plump Kernels Extreme	Increase % Plump Kernels Average	Decrease % Protein Extreme	Decrease % Protein Average
Bu/A.		Lb./Bu.					
18.9	8.0	7.6	2.5	34.7	6.1	2.2	0.9

TABLE 2—DRILL-APPLIED P INFLUENCES MALTING BARLEY YIELD ON SUMMER-FALLOW AND NON-FALLOW LAND.

Location	N	P_2O5 lb/A.	K_2O	Barley Yield Bu./A	Added Yield Bu./A
		(Summerfallow)			
North Dakota	0 +	0 +	0	65.2	
	0 +	35 +	0	76.5	11.3
		(Nonfallow)			
	60 +	0 +	0	73.4	
	60 +	35 +	0	81.2	7.8
		(Nonfallow)			
Manitoba	60 +	0 +	0	52.4	
	60 +	30 +	0	69.7	17.3
		(Nonfallow)			
	60 +	0 +	100	18.3	
	60 +	20 +	100	40.3	22.0
	60 +	40 +	100	47.3	7.0

TABLE3—EFFECT OF SEEDING DATE AND N FERTILIZER ON YIELD AND PROTEIN CONTENT OF MALTING BARLEY, FROM ONE TRIAL AND THE AVERAGE OF TWELVE TRIALS.

Seeding Time	Broadcast N lbs/A	Yield Trial 1 bu./A	Yield Average bu./A	% Protein[1] Trial 1	% Protein[1] Average
Early	0	30.1	44.3	12.1	12.0
	30 or 40	41.4	52.9	11.9	12.5
	60	49.3	55.3	12.5	13.1
2 weeks later	0	29.4	38.0	12.8	12.9
	30 or 40	35.1	43.7	13.1	13.5
	60	37.6	45.7	13.5	13.9

[1]Percent Nx6.25

TABLE 4—POTASSIUM APPLICATION METHOD AFFECTS MALTING BARLEY YIELD ON MANITOBA SOILS LOW IN EXCHANGEABLE POTASSIUM.

Fertilizer Treatment[1] N P_2O_5 K_2O	Yield (Bu./acre) Trial 1	Trial 2	Trial 3
60 + 20 + 0	33.4	38.0	34.3
60 + 20 + 15 D	44.6	53.9	40.2
60 + 20 + 30 D	41.5	53.3	46.1
60 + 20 + 100 B	46.0	57.7	40.3
60 + 20 + 200 B	50.1	59.9	43.9

[1]N was broadcast. P_2O_5 was drilled in with seed.
D indicates drilled with the seed, B indicates the K_2O was broadcast.

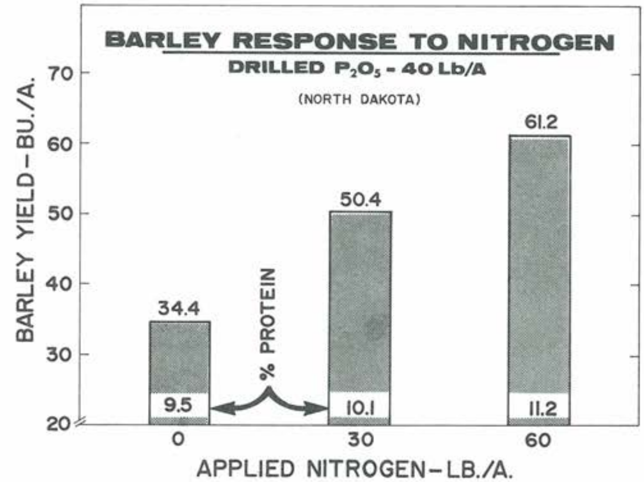


FIGURE 1

earlier seeding than at the later seeding. This may reflect cooler soil temperatures at earlier seedings, which have been shown to decrease the availability of the native soil K supply.

When seeded early, seven of the twelve trials have shown yield responses of 1 or more bushels per acre by adding 15 pounds per acre of K_2O. **Average yield response for this treatment in these seven trials equals 3.0 bushels per acre.**

So far, Manitoba trials have shown K responses 5 out of 7 times on soils high in exchangeable K. About 1 bushel of malting barley is needed to pay the cost of 15 pounds K_2O at present prices.

Malting barley has usually responded best to applied fertilizer potassium on the coarse textured soils in the North Dakota trials. Response ranged as high as 6.7 bushels per acre by adding 15 pounds K_2O per acre.

Using exchangeable potassium levels in soils may not be the whole answer in determining adequate potassium supply, for growing malting barley on some soils of Manitoba and North Dakota. These results suggest fertilizer potassium may well be used on soils testing very high in exchangeable potassium, as trial application, once the grower has met nitrogen and phosphorus needs of his malting barley crop.

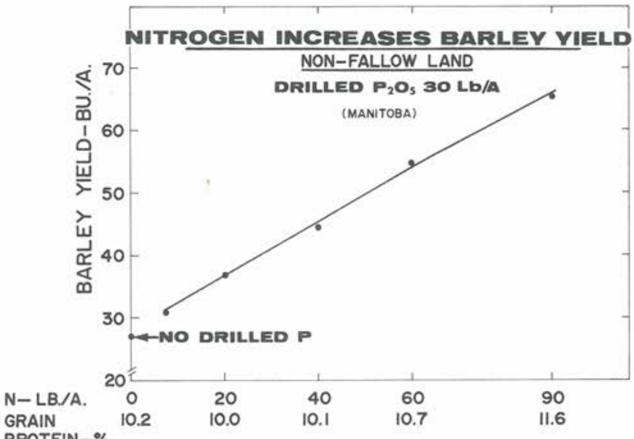


FIGURE 2

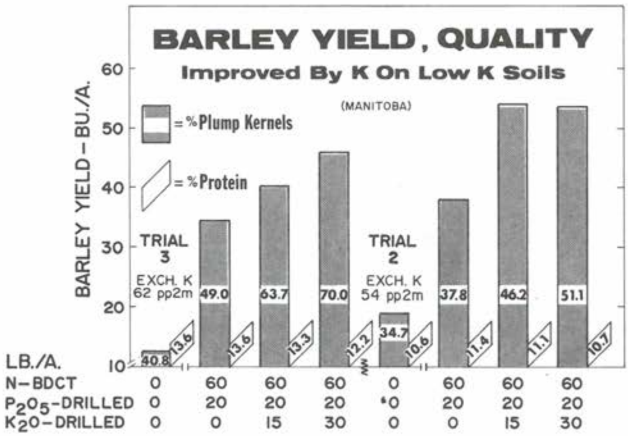


FIGURE 3

IN SUMMARY

Growing malting barley is a profitable enterprise for many North Dakota and Manitoba farmers.

There is every reason to expect that a good management program—**including early seeding, use of adequate fertilizer N, P, and K on soils deficient in these elements, and trial use of fertilizer K on soils testing high in exchangeable K**—could make malting barley growing an even more profitable enterprise.

Malting barley responds well to needed fertilizer. Yield response to additional N, P, and K has normally been best when the malting barley was seeded early. **Small, but profitable yield responses to applied fertilizer potassium often occur when malting barley is grown with adequate levels of nitrogen and phosphorus on soils testing high in exchangeable potassium in North Dakota and Manitoba. Other valuable quality effects may also be associated with the use of applied fertilizer potassium on malting barley grown on such soils.**

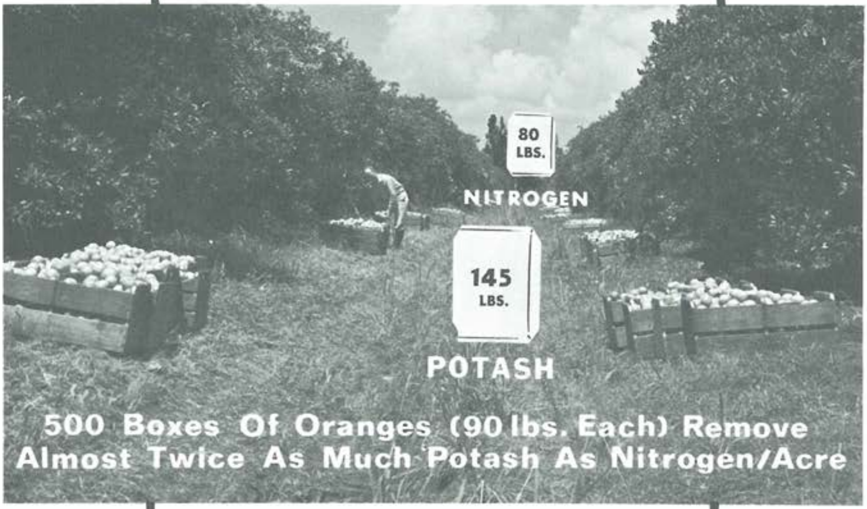
Regardless of the crop, early seeding has always been urged. With malting barley it appears to have an influence on not only yield potential but also on quality factors, especially protein content.

THE END

TABLE 5—MALTING BARLEY RESPONDS TO APPLIED FERTILIZER POTASSIUM ON SOILS TESTING HIGH IN EXCHANGEABLE POTASSIUM.

Location	Soil Type	Exchangeable Potassium Level (p.p.m.)	Fertilizer Treatment[1] (Lbs/Acre)	Yield Bu./A.	% Plump Kernels (on 6/64 in. Screen)
Manitoba	Lakeland SiC	275	60 + 30 + 0	55.1	33.2
			60 + 30 + 30	60.9	35.2
North Dakota	Hecla FSL	150	60 + 40 + 0	41.9	25.6
			60 + 40 + 15	48.6	36.1
			60 + 40 + 30	48.2	32.3
	Fargo C	300+	60 + 40 + 0	60.5	70.7
			60 + 40 + 15	61.4	71.1
			60 + 40 + 30	67.7	76.9

[1]Refers to pounds of nitrogen (N) broadcast + available phosphate (P_2O_5) drilled in with seed + potash (K_2O) drilled in with seed in that order.



R.C.J. KOO

CITRUS EXPERIMENT STATION
LAKE ALFRED, FLORIDA

Nitrogen and potash are the two major constituents used in Florida citrus fertilizers.

Using potash in moderate amounts is reasonable because most citrus soils in Florida are not well supplied with potassium containing minerals.

Like nitrogen, potassium does not accumulate in sandy soils and much of that not absorbed by the citrus tree roots is lost through leaching. But, unlike nitrogen, potassium deficiency symptoms are not easily recognized under field conditions and citrus trees seem able to tolerate a wide range of potash fertilization without affecting fruit production.

When 200 mature 'Valencia' groves were surveyed in central Florida 10 years ago, they showed potash fertilization ranging from 72 to 310 pounds per acre per year. Citrus growers obviously differ on the optimum amount of potash they believe in using.

Since that survey, much potash research has been done on citrus. The findings can help guide Florida citrus growers to a potash program for the tree.

WHAT POTASSIUM DOES TO CITRUS FRUIT

Potassium affects fruit quality more than any other element.

