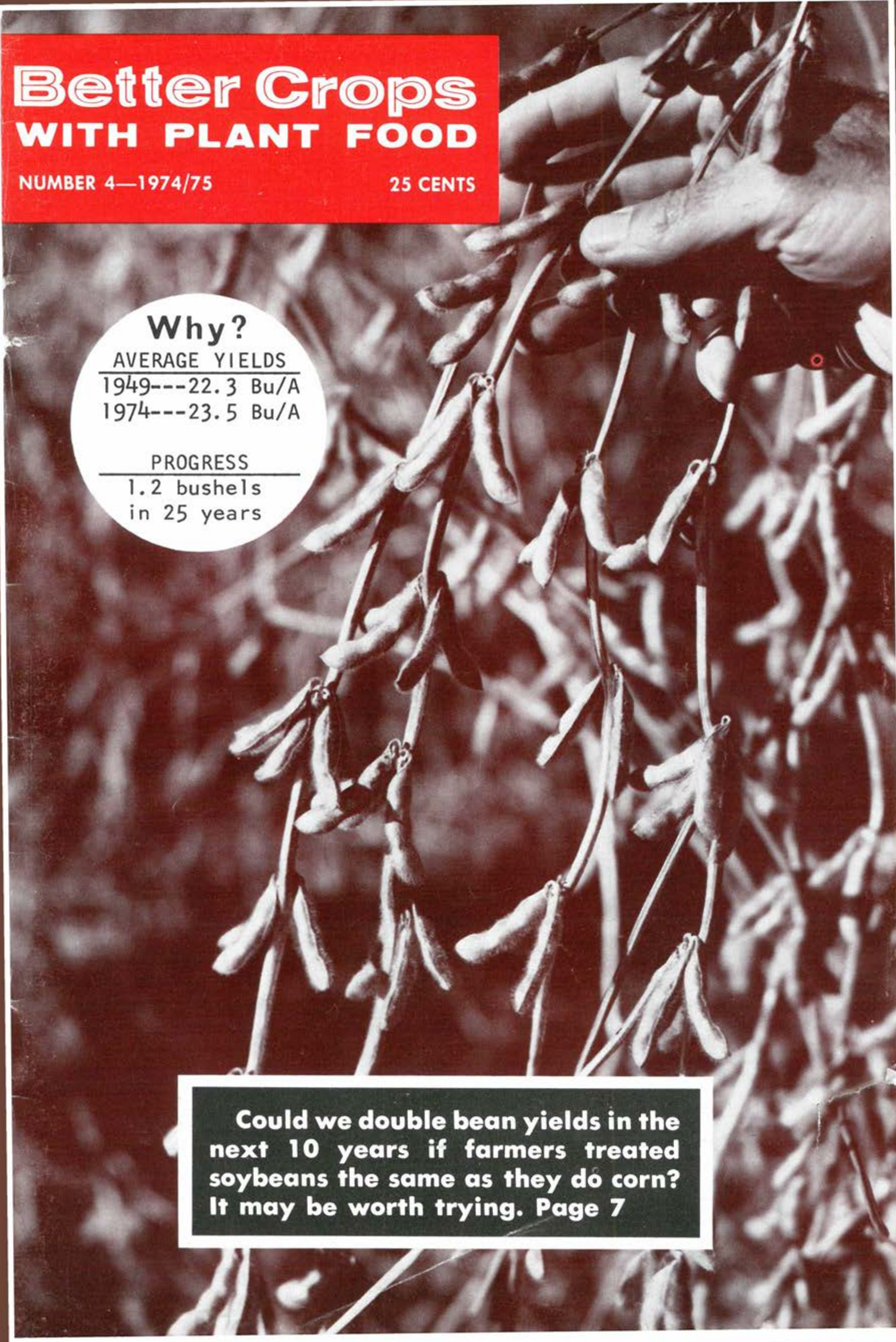
Better Crops WITH PLANT FOOD

NUMBER 4—1974/75 25 CENTS



Why?

AVERAGE YIELDS

1949---22.3 Bu/A

1974---23.5 Bu/A

PROGRESS

1.2 bushels in 25 years

Could we double bean yields in the next 10 years if farmers treated soybeans the same as they do corn? It may be worth trying. **Page 7**

Better Crops
WITH PLANT FOOD

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HIGH-K Soils Sometimes Need MORE K

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CAN CROPS GROWN on dark, fine-textured, imperfectly drained soils respond to added potash even if the soil tests high in K?

Let's look at an imperfectly drained Drummer silty clay loam in east central Illinois. Original soil test level was 257 lbs/A of exchangeable K. To this soil these rates were applied: 0, 50, 100, 200, and 400 lbs K/A as KC1 to the same plots during both 1967 and 1968.

During 1969 and 1970, each plot was split into THREE SECTIONS to receive either 0, 100, or 200 lb K/A. The purpose was to learn the effects of both **carryover K** and **further K applications.**

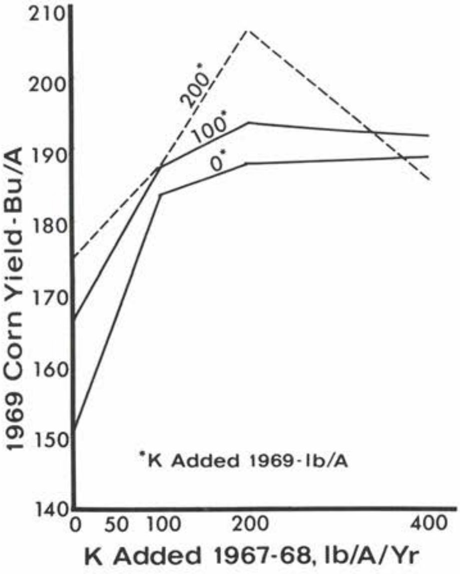
Corn was grown during 1967 through 1970. Soybeans followed in 1971 without further K being added. The rows were 38 inches apart. Corn plant population was 26,000. And all corn plots received 300 lb N and 150 lb P_2O_5.