The fruit may be affected along the whole range from potassium deficiency to excess. Trees low in potassium will produce small fruit, having a thin, smooth-texture rind, but good color. Trees high in potassium, on the other hand, produce large fruit having a coarse, thick rind with poor color.

Since fruit rind thickness is influenced by the potassium level in the tree, rind disorders (such as creasing and fruit splits) have been

IN FLORIDA

Potash Puts QUALITY Into Citrus

associated with low potassium. While the exact causes of these disorders have not been established, potassium could be one of the contributing factors.

Potash fertilization also influences the juice quality of oranges and grapefruits.

The acid content of the juice is increased by increasing potassium level in the tree.

The soluble solids (soluble sugars) and juice content are little affected by potash fertilization other than by its influence on fruit size.

Large fruit usually has a lower soluble solids content than small fruit. Large fruit has more juice than small fruit but a lower percentage of juice on the basis of fruit weight. Therefore, a 90-pound box of large fruit will have less juice than a box of small fruit.

FRUITFUL FACTS

Successful growers plan their fertilizer program from facts. These well-known, but often overlooked, facts should help growers plan their potash fertilization program most profitably:

POTASH REMOVAL by the crop

A crop of citrus removes more potash than any other element. Every 90-pound box of fruit harvested removes about a quarter pound of potash—almost twice the amount of nitrogen removed. So, more potash should be applied during years of heavy crop.

POTASH LOSS by leaching

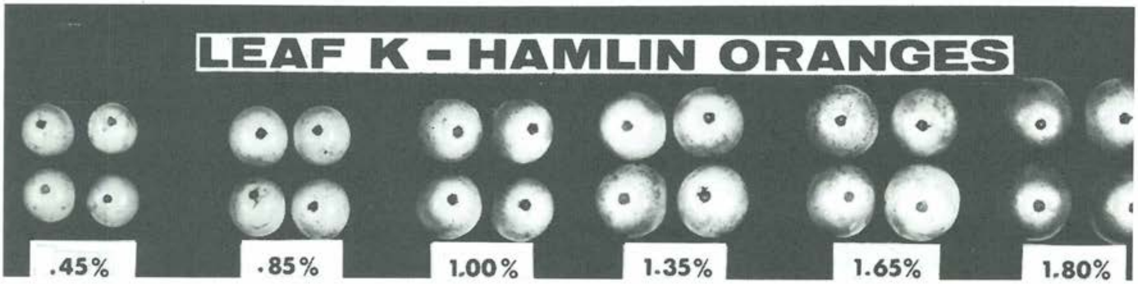
Most Florida citrus soils can hold 4 to 5 inches of water in the root zone. When rain exceeds water holding capacity of soil, some leaching will occur. Growers should be aware of rainfall distribution.

Several inches of rain in one week can cause leaching, even in a year with below normal total rainfall. On the other hand, little leaching may occur in a year with above normal rainfall IF most of the rain is distributed normally over the year.

The key is distribution. Growers should watch it carefully when forming their fertilizer program.

POTASH USE for long term

Fruit production and fruit quality depend on the ACCUMULATIVE effects of potash. Frequent change in the potash program will serve no useful purpose and may be costly in the long run.



ORCHARDS DEFICIENT IN POTASSIUM or bordering on it always have a problem with fruit sizing. These oranges show what % K in the orange leaf meant to fruit size. Adequate potassium also helps trees hold fruit until maturity. Potassium fertilization reduced grapefruit drop from 46% to 33% in Florida tests.

POTASH FERTILIZER RECOMMENDATIONS

Florida Bulletin 563B now recommends potash fertilization as follows:

"On acid soil, for early and midseason orange trees, apply 0.4 pound and on late season oranges and grapefruit, 0.3 pound of potash per year per box of fruit, up to a maximum of about 250 pounds per acre.

"On calcareous soils, apply about one-fourth more potash than the recommended rate."

The recommended rates allow ample supplies of potash for new growth and for fruit production for average bearing groves under normal conditions.

To try to produce smaller oranges for processing, some growers have used lower potash rates than recommended in recent years. Such a program demands close watch of the potassium status of the trees.

A normal bearing citrus tree will usually take several years to show potassium hunger. Once the symptoms are recognized, it will take over a year to restore potassium to needed level in the tree.

A few pounds of prevention is worth many months of cure. Citrus

NPK Teamwork Boost

THE PER-ACRE number of marketable tomato transplants increased 6 times by supplying proper amounts of nitrogen, phosphorus and potassium, a U.S. Department of Agriculture soil scientist reports.

Dr. Casimir A. Jaworski, vegetable crop specialist of USDA's Agricultural Research Service, reports that in his highest yielding test he obtained 615,000 marketable transplants per acre.

The industry average is about 100,000 per acre. The Georgia Agricultural Experiment Station cooperated in the tests.

About 90 percent of all tomato transplants set out in the Midwest, along the Eastern Seaboard, and much of the Great Lakes area of Canada come from some 6,000 acres of plant beds near Tifton, Ga.

Transplant growers, however, have been beset by large numbers of culls, a problem that reduces efficiency and hampers mechanical harvesting.

growers can easily prevent their trees from becoming deficient in potassium and below par in production. The following tool, along with standard recommendations, will help a grower form a profitable potash fertilization program.

LEAF ANALYSIS by the year

Field tests have fairly well determined the relation between leaf potassium content and fruit quality and yield characteristics. The following leaf potassium levels are based on 4 to 5-month-old spring flush leaves from nonfruiting stems:

Maximum fruit production and desirable fruit quality can be obtained by maintaining the leaf potassium level between 1.2 to 1.7%.

Leaf analysis can show a grower what potassium content trend his trees are taking from a given fertilizer program over a period of years.

Annual leaf tests will detect any potassium extremes soon enough to adjust the fertilizer program before fruit production begins to decline.

LEAF K CONTENT	RANGE	FRUIT CHARACTERISTICS AND YIELD
1.8-2.3%	High	Large fruit, coarse-thick rind with poor color, high acid.
1.2-1.7%	Optimum	Moderate size fruit and good internal quality.
0.9-1.1%	Low	Small size, smooth-thin rind, frequently has more fruit splits and lower yield, good fruit color
0.6-0.9%	Very low	High incidence of premature fruit drop and sparse cover crop growth, excellent fruit color.
0.3-0.6%	Deficient	Twig dieback, tree very susceptible to cold damage.
Less than 0.3%	Extreme deficiency	Chlorosis of leaves, dieback of twigs.

THE END

Tomato Transplants

Transplants are grown largely on newly cleared pine forest land because these lands are relatively free of tomato-disease organisms and nematodes. But over the years that the land was pine forest, Dr. Jaworski said, the soil was depleted of needed minerals, and pine-needle residues made the soil acid.

Dr. Jaworski reported earlier that applying 1 ton of dolomitic limestone per acre corrected the soil's acidity and also corrected calcium and magnesium deficiencies.

From present research, Dr. Jaworski estimates that basic deficiencies in the 3 primary nutrients can be corrected by adding 40 to 60 pounds of nitrogen, about 90 pounds of phosphorus, and 25 pounds of potassium on a per acre basis.

He emphasized that local conditions might change these amounts, but accurate soil tests would point up exact amounts of nutrients needed.

THE END

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UNIVERSITY OF KENTUCKY

FEW FOLKS would ever guess it. The young corn plants growing on low-potassium (K) soil didn't look like they were loafing. But they were. Almost 100% loafing!

Oh, they may have been a little smaller than non-loafing plants. But little difference otherwise.

Some plants growing on magnesium (Mg) deficient soils were another story. They looked sick—real sick. Typically striped and yellowing. Who would guess they were growing at nearly normal rates?

While I was at the Connecticut Agricultural Experiment Station, Dale Moss and I began measuring the "instantaneous growth activity" of individual corn leaves from such plants to see whether K and Mg affected growth rates.

TRUE HIDDEN HUNGER

When plants capture the sun's energy, carbon dioxide (CO_2) is withdrawn from the air and into the leaf through tiny pores (stomata) in the surface of the leaf. Inside the leaf, the sun's energy is used to convert the CO_2 into new plant material, a process called photosynthesis.

We measured the rate of CO_2 used by individual corn leaves. This measurement required only a few minutes, indicating "instantaneous growth activity" or **photosynthetic abilities of the leaf.** We found photosynthesis closely related to the concentration of K or Mg in the leaves.

The nearly normal looking K-deficient leaves had very low rates of photosynthesis. In other words, a good looking leaf could be starved for K. This is "Hidden Hunger" at its ultimate!

CRITICAL LEVELS

As the K concentration in the leaf increased beyond a certain level, there was very little effect on photosynthesis—shown in Figure 1. This was the zone of adequate nutrition, or **"Safety Zone."**

As concentrations fell below a certain level, photosynthesis declined drastically. This was the **"Starvation Zone."** The region between safety zone and starvation zone is often called **"Critical Zone"** or **"Critical Level."**

The critical level of K in our corn leaves was about 2 mg/gm fresh weight (or 1.5% K on a dry weight basis). This is somewhat lower than has been measured in field experiments. A few comments on this in a moment.

Figure 2 shows the effect of Mg on the photosynthesis of corn leaves. About 200 mg/gm fresh weight (or

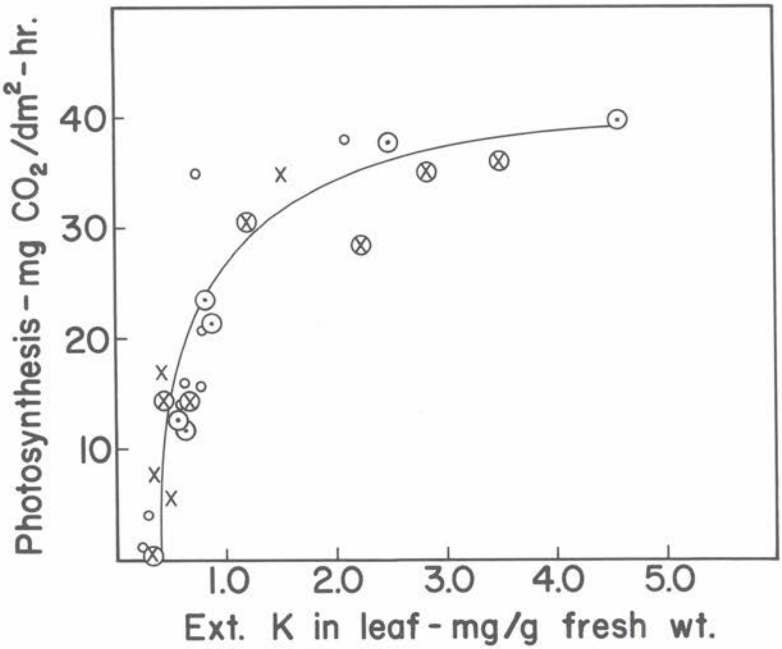


FIGURE 1

0.18% Mg on a dry weight basis) was the critical level in these leaves. Below this level, the leaves were in the starvation zone.

Recall now that the leaves in the critical and starvation range showed definite deficiency symptoms. Why did these "deficient-looking" leaves not show the sharply reduced photosynthetic rates one would expect when they lack only Mg? We do not know.

Most researchers feel that the green matter (chlorophyll) related to Mg supply in leaves may sometimes be present in amounts greater than actually needed.

WANDERIN' K

Earlier, I described the critical

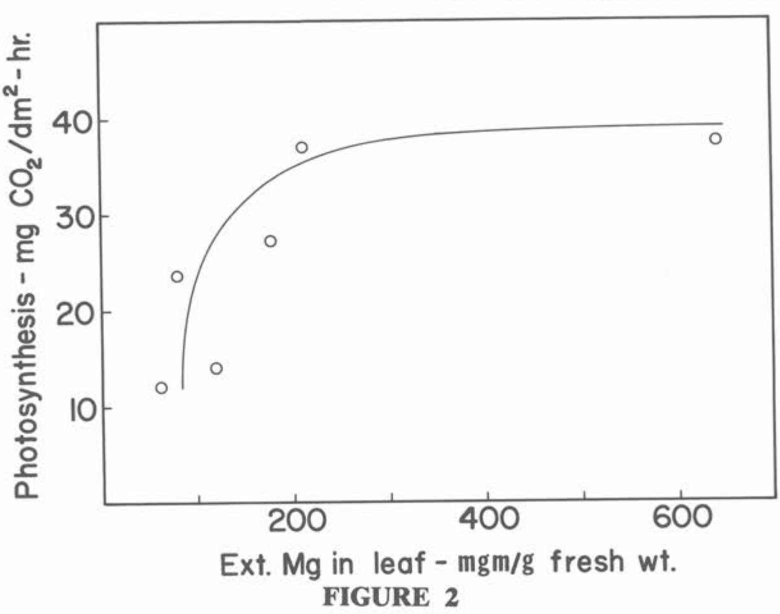


FIGURE 2

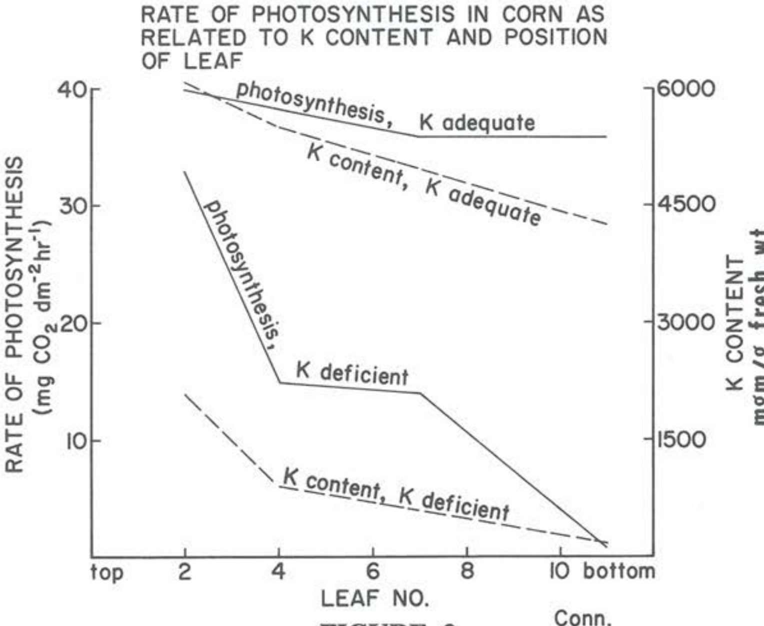


FIGURE 3

level of 1.5% as lower than most field values. There are several reasons for this.

This value (1.5%) assumes a constant supply of K to the plant through the complete growing season. Normally the supply decreases as the season progresses. So, in the field a little higher level is needed to carry the plant through the season.

A more important reason was seen in another experiment. Here we measured the photosynthesis and K concentration in several leaves from corn plants at tasseling time. Some plants had initially received low K supplies and finally K was withheld completely from the plants. The remaining plants received adequate K throughout the experiment.

Figure 3 shows what happened. Much of the K in the low-K plants had moved to the upper parts of the plant. Lower leaves were starved and lost growth activity. A few upper leaves on the starved plants maintained much photosynthetic activity since they were higher in K.

Of special interest were the high-K plants. Although K levels in these plants were 3.8% to 4.8% on a dry weight basis, the upper leaves tended to be enriched with K at the expense of lower leaves.

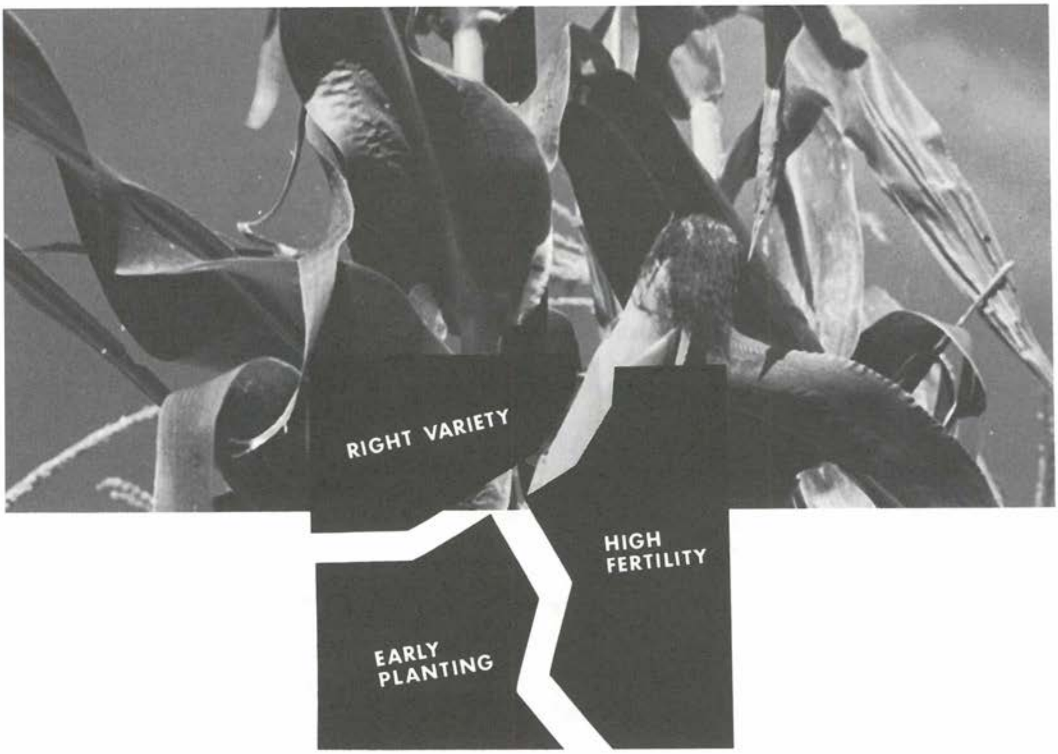
We can only conclude that to maintain all leaves above 1.5% K, many upper leaves will have to contain much more K—perhaps 2.5 to 3.0%.

As narrow rows and high plant populations continue to bring increased profits, we need to be more aware of the performance of the leaf canopy. Some leaves in high populations are operating at less than optimum lighting.

Perhaps more information will permit increased photosynthesis by leaves in suboptimum light. How important it is to have all leaves in the field carrying out full photosynthetic activity can only be determined by additional experiments.

This merely illustrates the complexities of plant nutrition. But, thankfully, we now have tools to observe it more closely than ever before.

THE END



GROWING CORN is like putting a jig-saw puzzle together. You have to study all the pieces (practices) and put them together right.

Early Planting Pays Off

WITH PLENTY OF FUEL

D. L. MULVANEY
R. R. BELL
J. W. PENDLETON

UNIVERSITY OF ILLINOIS

PLANTING corn early has paid off with extra bushels in the bin at harvest time in Illinois and many other corn belt states.

Corn planted early has a big advantage weatherwise. Early planting boosts the chances of having a favorable moisture supply in the soil at tasseling before the hot, dry days of late July or August. Corn needs plenty of water throughout the growing season, but the most critical time is around silking.

Early planting also allows the plant to grow during the long light days—and corn loves light. In most years, early corn planting is one way we can make weather work for us.

NITROGEN PUTS PUNCH IN EARLY PLANTING

Early planting pays off only when we pay proper attention to fertility.

It's like lighting a rocket fuse—**useless unless there is plenty of fuel aboard.**

An experiment at DeKalb, Illinois in 1964 and 1965 showed how nitrogen fertilizers help produce top yields with early planted corn:

(1) Three corn varieties were planted on May 4, May 14, May 26, and June 4.

(2) The varieties used were a full season, medium and an early maturing type.

(3) The corn was planted on a highly fertile Drummer silty clay loam at 24,000 kernels per acre.

(4) The corn followed winter wheat with red clover seeded as a catch crop.

(5) Three nitrogen levels were maintained on all varieties and planting dates—no nitrogen fertilizer, 80 pounds nitrogen per acre, and 160 pounds of nitrogen per acre.

(6) All nitrogen was applied before plowing in the spring along with 120 pounds of P_2O_5 and 60 pounds of K_2O.

FIGURE 1 shows different yields of full season hybrid planted at four dates to three nitrogen levels.

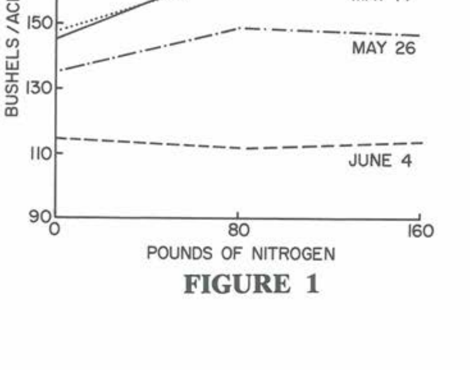


FIGURE 1

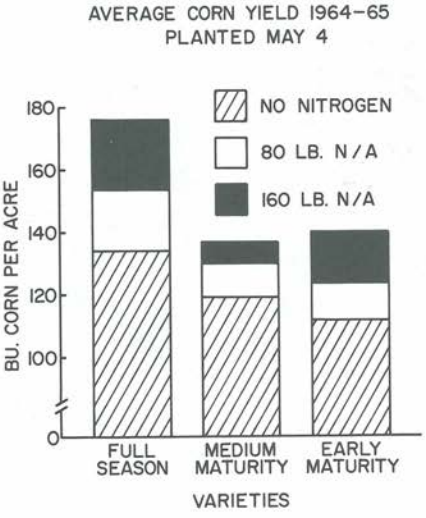


FIGURE 2

Without additional nitrogen, yields for the May 4, May 14, and May 26 planting dates were about equal.

When 80 pounds of nitrogen was applied, the May 4 and May 14 planting dates produced higher yields.

With an additional 80 pounds of nitrogen, or a total of 160 pounds, the May 4 planting date rose to the top yield of 176 bushels per acre (two-year average).