CORN RECEIVING 150 lb K/A yielded 16 bu/A more in 1967, 17 bu/A more in 1968 than the check plot. There were no further responses to the higher rates.

Figure 1 shows 1969 yields. These three chart curves show how much carryover K can affect yields. Note how yields continued increasing up through 200 lb K/A per year in all three cases.

When no K was applied in 1969, carryover K boosted yields 38 bushels—from 151 to 189 bushels/A. When K was applied in 1969, it boosted yields 24 bushels (from 151 to 175 bu/A) on plots that got no K in 1967-68 but showed no increase on plots that got 400 lb K in 1967-68.

FIGURE 1—These three curves show how much carryover K can affect yields. Yields continued increasing up through 200 lb K/A per year in all three cases.



This seems to say the crop responds better to carryover K than to direct applications—in this case, at least. The best yield—207 bu/A—came from 200 lb K/A applied EACH OF THE 3 YEARS.

STRESS FROM BLIGHT apparently declined when the soil con-

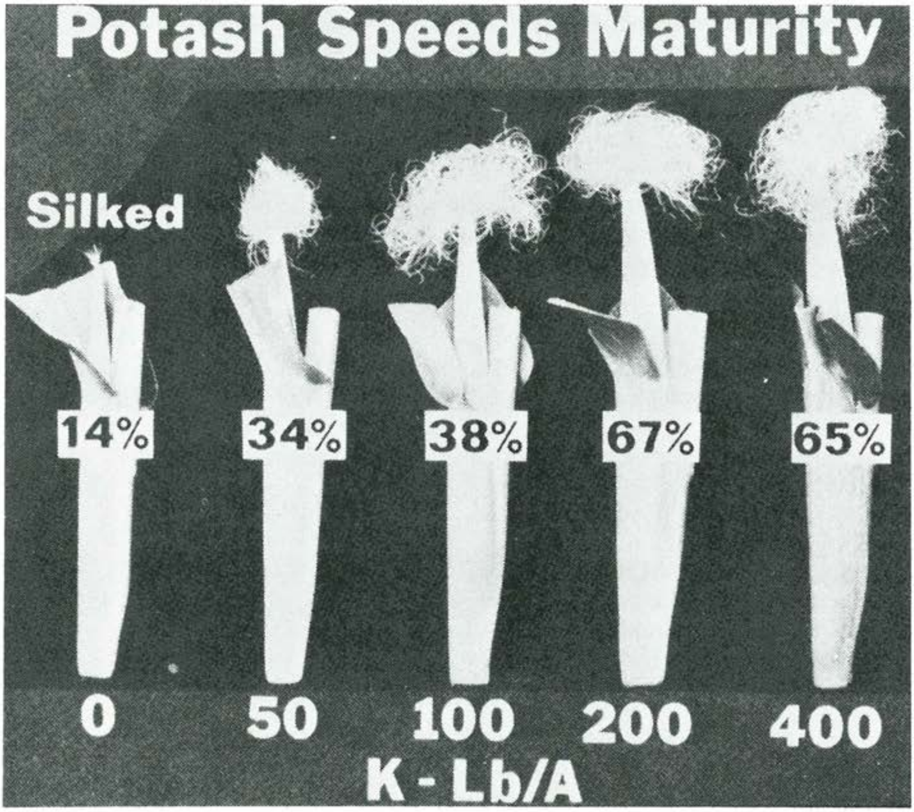


FIGURE 2—Potassium speeds up silking on a soil testing 337 lb K/A air dry. (1968).

tained high available potassium (K). **Table 1** shows this influence when Southern corn leaf blight severely infected the field in 1970.

In the 3 years before 1970, yields topped out with 200 lb K/A. But when the blight hit in 1970, yields increased steadily as carryover K increased in the soil.

The highest yield of 137 bu/A came on soil that had been built up to 421 lb/A exchangeable K.

CORN SILK EMERGED sooner when potassium was added. Figure 2 shows the trend on the particular day these plants were checked—only 14% silk on no-K plants, 65 to 67% on the plants receiving the two highest K rates.

The same effect occurred in 1969 when 50% of the plants silked 4 to 5 days sooner with high K rates than with no K.

This influence may well increase corn yields by lengthening grain filling time. It may also help prevent pollen shed and silking times from getting mismatched during hot, dry weather when silking is often delayed.

LODGING DECREASED as potassium rates increased, in most cases. Lodging was severe in 1967—over 50% in all plots. But on October 19, 1968, the lodged plants showed a de-

TABLE 1—The Highest Potassium Level Was Still Increasing Yields When Corn Was Under Stress From Southern Leaf Blight. (1970)

Annual K rate	K soil test** after 3rd year	3-yr average corn yield, 1967-69	Yield with Southern leaf blight (1970)
lb/A	lb/A	bu/A	bu/A
0	280	149	104
100	322	172	126
200	363	177	130
400*	421	171	137

* This rate was applied only the first two years of the study.
** Tests run on air-dried samples taken 3/30/70.

cline with increasing K rates—30% lodging with no added K, 25% with 50 lb K, 25% with 100 lb K, 21% with 200 lb K, and 18% with 400 lb K.

By October 14, 1969, lodging hit 30% of the plants receiving no K and generally declined to as low as 12% on plots receiving 200 lb K/A per year.