The yield advantage for early planting occurred only when high nitrogen was present. Actually the yields were still going up with 160 pounds of nitrogen per acre.

This experiment does not rule out the possibility of higher yields if more nitrogen had been added. This same relationship was generally present with all hybrids, but yield increases were less with the medium maturity and early maturing varieties.

FULL SEASON HYBRID STARS

The full season hybrid produced a higher yield than either of the other two hybrids at all planting dates.

FIGURE 2 shows yields from three varieties with the three nitrogen levels from the May 4 planting. All varieties responded to added nitrogen. But amount of increased yield varied greatly between hybrids.

The full season variety produced 20 bushels MORE per acre with 80 pounds of nitrogen and 22 bushels MORE per acre for the additional 80 pounds of nitrogen per acre.

The medium maturity hybrid produced about 11 bushels MORE for 80 pounds of nitrogen and 7 bushels MORE per acre with the 160 pounds of nitrogen rate.

This study shows how important it is to put all factors together properly for high yields. Additional nitrogen affected yields very little when the corn was planted in late May or early June.

Evidently nitrogen from the red clover catch crop and the soil had been mineralized to supply sufficient nitrogen for the yields obtained. But when the corn was planted in late April or early May, additional nitrogen increased the yield by 42 bushels per acre.

The two-year average, top yield of 176 bushels, was obtained by putting three production practices together: early planting, right variety, and high fertility.

THE END

IN A SPRING RUSH?

USE THE TOOLS
ON PAGES 20-25
TO HELP YOU SELL
THE VALUE OF GOOD
NUTRIENT MANAGEMENT

IDEAS ARE LIKE SEEDS—YOU
MUST PLANT 'EM TO GET RESULTS

MRS. SCHMIDT FILES HER LAST COPY

THEY COULDN'T keep her in the nursing home. She got up and returned to her Washington apartment, vowing never to get "stuck with old folks again."

She did make one concession to age. She liked to call herself the Grandmother of Potash. It was an apt title, for she began work for the old Kali Potash Midwest office in 1905.

When she left for the hospital on December 27, 1966, an abstract card on a potash research project sat firmly in her typewriter, half completed.

Catherine Schmidt, founder of the American Potash Institute Library, is dead at 83.

Not long after going to work for Dr. H. A. Huston in the Chicago potash office 62 years ago, Mrs. Schmidt found herself performing many duties: searching official bulletins for reports on potash work, helping develop compact educational folders on different crop responses to potash, editing picture possibilities for early attempts at visual aids, etc.

This work soon led her into developing the American Potash Institute Library, eventually recognized by the Library of Congress as one of the world's most complete collections on potash research results. She became an active, respected participant in the library circles of Washington, D. C.

Catherine Schmidt did not have to build this library. She was not employed to do it. She had attended college one year on a small campus in rural Wisconsin, far removed from anything called "library science." But in this little woman there dwelled the Midwest love for hard work, self-development, and self-sufficiency, supported by a remarkable memory no college can give a mind.

Put these traits into a solid, healthy body and you get a mixture that defied 8-hour workdays—a sturdy little dynamo producing literally bushels of work in collecting, classifying, condensing, interpreting, and preserving the important potash work done around the world in this century. She built her library on a common sense basis, so facts could be found easily and used rapidly. She was working for farm-bred scientists, not egg-head scholars, and her Wisconsin heritage served her well.

At the same time, she took delight in quoting the latest wit from *New Yorker* magazine or remembering a certain concert at Constitution Hall or a certain play at National Theatre or a certain viewpoint from a foreign affairs meeting. Catherine Schmidt was forever building her mind.

We remember the day she ran across a distant study on the possibility of music improving plant growth—a real human interest grabber that the A. P. boys had not yet run across. Mrs. Schmidt's eyes sparkled. Think of it! Beethoven to lift the spirits of a little soybean plant on a distant row in West Tennessee. We suggested Tennessee Ernie Ford might do a better job.

Catherine Schmidt was a perpetual student. That's why an Institute colleague found potash work in her typewriter after the hospital attendants had picked her up.

That's why the Wisconsin soil in which she rests will surely produce a sturdier turf this spring, the kind that can survive much weather, disease, traffic; a hardiness Catherine Schmidt stubbornly attributed to potash.

She should know. She covered the world in her mental search for the truth about this nutrient to which she gave most of her life.

NEW K-TELLING TRIO

Soils are complex mixtures derived from many kinds of rocks and minerals. The primary minerals may or may not contain K. Quartz, calcite, and kaolinite contain no K. Feldspars, micas, and many other minerals contain K as a part of the mineral. Clays resulting from the breakdown of such minerals vary in K content and in adsorptive capacities for added K.

Soils of any color may be low in available K. Dark soils, generally thought fertile, may be relatively low in available K.

Comparing soils by water-separation method shows how widely they vary in physical make-up, which also affects their chemical properties. Clay particles and humus act as a storage bin for available K. Even though the sand and silt may contain some K tied up in the mineral complex, this K is practically unavailable to plants.

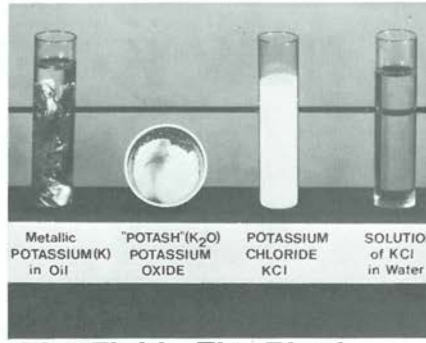
K moves slowly—by diffusion in water films—from one soil particle to another. Rapid plant growth may deplete available K about the roots, though chemically available K is only short distances away.

Hidden hunger may thin out alfalfa stands before outstanding symptoms appear. Soon K deficiency causes loss of stand. Without enough K, the plant cannot restore root reserves, necessary for spring regrowth and fast recovery after cutting.

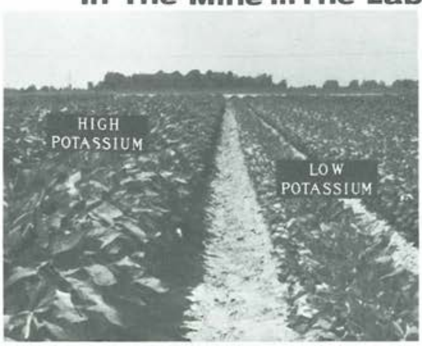
Better quality (a bonus) usually comes with increased yields from proper fertilization. When K improves corn ear size, MORE + BETTER corn results. K-starved ears have unfinished tips and small, chaffy kernels. Adequate K increases the carotene content of corn silage.

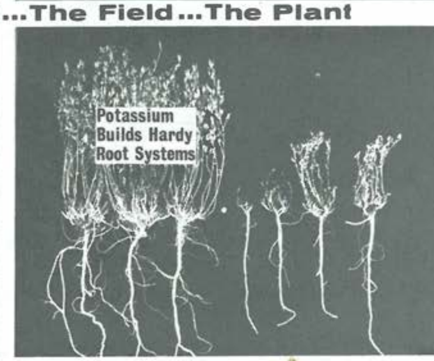
Potassium helps improve the plant's use of higher nitrogen rates. Here increasing K raised the level of true plant protein in orchardgrass, as plant nitrogen content increased. If N is high and K is low, intermediate N compounds (such as asparagine) may accumulate to make feed less palatable or nutritious.

Schedule K-Telling Trio On Page 20



In The Mine ...The Lab...The Field...The Plant





NEW MOVIE SLIDE SET

PLEASE SCHEDULE POTASSIUM FOR AGRICULTURE AS FOLLOWS:

MOVIE (25 Min., Color) ______ Date Desired ______ Alternate Date

SLIDE SET (66 Slides) ______ Date Desired 10-day Loan ______ Purchase ($5.00)

BOOKLET (32 pp.) ______ Free Sample ______ Quantity (10¢ ea.)

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CHEDULE TODAY!

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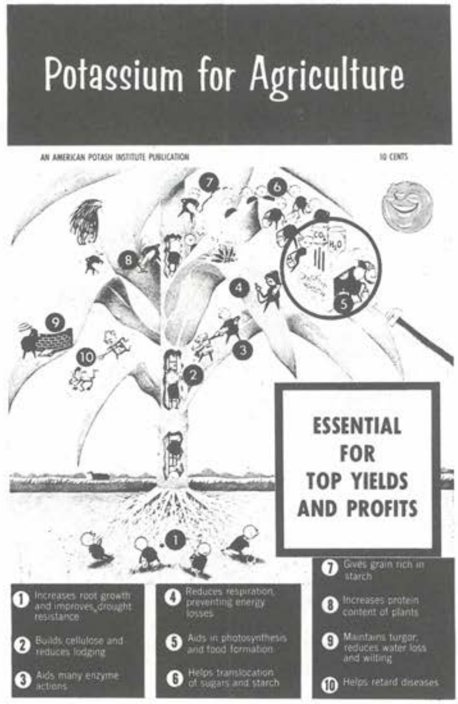
ere does it come from?
at does it do?
y is it so vital?

W THEY HAVE THE ANSWERS

a new color movie
l a new slide set

'ASSIUM FOR AGRICULTURE

th the K handbook audiences
take along for references)



BOOKLET

The new Potassium For Agriculture trio--color movie, slide set, and booklet--has many uses:

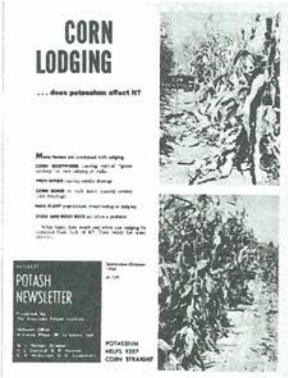
FOR CLASSROOM
FOR CONVENTIONS
FOR LOCAL MEETINGS
FOR SHORT COURSES & WORKSHOPS

USEFUL TRIO

FOR EVERYONE wanting to know the story of this life-giving element --how it's mined and processed, how it acts in soils and plants, how it builds yields and quality.

The Slide Set goes into more technical detail than the 25-minute Color Movie. The 32-page Booklet is an excellent reference tool to distribute to viewers at each showing of the Slide Set and Movie.

NEWSLETTERS



E-123 M-129
ON DOWN CORN

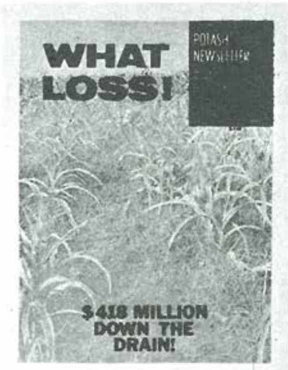
Tells the story of how adequate potash fertilization helped keep corn straight . . . in different parts of the nation . . . helped reduce premature dying, stalk and root lodging.

E-125 M-134
ON EXTRA ALFALFA

Shows growers how they can get 2 EXTRA tons and more with check-list management: fertility-lime, variety, cutting schedule, stand, insect & weed control. Records impressive results.