But plots that had received 400 lb K/A in 1967 and 1968 lodged more

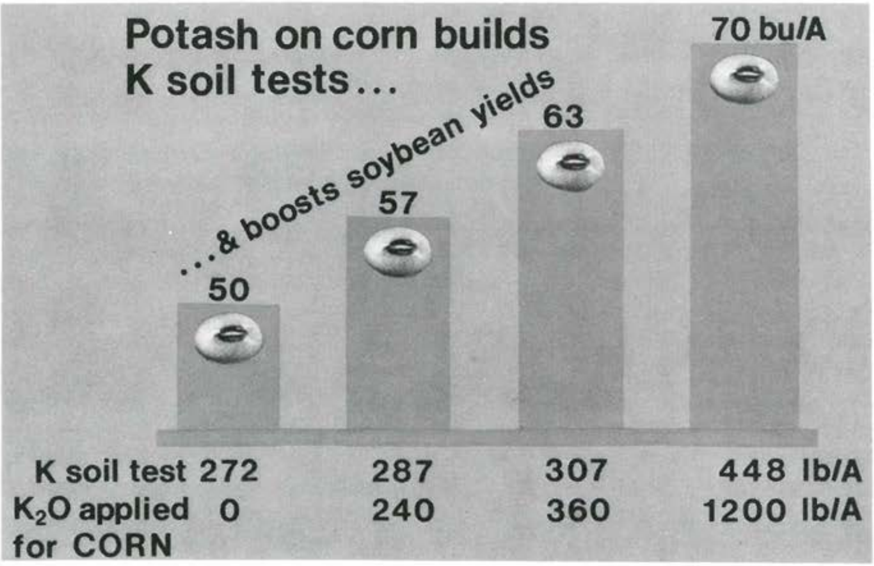


FIGURE 3—Carryover potassium applied the previous 4 years on corn increased the soil test and the soybean yield 20 bu/A—from 50 to 70 bu/A (1971). Air dry soil test September 23, 1971.

than the other K treatments, approaching the no-K plots. In 1970, the tops of plants on the low-K plots were broken over by September 1.

SOYBEAN YIELDS CLIMBED from carryover potassium when they were grown in the plots during 1971 to test carryover effects.

Figure 3 shows this influence. Plots receiving no K on this high-K soil yielded 50 bu/A. Increasing levels of carryover K showed increasing yields up to 70 bu/A with 1,200 lb K_2O/A applied to corn over the 4 years of 1967-70.

Figure 3 also shows how the treatments built up K soil tests. The no-K plots averaged 272 lb/A exchangeable K. The plots receiving 1,200 lb K_2O/A increased to 448 lb/A exchangeable K.

After allowing for K removal in the grain, we see that this particular soil required about 5 lb of applied K_2O to increase K soil test 1 lb. Building up the K soil test level like this helps increase yields in future years.

THESE RESULTS are supported by facts from a long-term corn-soybean rotation study at the Hartsburg Agronomy Research Field on a similar type soil—a Hartsburg silty clay loam.

The plots receiving no K showed a 339 lb K/A soil test level in the spring of 1973. And plots receiving 100 lb K yearly as KCl in the 1970-73 period averaged 21.6 MORE bushels of corn, 5.5 MORE bushels of soybeans per acre than the no-K plots.

In addition to the 100 lb K, the corn received 180 lb N and 90 lb P_2O_5, the soybeans 90 lb P_2O_5. Soil pH tested about 7.0.

A 1966 study at the Agronomy South Farm in Urbana showed similar results on a Flanagan silt loam soil testing 358 lb/A exchangeable K. Plots receiving 150 lb K/A produced 11 MORE bushels of corn per acre than the no-K treatment—from 162 to 173 bu/A on this high-K soil.

THE CONCLUSION—Crop yields CAN sometimes be boosted on certain high-K soils under high-level management. The key is to define the soils that need this management.

The high-K soils reported here were dark, heavy-textured, and imperfectly to poorly drained. Illinois has about 5.6 million acres of silty clay loams, clay loams, or silty clays. Farmers with such soils may want to try additional potash to see if it pays in their particular situation. **The End.**

Acknowledgment is due for the contributions of L. V. Boone, University of Illinois for the information from Hartsburg and to G. W. Colliver, University of Missouri, and Noble Usherwood, Potash Institute of North America.

EXTRA HIGH MANAGEMENT AND NUTRIENTS FOR SOYBEANS

ROBERT D. MUNSON
ST. PAUL, MINNESOTA

The road to higher soybean yields is paved with many ideas and experiments. This is a look at some of them.

SOYBEAN FERTILIZATION and management hold an important spotlight because of the world food and protein needs.

Soybeans DO respond well to fertilization and improved cultural practices. Certain cultural and management practices will produce best results from extra use of potash and other applied nutrients. You can use a checklist approach on these practices.

✓

VARIETY SELECTION—Soybean varieties differ in yields—sometimes as great as 20 bushels per acre, but usually around 5 or 6 bushels.

Some varieties respond better to high fertility and improved management. Corsoy, along with newer varieties, such as Evans and Hodgson, should improve yields in the northern states. Earlier varieties, such as Anoka, Portage and Clay, will help boost yields where still shorter season varieties are needed. Columbus and Calland appear to be productive varieties for the Western Corn Belt. Some new experimental selections in Kansas have yielded 98 bu/A under irrigation. The future yield potential of varieties looks bright. Check on varieties that have had consistent results in your area, along with phytophthora resistance.

✓

INOCULATING soybeans is a profitable venture if soybeans are new in your area—but if soybeans have been grown for years, don't expect much benefit from inoculation.

Certain strains of *Rhizobia* have increased soybean yields in Minnesota up to nine bushels per acre when beans were inoculated and grown on a "Rhizobia-free" soil. The increases will be even greater on some soils. In the future specific *Rhizobia* may be developed for specific varieties and soils.

✓

SEED TREATMENT—Fungicide seed treatments may be helpful, particularly if one is

TABLE 1—NARROW ROWS MEAN MORE SOYBEANS BU/A

	Row Width			
	7 In.	10 In.	20 In.	40 In.
Iowa		50.3	46.9	39.4
Illinois (Corsoy)	61		53.5	

TABLE 2—GOOD SOYBEAN YIELDS CAME FROM LOWER POPULATIONS OF HIGH QUALITY SEED IN 15-INCH ROWS (Ohio)

Plants/A	Bu/A
42,500	60.3
77,900	55.4
113,000	52.8
156,000	52.2

TABLE 3—EARLIER PLANTING INCREASES BEAN YIELDS (Ohio)

Planting Date	Bu/A
May 1	51
May 10	47
May 20	44
May 30	41

EARLY PLANTING HELPS VARIETIES SHOW THEIR YIELD POTENTIAL (N. Dakota)

Variety	May 5	June 6
	(2 Yr. Avg. — 12-In. Rows)	
Anoka	69.3	35.8
SRF-100	50.6	35.5

(Irrigated—Oakes, N.D.)

dealing with low-quality seed from diseased plants.

If you are on acid mineral soils with a pH *below* 6.0, you may find it beneficial to add the micronutrient molybdenum seed treatment with the fungicide. The recommended rate adds about 0.19 ounce of Mo/A with the seed. More will be said about Mo.

✓

ROW WIDTH—For many years evidence has shown higher soybean yields coming from narrower rows.

The problems and questions revolve around equipment and weed control. Some are currently suggesting seven-inch rows and solid planting if weeds can be controlled. Some new herbicides look very promising.

Table 1 shows definite yield advantages for narrow rows.

With higher populations, lodging increases and yields actually may decline.

Ohio recently found that lower populations (43,000 to 65,000 plants/A from 16-25 lb/A seeding rates) gave excellent yields when high-quality seed was used. **Table 2** shows this work with 15-inch rows.

✓

PLANTING DATE—Soybeans respond well to early planting, just as other crops do.

Some of the highest yields have come from beans planted in April or by the first week of May. If one has a "perfect" long season, planting date becomes less important. However, in northern states, that rarely happens. So, it is best to get the beans in before May 15.

Table 3 shows the advantages of earlier planting in Ohio and North Dakota tests—a story many sources have learned and told.

Planting on time means having equipment ready to go earlier. The

TABLE 4—THESE POTASH (K_2O) RATES ARE SUGGESTED FOR BUILDING UP THE POTASSIUM (K) SOIL TEST (Illinois)*

K Soil Test	K_2O Needed Low CEC Soils (Less Than 12)	K_2O Needed Med. to High CEC Soils (Over 12)
	Lbs/A	Lbs/A
100	160	200
110	150	190
120	140	180
130	130	170
140	120	160
150	110	150
160	100	140
170	90	130
180	80	120
190	70	110
200	60	100
210	50	90
220	40	80
230	30	70
240	20	60
250	10	50
260	0 (Maintenance rates are added to a 360 lb cutoff level (see Table 5))	40 (Maintenance rates are added to a 400 lb cutoff level (see Table 5))
270	0	30
280	0	20
290	0	10
300	0	0

*(Data based on a 4-year buildup period, applying the shown amount *each* year for 4 years. CEC=cation exhange capacity.)

TABLE 5—MAINTENANCE PHOSPHATES AND POTASH INCREASE WITH SOYBEAN YIELDS (Illinois)

Yield Bu/A	Added With Nutrient Phosphate—P_2O_5	Buildup Rates Lbs/A Potash—K_2O
30	26	39
40	34	52
50	42	65
60	51	78
70	60	91
80	68	104
90	76	117
100	85	130

costs are the same, but the benefits can mean more money in the bank next fall.

✓

PLANTING DEPTH—Soybeans should be planted relatively shallow.

On most soils, a planting depth of one to one and one-half inches should be adequate. This enables the beans to germinate and get out of the ground and start growing. Deeper planting depths can be a real problem on soils that crust or puddle.

✓

POTASH NEEDS OF SOYBEANS—The amount of potash recommended for top soybean yields varies with (1) Results obtained experimentally, (2) Soil test calibration results available, (3) The thinking and experience of those interpreting the data.

Contrary to some beliefs making potash or fertilizer recommendations is not an exact or infallible science. But, by using what we know, we can make

TABLE 6—RATES OF K_2O LBS/A SUGGESTED FOR GIVEN K TESTS & SUBSOIL K LEVELS (Iowa)

K Soil Test (Surface 6″) pp2m = lb/A		Subsoil K Levels			
		V. Low	Low	Medium	High
0—70	V. Low	90	80	70	60
71—125	Low	70	70	60	55*
126—150	Medium	55*	55*	55*	55
151—200	M. High	55	55	55	55
201—300	High	55	55	55	55
Over 300	V. High	0	0	0	0

*Computer program restricts the recommendation to 55 lbs of K_2O/A for soils testing 300 (high) or less to cover maintenance amounts for 40-bu soybeans. Maintenance amounts are based on 8 lb P_2O_5 and 14 lb K_2O for each 10 bushels of soybeans.

suggestions that produce very profitable results for farmers.

If we are going to apply top management practices to soybeans as we do to corn, it will be more profitable to have top nutrient levels in the soil for the crops.

Currently, the approach that has evolved runs roughly like this:

If a soil is low in a particular element, semi-corrective rates of the element are added over a several-year period to bring the soil to a high or very high soil test level. Maintenance rates are also added to the semi-corrective additions annually to replace the nutrients removed by the crop. This is true for both phosphate and potash. These rates are established through soil test-fertilizer-soybean response trials.

Once the soil is built up, only maintenance rates of the nutrient are used until a soil test cutoff level is reached. The maintenance rate of the nutrient is discontinued until the test drops below the cutoff level. In this plan, the maintenance rates of nutrients are increased or adjusted with the yield levels achieved or goals.

Illinois and Iowa have recently adjusted their fertilizer recommendations. Illinois suggests that build-up applications of potash plus maintenance rates based on yield level be applied annually. **Tables 4 and 5** are based on the Illinois report.