E-127
ON CORN SILAGE

Shows growers what a big potential there is for this crop in the Northeast . . . its high feed value and yield potential . . . and gives 7 clear steps to 30+ tons under right management.



S-148
ON LIME NEEDS

Gives a major look at the heavy cost of acid soils all over the South . . . problems created by them . . . specific benefits of lime when needed . . . answers for acid soil reaction.

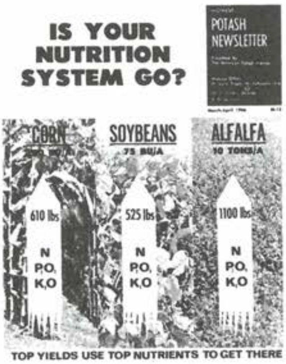
S-146
ON SOYBEAN FUTURE

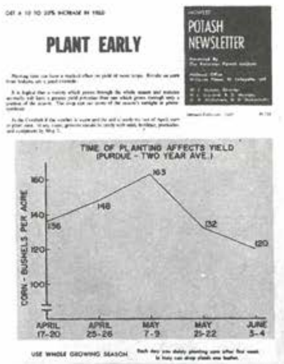
Shows the bright future for soybeans in the South . . . the big growth in acreage over recent years . . . what 10 MORE bushels can mean to the grower . . . some steps he can take to get them.

S-149
ON K ADVANTAGES

Presents tangible evidence of what potassium can do to increase crop yield and quality . . . of corn, tomatoes, cotton, forages, turf, tobacco, and fruit . . . in many areas of the South.

THEMES TO TELL AND SELL THE FACTS





M-138
ON CROP NUTRIENTS

Gives latest facts on nutrient content of crops. High yield removals on such crops as corn, alfalfa, soybean, small grains largely Midwest—a few Eastern and Southern examples.

M-131
ON EARLY PLANTING

Proves how early planting can get 10 to 20% increase in yield. Lists advantages of more plants, narrower rows, lower grain moisture, less harvest loss, and efficient moisture use.

W-32
ON FRUIT QUALITY

Shows potassium building fruit quality. Helps grapes resist disease . . . boosts prune yields . . . puts more size on pears & peaches . . . improves citrus for processing.

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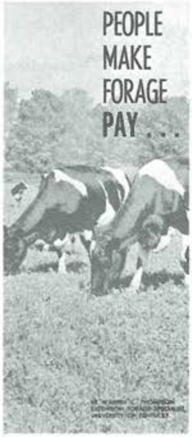
COMPACT FOLDERS

ON CORN
(H-3-65F)
Shows nitrogen-potash teamwork making more money for grower.
With early maturity, stronger standing.
More protein, less dry matter loss.



ON FORAGES
(I-12-64F)
Tells the success story of 3 Ky. farms.
How new ideas—on pasture renovation, fertilization, feed, and animal management—paid off big!

ON REMOVAL
(B-63)
Shows nutrients an acre of high-yield corn will absorb in 4 months' growth.
Heavy nitrogen—phosphate — potash drain in 2nd-3rd months.

ON COASTAL BERMUDA
(D-65F)
Shows why it's a triple-threat grass. Drought resistant.
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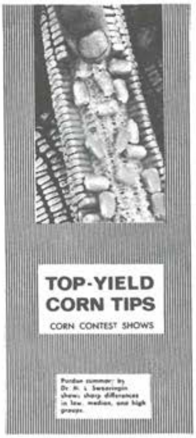
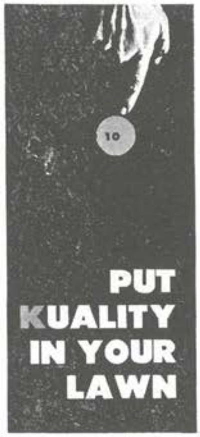


ON TOP CORN
(D-Su-66)

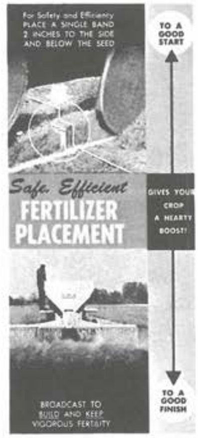
Gives latest tips on top-yield corn. Planting date, plant population, NPK rate top growers use.



ON LAWNS
(A-66-F)

Full color USDA-university pictures show how potash strengthens lawns.

For winter survival
For summer heat
For disease attacks



ON PLACEMENT
(E-59)

Shows importance of band and broadcast placement.

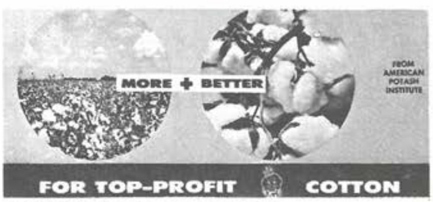
Band to get crop off to fast start.

Broadcast to keep it going strong.

ON ALFALFA
(A-Su-66)

Gives growers tips for producing 10 tons of alfalfa.

Right varieties
Cutting times
Fertilizer program
Harvesting tips



ON TOP-PROFIT COTTON
(L-65F)

Tells how to get MORE plus BETTER cotton: more quantity, better quality.

Features lime-fertilizer effects on cotton yields all over South.

And some convincing evidence of how potash increases fiber quality.

ON STRONG-STALK CORN
(S-W-66)

Shows how undernourished stalks can age faster, inviting rot organisms to enter and weaken stalk for lodging.

How adequate nutrient supplies keep the stalk active longer, reducing lodging, insuring greater yield.

ON HIGH-K BARLEY
(E-W-66)

Shows the road to top-profit malting barley paved with right variety, early seeding, and adequate plant nutrition.

Features a major fact: that barley has responded to potassium not only on low-potassium soils, but also on high-potassium soils-

ON TOP-PROFIT SOYBEANS
(B-Sp-66)

Gives 7 clear steps to high-yield soybeans in the South.

Weed control methods, adequate fertilizer and lime, top quality seed, proper innoculation, fungicide-seed treatment, insect control, efficient harvest.

JAN.	Apply lime anytime, if needed. Mix through plowed layer. Are you satisfied with growth and production of livestock? If not, what about some feedstuff tests?
FEB.	Apply fertilizers, especially nitrogen, to grass pastures or fall grains to be pastured.
MAR.	Sample soils (if not done last summer or fall). Don't compact soils by pasturing or working when too wet. Plow down PK or NPK fertilizers while spring plowing for corn or spring grains. Get some nutrients into lower half of root zone.
APR.	Early planted corn needs some "pop-up" and/or side-band fertilizers.
MAY	Top-dress alfalfa after first cut. Cut early and more often for both higher yields and quality.
JUNE	Side-dress corn with nitrogen, if not applied pre-plant. Side-dress early, so as to injure less roots.
JULY	Watch crops closely for any symptoms or abnormalities. Diagnose with tissue tests or plant analyses. Sample soils *under* crops. Best indications of actual availabilities.
AUG.	If band-seeding alfalfa about Aug. 1, plan to get corrective lime or PK fertilizer treatments plowed down or tilled deeply.
SEPT.	Plow under some PK fertilizers ahead of fall planted grains to be over-seeded with alfalfa or clovers. Need nutrients in deeper root zone. The same applies to fall-applied fertilizers for corn the next spring.
OCT.	Winterize alfalfa by top-dressing established stands. (0:1:3 or 0:1:4). Check nutrient removals. Be sure you are not depleting soils.
NOV.	If storing nitrogen fertilizers in soil for next year, apply after soil cools to 50°F. or less.
DEC.	Check on quality of forages by having feedstuff or plant analyses made in a reliable laboratory.

YEAR-ROUND

Forage Fertilization Calendar

HERBERT L. GARRARD
GARRARD AG PHOTOS
10 HEATHER LANE
NOBLESVILLE, INDIANA

ALFALFA, queen of forages, can't produce like a queen when it gets hungry.

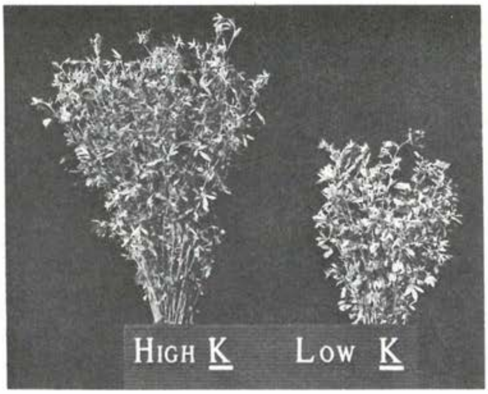
By the time alfalfa is so starved for potassium (K) that plants are stunted and leaves show whitish spots and yellowing, the unseen roots may also be stunted and even dying.

Why do K-starved alfalfa stands soon start to thin out? Dig out some roots from low-potassium soil. You'll find a range of conditions:

From tiny roots already dead TO some that are slender with few crown buds TO medium-sized roots with more potential regrowth buds.

Such roots are starving to death. When tops are undernourished, leaves cannot produce sugars to be stored in roots as starch for regrowth energy after tops are pastured off or harvested for hay.

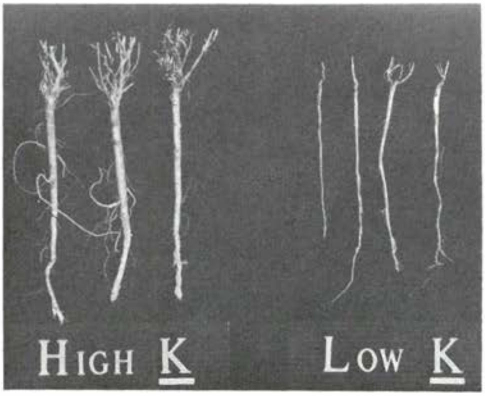
The high-K roots and crowns shown here have plenty of regrowth energy to meet heavy harvest demands. High-K alfalfa also has better quality nitrogen compound, not as much of the less desirable asparagine.



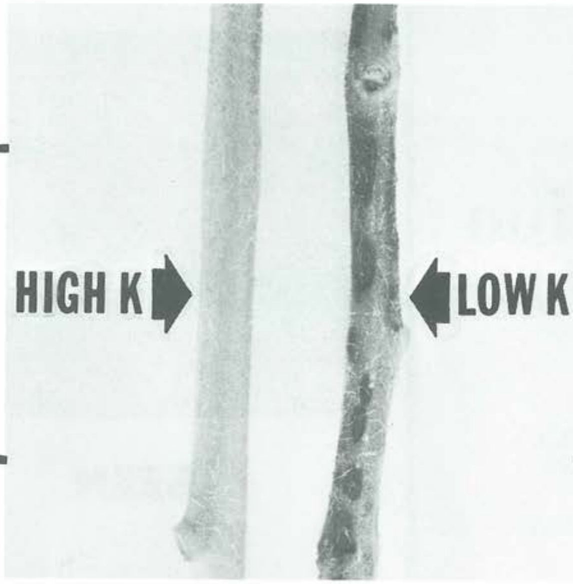
SEEN

and

UNSEEN



Needs For K
(POTASSIUM)



D. N. MAYNARD
A. V. BARKER
W. H. LACHMAN

FIGURE 1—Tomato stem lesions developed on plants receiving low K^+ and high NH_4^+, shown right above.