Ohio is now adjusting the levels of their K tests considered adequate.

During the buildup years, potash required for buildup plus that required for maintenance is added until the low CEC soils test 360 lbs or more in K and the medium and high CEC soils test 400 lbs or more. **Table 5** shows increasing maintenance rates of P_2O_5 and K_2O as yields increase.

Iowa determines K soil tests on field-moist samples. These field-moist samples tend to give lower K test values than air-dried samples on many fine textured soils. On some soils, the two tests (air-dried vs. field-moist) may differ as much as 200 lbs of available K. Iowa personnel believe the field-moist K values more nearly reflect the availability of soil K to the growing crop.

Iowa also considers subsoil K levels, as do other states, and increases or decreases the amount of potash suggested, depending on drainage, calcareous nature, texture, and physical limitation of the soil. Their suggested potash rates for various test levels and levels of subsoil K are given in **Table 6.**

Wisconsin uses a corrective or buildup fertilizer program which allows for more rapid adjustments of levels. They also include special allowances for irrigation and land receiving manure. In addition, they include maintenance amounts and make adjustments of management levels. **Table 7** shows corrective applications for both phosphate (P_2O_5) and potash (K_2O), and **Table 8** shows the maintenance nutrients that should be included, also.

Let's use these recommendations for low subsoil levels as an example. If we had a P test of 10 and a K test of 90 on unirrigated soils without manure applications, the recommendations would initially call for 111 lbs. of P_2O_5 and 270 lbs of K_2O. If the P and K tests were 25 and 150, the recommendation would be 130 lbs P_2O_5 and 150 lbs of K_2O.

Minnesota's recommendations for soybeans are very simple. **Table 9** shows the corrective applications for both phosphate (P_2O_5) and potash (K_2O).

Minnesota does not consider maintenance recommendations for soybeans.

These facts show how much phosphate and potash recommendations can vary, though soil tests and methods are similar. These are only two elements of the 16-plus elements soybeans require.

Soil pH changes are very important to reduce toxicities in some soils and improve conditions for the symbiotic nodulating **Rhizobia** that fix N. Usually, liming such soils to a pH of 6.0 or slightly above will be adequate. Be cautious about increasing soil pH much above 6 on soils low in manganese.

Some of the most dramatic potash results on soybeans came from an Illinois study. Different potash rates were added to a fine textured soil that initially tested high in exchangeable K (272 lbs K/A) during four years of continuous corn. The fifth year the plots were planted to soybeans, resulting in increases as great as 20 bu/A.

Table 10 shows (1) The amounts of potash previously applied to corn, (2) The soil tests, and (3) The soybean yields from the residual buildup potash.

TABLE 7—THESE CORRECTIVE P_2O_5 AND K_2O APPLICATIONS (Lbs/A) ARE SUGGESTED IN WISCONSIN

P Soil Test	(Irrigated) K Soil Test—Lb/A			
	0—100	101—150	151—200	Over 200
	P_2O_5 K_2O	P_2O_5 K_2O	P_2O_5 K_2O	P_2O_5 K_2O
0—25	120 + 240	120 + 180	120 + 120	120 + 0
26—50	60 + 240	60 + 180	60 + 120	60 + 0
51—75	30 + 240	30 + 180	30 + 120	30 + 0
Over 75	0 + 240	0 + 180	0 + 120	0 + 0

P Soil Test	(Unirrigated) K Soil Test—Lb/A				
	Less Than 90	91—120	121—160	161—200	Over 200
	P_2O_5 K_2O	P_2O_5 K_2O	P_2O_5 K_2O	P_2O_5 K_2O	P_2O_5 K_2O
15—25	80 + 240	90 + 180	100 + 100	90 + 45	90 + 0
16—30	60 + 240	60 + 180	100 + 120	60 + 60	60 + 0
31 to Over 50	0 + 240	0 + 180	0 + 120	0 + 60	0 + 0
	With 10—15 Tons of Manure				
Low	80 + 180	60 + 120	60 + 60	60 + 0	60 + 0
Medium	0 + 180	0 + 120	0 + 60	0 + 0	0 + 0
High	0 + 180	0 + 120	0 + 60	0 + 0	0 + 0

✓

NITROGEN—Soybeans do not generally respond to N, though specific cases can be cited where nitrogen increased bean yields.

In a recent Wisconsin study, 33 lbs of N reduced bean yield while 200 lbs K/A on a soil testing 150 lbs exchangeable K improved yields. **Table 11** shows the N and K relationships.

Dr. Ham at Minnesota has had significant yield increases from banded or broadcast N. In some cases, the N may be significantly increasing the availability of micronutrients, particularly if it is banded. This is due to nitrogen's acidifying effect on soils. In other cases the effect may be direct.

Moisture stress can reduce nodulation—so some N in western drier areas may boost yields. Also, for 100-bu yield levels some applied N may be needed. But for 50-bu yields applied N is usually just a tradeoff for a reduction in the amount of N that would otherwise be fixed symbiotically by **Rhizobia.** In years of N shortages, use N for corn and small grain.

✓

SULFUR—Minnesota has a vast area of soils basically low in sulfur, but these are north of the major soybean area. Wisconsin also has localized areas of soils low in sulfur.

These soils are usually low in organic matter and/or are of a coarse texture (sandy). Some years excess rain will create S deficiency (shown by soil tests) in soils that would otherwise give adequate S. During such years added S may not produce the anticipated response. The spring of 1974 was an example, at least in Minnesota and Wisconsin.

Both Minnesota and Wisconsin test for sulfur. In some cases, refinements

TO MUNSON, PAGE 28

TABLE 8—THESE MAINTENANCE P_2O_5 AND K_2O RATES (Lbs/A) ARE ADDED TO CORRECTIVE APPLICATIONS IN WISCONSIN

Soil Test		Maintenance Rates		
P lb/A	K lb/A	P_2O_5 lb/A		K_2O lb/A
0—40	0—240	30	+	30
	Over 240	30	+	15
Over 40	0—240	10	+	30
	Over 240	0	+	0

TABLE 9—THESE CORRECTIVE P_2O_5 AND K_2O APPLICATIONS (Lbs/A) ARE USED IN MINN.

P Soil Test	K Soil Test—Lb/A 0—100	101—200	Over 200
	P_2O_5 K_2O	P_2O_5 K_2O	P_2O_5 K_2O
0—15	40 + 100	40 + 40	0 + 0
16—30	20 + 100	20 + 40	0 + 0
Over 30	0 + 100	0 + 40	0 + 0

TABLE 10—RESIDUAL POTASH APPLIED TO CORN INCREASES SOIL K AND BEAN YIELDS

Total K_2O Applied to Corn Over 4 Years	K Soil Test	Soybean Yield
lb/A	lb/A	bu/A
0	272	50
240	287	57
360	307	63
1200	448	70

L-I-F-E

FEW OF US barking constituents really understand the pressures our legislators face while trying to meet our endless demands.

When the patio set starts accusing legislators of every sin under the sun, I often chime in . . . until a distant voice shuts my mouth.

The voice says, "Don't fan the snide comments. Just listen. Could the accusers represent the people any better than the ones they attack? Could YOU? If so, then offer yourself for public office . . . and learn what it demands."

That voice comes from a far distance . . . across the cosmos . . . from the son of a humble Brushy Mountain mother . . . a very wise man I knew in my youth.

The day after his burial the legislature of his state voted a resolution of appreciation for his life and directed their Secretary of State to deliver it to his widow. He never sought a public office in 71 years on earth, but the press said his counsel was sought by each governor and legislature of their state from 1912 to 1956.

Any normally observant youngster growing up around such a person is bound to absorb some understanding of politics —especially the abuse democracy can shower on its craftsmen of freedom while they do their best to retain that freedom for everyone, including abusive critics.

Don't misunderstand me. I'm not an uncritical pigeon. The recent rash of alleged neurotics ravaging the highest home of our government generated vehement comments from my coffee-nervous tongue. Comments much more emotional than thoughtful.

But I write today in the most thoughtful way I can. Our legislators face a tendency every legislature in history has faced in "tight times"—the tendency to pinch funds for research and education.

This is a dangerous temptation. No program is more important than agricultural research and education in sustaining and improving man's lot on earth. I'm sure our legislators have battalions of specialists telling them why—in terms my humble mind cannot grasp.

After all the well-groomed facts and figures have settled in the dust along the rungs of the committee chairs, there may be four thoughts each legislator can carry with him to the ultimate vote—four ideas that spell L-I-F-E.

1—LAND. When I get a new suit of clothes, I tend to puff up and start acting like I know fancy ways. THEN, I remember we all owe our very existence to a 6-inch layer of topsoil. A very deflating thought!

What we do to maintain that soil depends on what we continue to learn about its ever-changing personality. How receptive it is to ever-higher-yielding species of alfalfa, soybeans, corn, etc. What techniques and covers will work best in keeping it from washing into neighboring streams. How we can enrich it to give us more food for more and more mouths.

With a 6-inch layer of topsoil between us and oblivion, we cannot safely pinch funds for agricultural research and education . . . and expect to survive.

2 — INVESTIGATION. When I get a new car, I tend to puff up and start acting like I own property. THEN, I remember we all owe our very existence to a tiny 1% of water available to man. The other 99% is tied up in salty seas (97%) and ice at each pole (3%), hydrologists tell us. A very deflating thought!

What we do to conserve and use that 1% of water depends on what we learn about its ever-changing personality. We can go to the moon in 72 hours and then stumble on a 24-hour weather forecast.

Today we can produce some crops with half the irrigation water it took 20 years ago, but still face the salinity threat that devastated irrigation agriculture in Egypt 2,500 years BEFORE Christ. About half the water used by plants is consumed by those that give us food and timber, the other half by plants of little economic use.

With a 1% water quota going for us, we cannot safely pinch funds for agricultural research and education . . . and expect to survive.

3—FOOD. When I get a tooth into a Cornish hen, I tend to puff up and start acting like I've reached the social peak in one of those $150,000

houses. THEN, I remember we all owe our very existence to a 6 months supply of food. A very deflating thought!

What we do to expand and improve the quality of that food depends on what we continue to learn about its ever-changing personality. Five elements keep us going—minerals, carbohydrates, fats, protein, and vitamins.

Protein is a big key to health. Developed nations average 40 grams daily in their diet, developing nations barely 9 grams, while nutritionists recommend 70 grams a day.

In the past, men endured hunger silently and died without much struggle. A 10th century bishop herded the poor into barns and burned them to "solve" the hunger problem. About 800 years later a scientist named Malthus urged a more humane way—birth control. Neither idea took.

But you can bet on one thing today. Developed (educated) populations will not starve silently. Hunger knows no loyalty. With such thoughts in mind, we surely will not retreat on agricultural research and education in America.

4—ENERGY. When I get a costly physical exam, I tend to puff up and start acting like I'm immortal. THEN, I remember we all owe our very existence to a Creator who lets us harness the atom but not yet breed a plant that can use much more than 1% of sunlight energy. A very deflating thought!

What we do to warrant continued growth of knowledge from this Creator depends on how we manage the energy He gave us.

When all is said and done, the clearest picture we have of God's belief in this planet begins with the weather . . . a divinely organized system of sun energy and moisture geared in close enough measurements to keep plants growing and animals going.

The weather determines whether the seed of spring becomes the grain of fall. The grain of fall dictates the amount and price of bread, meat, and milk. The variety of groceries decides our diet. Our diet makes or breaks our health.