High Nitrogen Tomatoes Need Enough Potassium

. . . to control stem lesion
. . . to make up for K trapped in clay
. . . to insure good protein and plant development

THE RATE of applying N per acre of cropland in the United States has more than doubled in the last ten years.

Accompanying this increased application rate has been a shift toward substituting ammonium nitrate, anhydrous ammonia, and nitrogen solutions for sodium nitrate. This shift is expected to increase in the future. Urea and ammoniated phosphates are being used extensively.

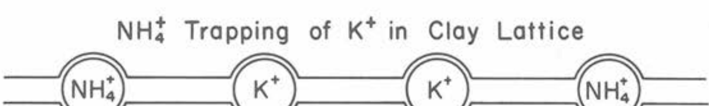


FIGURE 2

UNIVERSITY OF MASSACHUSETTS

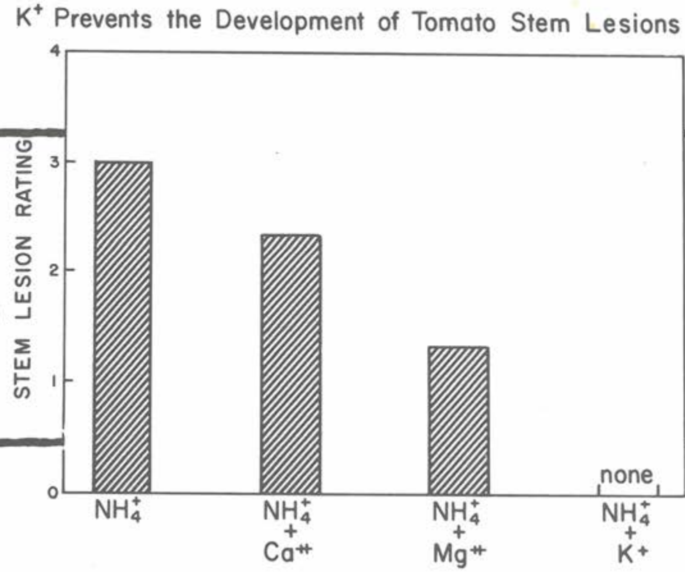


FIGURE 3

But caution must be taken in applying ammoniacal fertilizers. The absorption of too much ammonium N by some crop plants can result in their injury. Applications of other nutrients must be adjusted to meet the new needs of the crop as a result of changed N nutrition.

STEM LESION FORMATION INDUCED BY HIGH NH_4^+–N

In green house soil experiments conducted at the University of Massachusetts, a new necrotic stem lesion (Figure 1) on tomato was found related to application rate of ammoniacal fertilizers. Subsequent tests showed that in soil culture lesion formation occurred only when large amounts of NH_4^+ salts were applied. Large applications of nitrates did not produce lesions.

LESIONS NOT PRODUCED BY NH_4^+ IN SAND CULTURE

Experiments with tomato plants grown in sand culture soon showed that **lesion formation was not simply ammonium toxicity but was a complex nutritional disorder.** No lesions formed on tomato plants grown with over 200 ppm NH_4^+–N in the nutrient solution. Applications of NH_4^+ in this quantity had induced lesion formation when the plants were grown in soil.

SAND AND SOIL SYSTEMS CONTRASTED

The differences between the sand system and soil system were considered. The possibilities of a minor element deficiency and of excessive soil acidity caused by the ammonium applications were rejected. Considerable testing showed that withholding minor elements failed to produce lesions in sand culture and that liming failed to prevent lesion formation in soil culture.

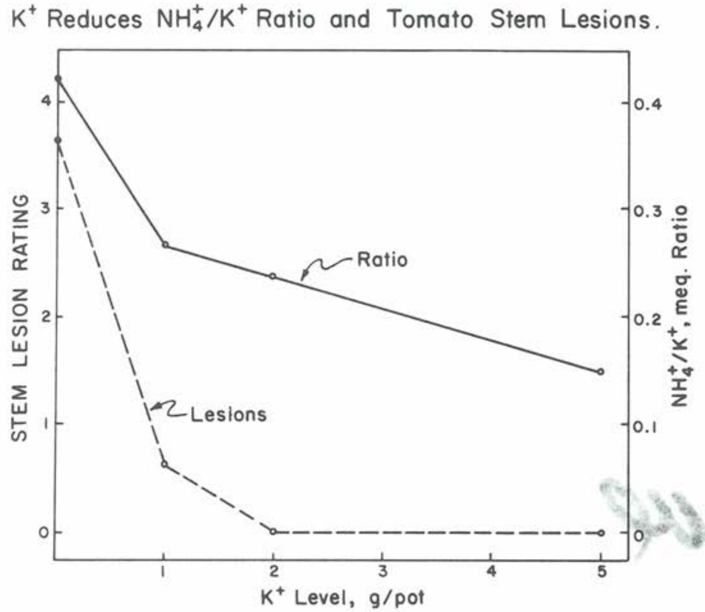


FIGURE 4

WITHHOLDING K^+ LED TO LESION FORMATION IN SAND-CULTURED TOMATOES

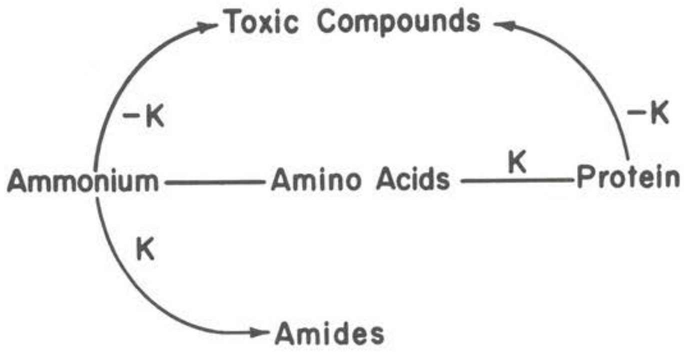
It had been suspected early in the experimentation that a cationic imbalance might exist within the plant when NH_4^+ was high. Because of the known relationship between K^+ and N metabolism, it was theorized that K^+ might be the limiting cation. This idea was soon confirmed when **withholding K^+ from the nutrient solution produced lesion formation on tomato plants.** K^+ deficiency did not produce lesions with nitrate nutrition.

RELEASE OF SOIL K^+ INHIBITED BY NH_4^+

With the normal system of sand culture, K^+ was supplied at 234 ppm which was adequate K^+ for plant growth on NH_4^+–N. No further benefits were obtained by increasing the K^+ supply. On the other hand, in the soil system, all the K^+ supply had to come from the soil clays (micaceous minerals) since no supplemental K^+ was applied in the initial experiments. Ammonium ions in high enough concentrations apparently caused a fixation of K^+ in the clay.

The work of C. I. Rich at Virginia Polytechnic Institute and of I. Barshad at the University of California provided a working model which served to explain the trapping of K^+ by NH_4^+.

In a soil system saturated with NH_4^+, all the exchangeable K^+ would be replaced by NH_4^+, and NH_4^+ would also occupy many of the readily accessible clay interlayer sites. The NH_4^+ and K^+ ions have nearly identical hydrated ionic radii. The replacement of K^+ by NH_4^+ within the interlayer would result in a contracted clay lattice, so K^+ was unable to diffuse out into the soil solution. **K^+ was effectively trapped by the NH_4^+ as shown in Figure 2 and was unavailable to plants.**



Roles of Potassium in Ammonium Utilization
FIGURE 5

CA^{++} AND MG^{++} LESS EFFECTIVE

The addition of $CaCl_2$ or $MgCl_2$ resulted in some reduction in lesion formation (Figure 3), but did not eliminate them. Actually Mg^{++}, which was next in effectiveness to K^+, increased the K^+ supplying power of the soil in the presence of NH_4^+. Three to four times as much K^+ could be extracted in the presence of $MgCl_2$ as in the presence of $CaCl_2$ or no cation addition. Ca^{++} did not increase the extractable K^+.

K^+ HAS A ROLE IN NH_4^+ UTILIZATION

For reasons not yet fully known, plants receiving NH_4^+ require more K^+ than plants growing on nitrates. This is well illustrated by this study in which lesion development was induced by the combined effects of NH_4^+ toxicity and K^+ deficiency.

The K^+ Deficiency resulted from two main causes: (1) the reduced K^+ supplying power of the soil and (2) an increased K^+ requirements for NH_4^+ utilization. The second cause is very important because nitrate grown plants do not develop lesions even with K^+ deficient conditions.

With a high NH_4^+/K^+ ratio in the plant, stem damage was high (Figure 4). On the other hand, a low NH_4^+/K^+ ratio indicated normal stems.

Without supplemental K^+, NH_4^+ and possibly other toxic N compounds accumulated and lesions occurred. K^+ in some way, as yet unknown, helps utilize NH_4^+ into protein or nontoxic storage compounds like the amides, glutamine, and asparagine. **Without K^+, proteins may break down into NH_4^+ and toxic degradation products (Figure 5).**

SUMMARY

1. **Tomato stem lesions occur under conditions of low K^+ and high NH_4^+ nutrition.**
2. **NH_4^+ ions trap K^+ in the clay, reducing K^+ supplying power of the soil. Plants growing on NH_4^+ require a higher K^+ level than plants growing on NO_3^-, so the K^+ stress is accentuated.**
3. **K^+ regulates the plant's use of NH_4^+. NH_4^+ accumulation is much less when supplemental K^+ is added. Adequate K^+ is needed for NH_4^+ to be used in protein synthesis and plant growth.**

Soil P UP

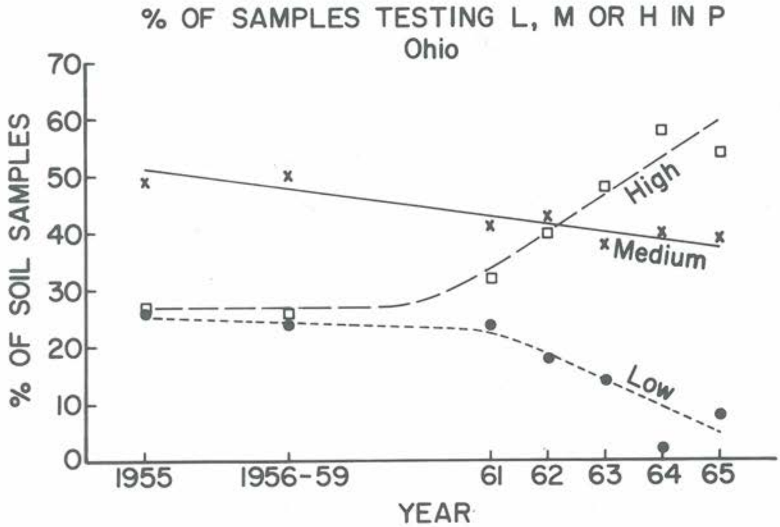


FIGURE 1—Ohio soils are increasing in P content, as these trends in high, medium, and low soil tests show. This is the direction we want to see them go.