The biggest difference between America and the rest of the world, so far, has not been political, social, or economic. It has been scientific—the abundant energy God Almighty has allowed our agricultural researchers to coax from our resources:

Agronomists to enrich the soils . . . **plant breeders** to create higher yielding food . . . **chemists** to protect us from plant pests and diseases . . . **engineers** to improve cultivation, irrigation, harvesting, and handling systems . . . **meteorologists** to keep closing the gap in weather measurements . . . **progressive farmers** to reap so much that 25% of their harvest goes abroad to become 60% of the surplus food in world trade.

These gifted scientists and farmers are not concentrated in any one university or state. They are sprinkled like golden grain through a blessed land. That is why no state legislature will retreat on agricultural research and education in these critical times.

These ARE critical times. But they are an old-fashioned Sunday School picnic compared to what can happen if agricultural research gets BEHIND in its eternal quest for human sustenance.

I do not fear for the future, because the oldest son of a Brushy Mountain mother early taught me one lesson of life:

When the going gets tough, it matters little whether the so-called tough get going but it matters much whether the **good** get going.

And, invariably, history always calls the **good** men to step forward . . . not the cunning, the shrewd, the sharp or glib, but the **good** men . . . to save the day.

They did 40 years ago, 80 years ago, 115 years ago . . . and they will today . . . because the Creator works through them to keep this planet going.

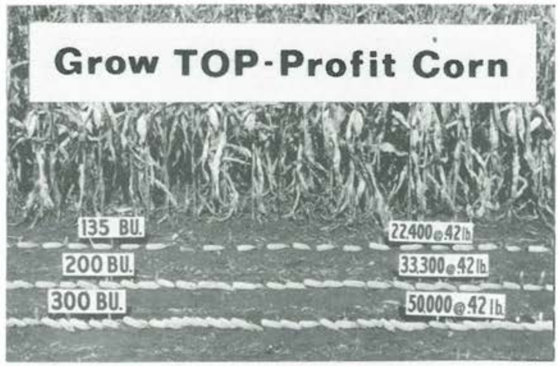
Surely this Creator has led such men into agricultural research and education generation after generation.

For where else has such a **large body of land** been blessed with such climate and soil as ours—and with men steadily understanding more and more about it to feed man?

What a great investment for our legislatures . . . this Partnership with Providence!

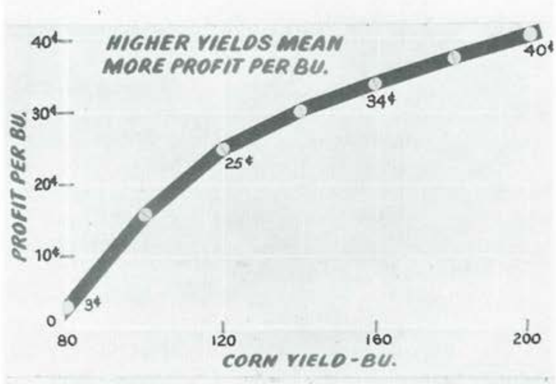
CORN: Grow Top Profits Slide Set

SLIDE 1—You can grow top-profit corn. Set a realistic goal . . . then design a production system to reach it. Rising yield goals—200 to 300 bushels—are not uncommon. Why? The answer is simple.

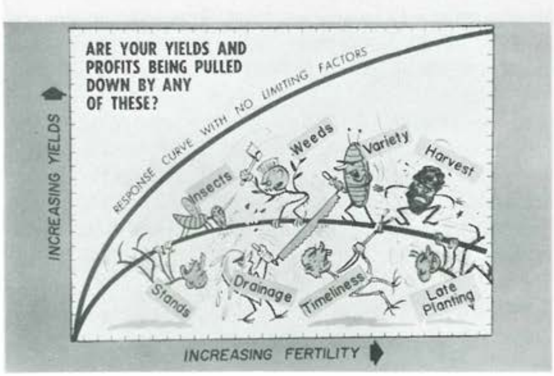


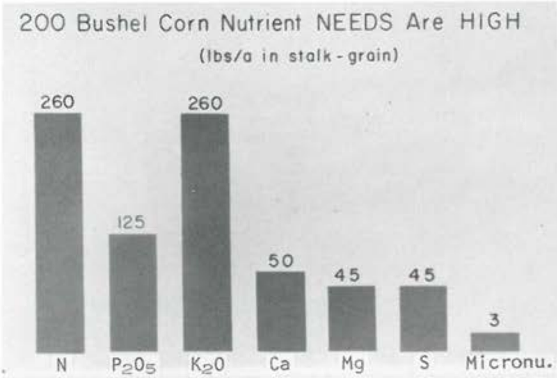
SLIDE 2—Average yields don't make money. Highest state average reached 100 bushels per acre. Crop value for past few years would vary from $90 to $120. Costs would range from $80 to $120 or more per acre. Not much profit there for average yields. Farmers hitting 150 to 200 bushels may reach $40 to $90 profit/acre. You must apply the whole corn management package to make high profit.

SLIDE 3—Higher yields mean more profit per bushel. That's why yield goals keep rising. You must get above breakeven yields to make money. And breakeven yields move up with rising costs. As yields rise, profit per bushel of corn rises to a maximum amount. (Illinois). Getting high yields is the first step toward high profits per acre.



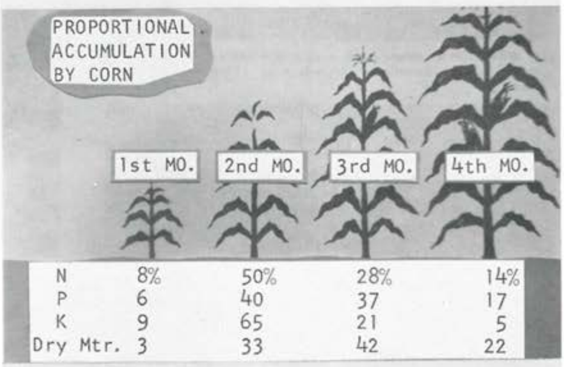
SLIDE 4—Remove all limiting factors. Use the best facts to select the right fertilizer program . . . hybrids . . . right insecticides and herbicides . . . and right plant population. Top-profit corn demands right timing in early planting, insect and weed control, and harvest. Use sure amounts of nutrients to reach your yield goal. How much fertilizer can be profitably used? That depends on how well other limiting factors are cared for—and the yield potential of the field this season.