A Great State Pushes The POTASH BUTTON

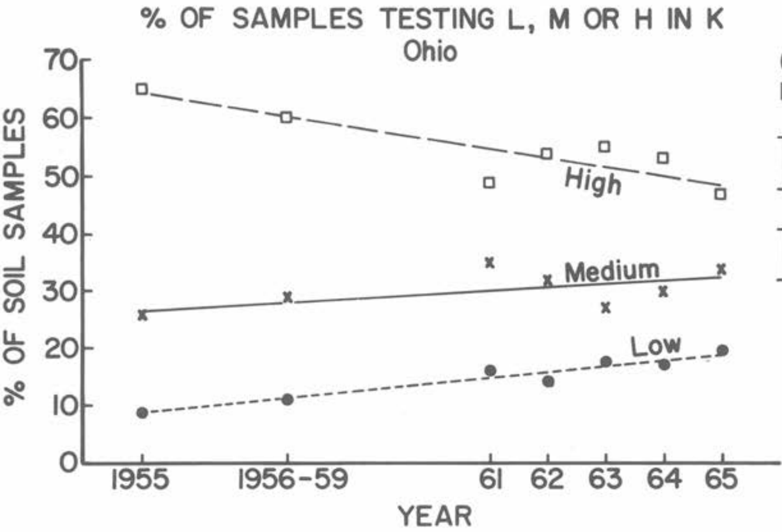
AFTER GETTING CAUGHT WITH ITS K RECOMMENDATIONS DOWN

SOIL PHOSPHORUS (P) levels are rising while soil potassium (K) levels are falling in Ohio soils. What a contrast to just a few years ago when P was considered the fertilizer nutrient most needed.

Extension teaching emphasized P because so many soil tests were lower in P than in K. Industry cooperated and made complete fertilizer high in P. Many farmers started using more P and kept on using it.

POTASSIUM IS TAIL-END CHARLIE

The use of nitrogen (N) finally caught on, too, and farmers began to pour it on their soils. This fertilizer revolution, coupled with use of improved hybrids, minimum tillage, and earlier planting pushed yields higher. Higher crop yields



Soil K DOWN

HAROLD E. SHOEMAKER
OHIO STATE UNIVERSITY

FIGURE 2—Ohio soils are declining in K content, as these trends in high, medium, and low soil tests show. This is the wrong direction for top-profit production.

have siphoned more nutrients from the soil, pulling the K level down.

This is striking when a field is converted from poor pasture to good alfalfa. The K levels are usually high under the low yielding pastures because soil K release is greater than the removal.

But these high K levels drop to low in 3 to 4 years when several tons of alfalfa hay are removed annually and the original soil test recommendations are followed.

Figure 1 shows the trends for soil samples testing low, medium, and high in P in eight representative Ohio counties, two in each quarter of the State.

The percent of samples testing low and medium has been decreasing while the percent testing high in P has been increasing. This is in the right direction since we would like to see them all high.

The trend is just the opposite for K levels (Figure 2). The percent of samples testing high is decreasing while the percent testing low and medium is increasing. **We're losing ground since the increase in medium and low soil K levels are at the expense of high K soils.**

WHAT HAPPENED TO SOIL K LEVELS?

The 1961 Soil Test Summary sheds some light on the effect of rotations on K levels. Figure 3 shows a decrease in the % of samples testing high in K and an increase in the % testing low and medium in K, as the number of years of corn in the rotation decreased and the number of years of legumes increased.

Why such a shift? Census data indicate that more fertilizer is applied to corn than to meadows, yet legumes remove more K than corn.

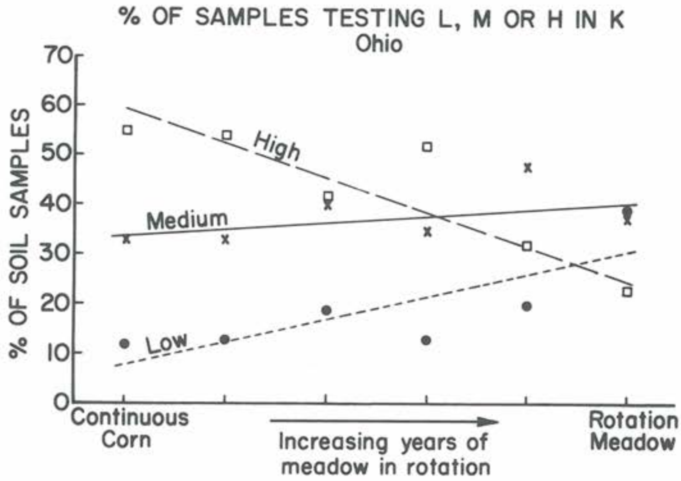


FIGURE 3—Potash soil content declined as corn years decreased and legume years increased in the rotation. Legumes are very heavy potash removers.

WE GOT CAUGHT WITH OUR K RECOMMENDATIONS DOWN

These trends made us wonder if our K recommendations were high enough, but more facts were needed.

In addition to our Soil Testing Program, we also have an excellent Plant Analysis Program in Ohio.

This statement was found in the 1965 Plant Analysis Summary: **". . . the low level of K observed in many corn and alfalfa samples indicated that K deficiency may be more widespread than formerly realized."**

Plants needed more K, especially corn, soybeans, and alfalfa, since 35%, 33%, and 25% of the samples tested low in K, and only 21%, 27% and 6% tested low in P.

If the best farmers are having these problems, then what shape are the others in—those who do not have their soils tested and do not follow through with plant analysis?

It was also found that soil test K levels had to be around **300# K/A in order to get sufficient K in the corn plants.**

WE "JACKED-UP" OUR K RECOMMENDATIONS

This meant but one thing. Higher K recommendations were needed for Ohio soils. The Agronomy Department Soil Fertility and Soil Chemistry Committee met to determine how much. Research, teaching and Extension staff were represented on this Committee.

Figure 4 shows how much we increased our potash (K_2O) recommendations for alfalfa.

Not only are greater amounts of potash (K_2O) being recommended, but a distinction is made between sands, silts, and clays (Table 1).

Recommendations were also made for multiple yields, providing an opportunity to select the recommendation for the yield goal best suited for the soils.

Tables 2, 3, and 4 show how much applied K may be needed to meet different yield goals for corn, alfalfa, and soybeans at specific soil test values.

PUSH THE POTASH BUTTON

Potash tonnage used in Ohio has

TABLE 1 EFFECT OF SOIL TEXTURE ON K RECOMMENDATIONS 150+ BU. OF CORN PER ACRE

Soil Test Value	Soil Texture Groups[1]		
K Lbs/A	A	B	C
	Annual application - pounds K_2O per acre		
0-99	130[2]	140[2]	190
100-149	110[2]	120[2]	150
150-199	95	100	125
200-299	70	70	70
300-399	40	40	40
400+	10	10	10

[1] Soil Texture Groups: A—clays, silty clays, silty clay loams, clay loams; B—loams, silt loams; C—sandy loams, loamy sands, sand, and organic soils.
[2] It may be difficult to obtain the listed yield levels at these soil test values.

TABLE 2 EFFECT OF YIELD GOAL ON K RECOMMENDATIONS FOR CORN

Soil Test Value	Bushels of Corn Per Acre - Loams and Silt Loams		
K Lbs/A	100—124	125—149	150+
	Annual application - pounds K_2O per acre		
0—99	100	120[1]	140[1]
100—149	80	100	120[1]
150—199	70	85	100
200—299	45	60	70
300—399	20	30	40
400+	10	10	10

[1] It may be difficult to obtain the listed yield levels at these soil test values.

TABLE 3 EFFECT OF YIELD GOAL ON K RECOMMEMDATIONS FOR ALFALFA

Soil Test Value	Tons of Alfalfa Per Acre - Loam and Silt Loams		
K Lbs/A	4½ — 6	6 — 7	7+
	Annual application - pounds K_2O per acre		
0—99	230	280[1]	315[1]
100—149	195	235	270[1]
150—199	175	210	240
200—399	110	140	165
400+	60	80	100

[1] It may be difficult to obtain the listed yield levels at these soil test values.

TABLE 4 EFFECT OF YIELD GOAL ON K RECOMMENDATIONS FOR SOYBEANS

Soil Test Value	Bu. of Soybeans Per Acre - Loams and Silt Loams		
K Lbs/A	25—34	35—44	45+
	Annual application - pounds K_2O per acre		
0—99	50	65[1]	75[1]
100—149	40	50	60[1]
150—199	35	40	50
200—299	25	30	35
300+	10	10	10

[1] It may be difficult to obtain the listed y ield levels at these soil test values.

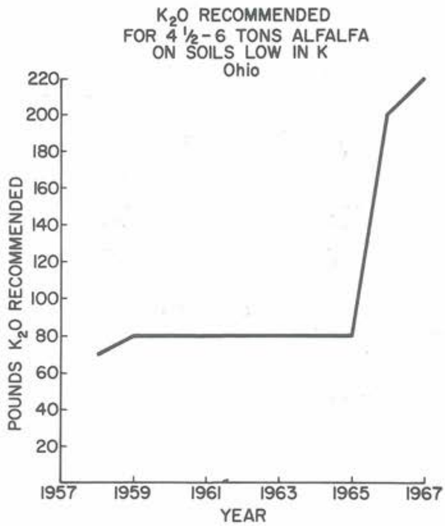


FIGURE 4—Ohio increased its potash (K_2O) recommendations to meet the high production needs of alfalfa.

been rising and will probably increase more rapidly in the future.

The trend is toward larger farms run by managers who will apply the needed fertilizer. This willingness, teamed with higher recommendations, will increase the demand for K.

Ohio farmers purchased 186,717 tons of potash (K_2O) in 1965-66. This will probably triple by 1980—to at least 570,000 tons (Table 5).

Table 5 POTASH USE WILL TRIPLE BY 1980 IN OHIO

Year	Tons K_2O
1965-66	186,717
1970	280,000
1975	410,000
1980	570,000

More K must be applied if the modern farmer is to meet the challenges of today . . . and provide the food needed for tomorrow.

THE END

IN LOW K TOMATOES

Blotchy Ripening Can Shatter Profits

FROM CORNELL NEWS

LOW POTASSIUM level may be causing blotchy ripening in tomatoes, according to Cornell University researchers.

A tomato showing blotchy ripening often has discolored areas on its surface and hard white tissue in the fruit walls or interior.

Blotchy ripening rarely reduces yield but frequently reduces the number of marketable fruits, re-

ports Prof. P. A. Minges, Vegetable Crops Dept., N.Y. State College of Agriculture, Cornell.

Minges and Edward Boutonnet, graduate student, studied blotchy ripening to see if it could be influenced in the field by different nutritional treatments.

In working with Fireball tomatoes, Boutonnet found that plants treated with a high potassium rate produced fruit with significantly less white tissue than plants receiving no potassium, even though yields were about the same.

This would suggest, he said, that higher potassium levels than presently recommended for field tomatoes grown in New York State might help reduce the severity of this disorder.

He also found that fruit with less blotchy ripening resulted when a nitrate form of nitrogen was used rather than an ammonium form.

Calcium had no effect, he said. High lime rates were applied to several plots for comparison with those receiving none. There was no significant difference between the groups, Boutonnet said.

In his studies, he observed a wide variation in the number of blotchy tomatoes produced by plants in the same plots. One plant would have a large number of blotchy tomatoes and the one beside it might have very few.

This variation might make it possible to select or breed plants with a genetic resistance to the disorder, he said.

Minges said further study is needed to determine the effect of higher potassium rates than used in this study, as well as the effect of other nutrients and the environment on the blotchy ripening.

THE END

SEE PAGES 20-25

IN NATIONAL SURVEY

OUR BEST corn growers provide an excellent measure of progress in corn production:

1—They adopt new ideas first—in fact, originate many of them.

2—They set practical limits on such variable factors as plant population and fertilizer rates.

3—They indicate the rate of change to new practices, such as narrow rows.

4—And their yield goals provide a valuable measure of how high we might expect to advance overall yield averages in the years ahead.

Top Corn Growers Set Trends

BY GEORGE D. JOHNSON
CHICAGO, ILLINOIS

In mid-December, I mailed a questionnaire to a list of 400 corn growers considered to be the best in their respective areas. Distribution was nationwide, roughly proportionate to corn acreage.

By the first of February, 224 of the questionnaires had been returned and summarized—first in total, then in four groups, as follows:

1. Corn Belt—Ohio, Indiana, Michigan, Illinois, Wisconsin, Missouri, Iowa, Minnesota.

2. South and East—states south of the Ohio River, and east of the Mississippi, including the eastern states.

3. West (Irrigated) and, **4. West (Dryland)**—all remaining states, divided as indicated.

Following are their answers to key questions, as tabulated to date.

"What was your 1966 overall yield average and average from best field?"

	ENTIRE ACREAGE	BEST FIELD
	BUSHELS	
Corn Belt	106.1	136.0
South & East	84.7	121.7
West (Irrig.)	114.7	139.5
West (Dryland)	77.9	106.2

Average yields in Corn Belt and South were down slightly from 1965, due to extreme heat and drought in July and August.

"What was your acreage in corn in 1966? What is expected acreage in '67?"

	1966	1967
Corn Belt	404.5	446.0
South & East	304.6	349.6
West (Irrig.)	667.1	867.2
West (Dryland)	238.1	281.1

This compares with 7-percent overall increase indicated by first USDA survey of 1967 of acreage intentions.

"What is your 1967 yield goal?"

Corn Belt	150.0 Bu.
South & East	133.4 Bu.
West (Irrig.)	148.9 Bu.
West (Dryland)	113.2 Bu.

Top corn growers continue to think higher yields. A similar survey in early 1965 revealed yield goals of 136.9 for the Corn Belt farmers and 119 for South and East.

"Indicate plant population at planting."

	1966	1967
Corn Belt	22,708	23,078
South & East	19,103	19,520
West (Irrig.)	22,523	23,850
West (Dryland)	19,307	19,307

Plant populations of top corn growers jumped 2,000 per year in '63 and '64. This raises questions: do small increases mean the "population explosion" is reaching its limit among top corn growers—or is this a normal reaction to a severe drought?

Because of a USDA study released in December, 1966, we can compare harvest time plant populations of top corn growers with average farm figures in two areas.

	TOP CORN GROWERS*	AVERAGE**
Corn Belt	20,437	15,900
South & East	17,193	10,300

* Planted population reduced by 10 percent.
** From USDA Statistical Reporting Service.

Please indicate fertilizer rates for '66 and '67.

CORN BELT:

	1966	1967
N	145.5	154.0
P_2O_5	91.1	97.9
K_2O	121.0	133.5

SOUTH & EAST:

	1966	1967
N	154.2	161.5
P_2O_5	89.3	87.6
K_2O	110.5	116.7

WEST (IRRIG.):

	1966	1967
N	163.1	173.4
P_2O_5	59.5	68.9
K_2O	35.0	50.0

WEST (DRYLAND):

	1966	1967
N	105.5	133.8
P_2O_5	49.3	47.5
K_2O	31.4	36.3

Rate of increase appears to be slowing—top farmers increased nitrogen 45 pounds per acre between 1962 and 1964.

"Please indicate 1966 row width and 1967 plans."

Of 224 surveys summarized, the following are 1966 row widths, and expected changes in 1967:

	15″ to 25″	26″ to 35″	36″ to 45″
1966	6	65	153
1967	7	78	139

Of 14 planning to switch in '67—13 will go to 30″ rows; 1 to 20″.

Again, thanks to USDA, we have a comparison with average figures.

ROW WIDTH USED IN 1966:

	TOP CORN GROWERS	AVERAGE
34″ or less	31.7	4.9
35″ or over	68.3	95.1

"How many hybrid varieties did you plant in 1966?"

(Corn Belt only.)

NO. OF HYBRIDS USED	NO. OF FARMERS REPORTING
One	5
Two	16
Three	23
Four	32
Five	17
Six to ten	29
Eleven to twenty	2

The survey reveals that more hybrids per farmer are now being used than in '64 and '65.

"Estimate your yield goal 5 years from now."

Corn Belt.....................185.64 Bu.
South & East.................161.7 Bu.
West (Irrig.)..................196.08 Bu.
West (Dryland)...............147.6 Bu.

A comparison with a 1965 survey reveals top Corn Belt corn growers that year saw long range yields of 156.6 bu./a.

What things are you going to concentrate on most in 1967?

PRACTICE	NO. OF FARMERS MENTIONING
More fertilizer	29
Hybrids	29
Weed control	20
Early planting	17
Herbicide change	12
Care in planting	11
Narrow rows	9

PRACTICE	NO. OF FARMERS MENTIONING
Adjust for weather	9
Minimum tillage	8
Lower plant population	7
Higher plant population	7
Every detail	7
Different fertilizing method	7
Less tillage	6
Insect control	6
Early harvest	5
Lime	5

CONCLUSION?

Top corn growers are continuing to set a fast pace for themselves.

They are making many changes and adjustments in production methods trying to reach their goal.

Relatively small increases in plant population and fertilizer rates compared to a high 1967 yield goal may indicate top corn growers feel they are approaching the limits of these practices—and that it will take other practices, plus favorable weather, to attain their '67 goal.

The yield difference between their best fields and their overall average (doubled to get the range of best to poorest field) gives us some idea of the great challenge the individual farmer has in bringing all his fields up with his best fields.

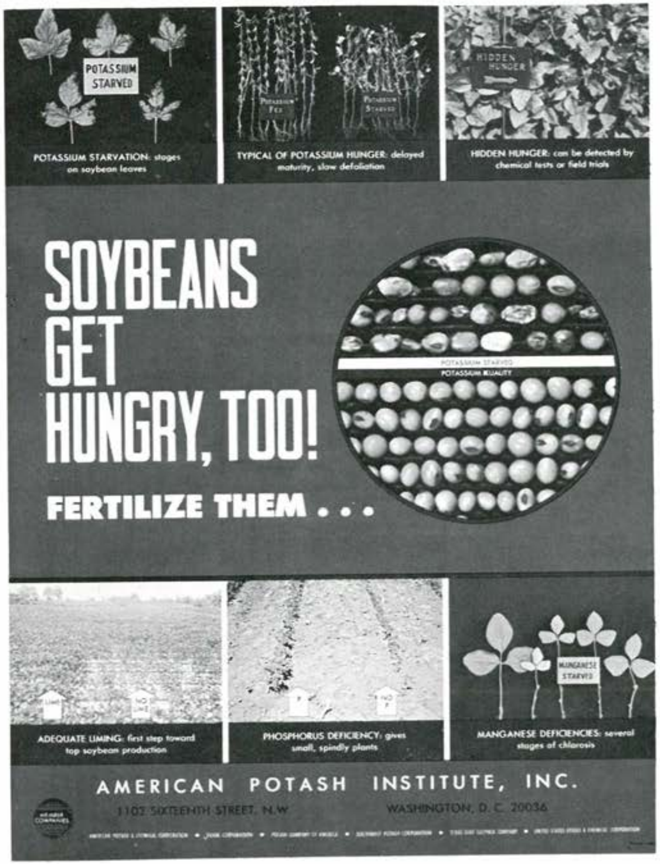
Rates of phosphate and potash are being increased slightly faster than N in most areas, indicating they are moving these elements into better ratio with nitrogen.

Is transition to narrow rows more gradual than first indicated? Most of the 71 farmers using narrow rows in 1966 made the switch in '66. By December, only 14 had decided to switch in '67.

Are farmers using more hybrids? Probably. This and other surveys confirm a trend toward a larger selection of hybrids—this is confirmed by their great interest in hybrids shown in the final question.

As for the future—if the outlook of top corn growers is any indication, it will be some time before their aspirations begin to level off. And with the average yields well behind, it is clear that corn yields will continue to move up for some time to come.

THE END



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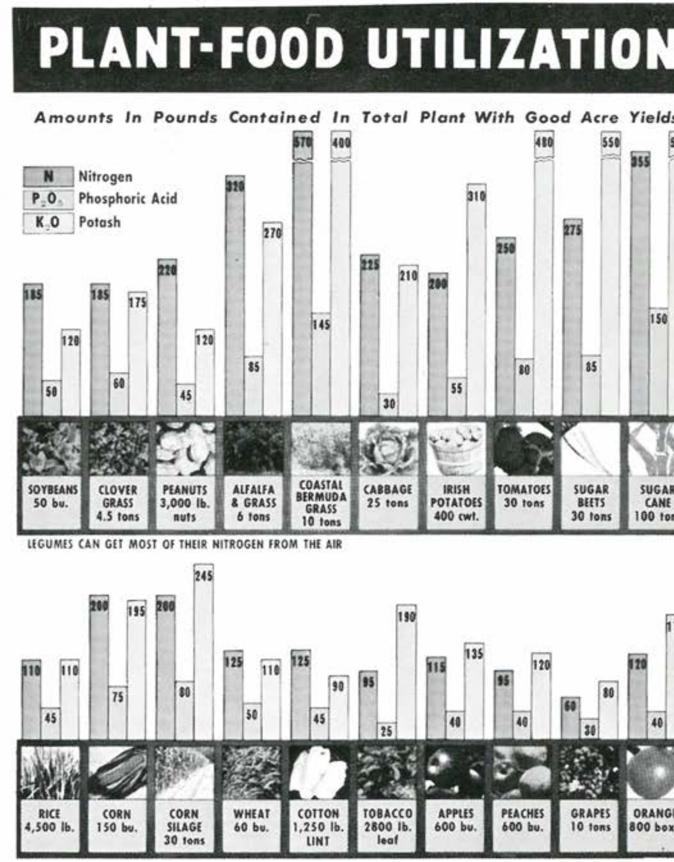
As A Wall Chart

As A Fact Pamphlet



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