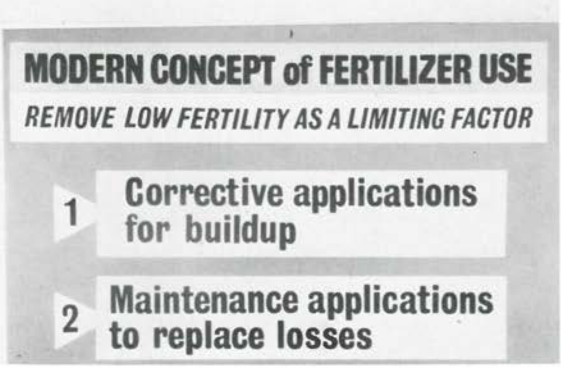
SLIDE 5—200-bushel corn needs plenty of nutrients. Top-profit yields often range from 150 to over 200 bushels per acre . . . may be higher in the future. Such yields come only when soil, climate, and management work together. A 200-bushel corn crop takes up huge amounts of nutrients—nitrogen and potassium in greatest amounts.

Hybrids, planting date, climate, and soil conditions cause these values to vary. Set goals reasonable for your soil's productive capacity, and your management ability. Raise your yield sights a little each year.



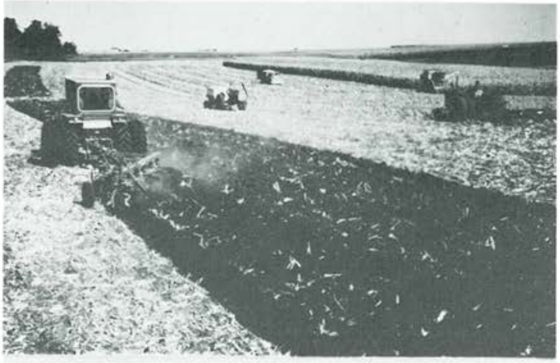
SLIDE 6—In the first two months of rapid growth, a corn crop takes up about 75% of its potassium, 58% of the nitrogen, and 46% of the phosphorus. Be sure your crop has plenty for all periods of heavy demand. Adequate fertility is especially important during EARLY GROWTH because much of the yield potential is determined then.

SLIDE 7—Sample soil while the crop is growing . . . to get the most accurate pH, P, and K levels . . . to avoid too-high K tests from late fall, winter, or early spring samples. Soils sampled under the growing crop will help you plan for fall fertilization. If thought necessary, check soil nitrates (N needs) through special samples in spring.



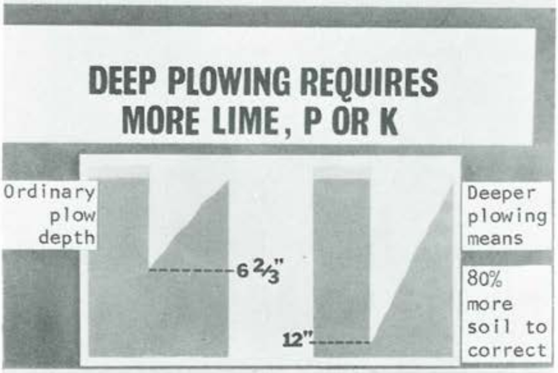
SLIDE 8—Low fertility no longer holds back top farmers. They apply the modern concept of fertilizer use: Corrective applications to build up the soil . . . maintenance applications to replace losses. They raise the soil test levels. They base needs on crop response and the soil's capacity to hold nutrients. If a corn-soybean rotation is fertilized only before corn, apply SURE amounts to be certain there is enough left for the soybeans.

SLIDE 9—Why do top farmers often plowdown lime, phosphorus, and potassium in fall? It makes them more flexible. Reduces next spring's work load when they're sweating to plant early for higher yields. Also, when they do it in fall, they're SURE it's on, not delayed or prevented by a soggy spring. It also reduces soil packing by heavy equipment on soft spring soils. Avoid fall plowing where erosion is a problem. Where fall fertilization and tillage are appropriate, the most important time to get additional labor and machinery into action is as soon as harvest starts.

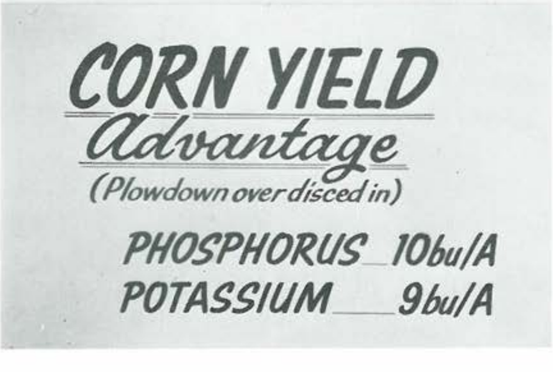


SLIDE 10—Winter applications of lime, P, and K can pay off on level land . . . or 4% slope with light residue-cover . . . or 8% slope with heavy residue-cover . . . but seldom on deep sandy soils, on excessive slopes, in deep snow, or on flood-subject land.

SLIDE 11—Why does deeper plowing demand more lime, P & K? Because you create a larger plow layer. The extra soil you are "turning" into your new plow layer dilutes the nutrients you once applied to the more shallow layer. Also the newly turned soil may be (often is) nutrient poor. You must increase your corrective fertilizer rates—about 80% if you gradually increase plow depth from 6⅔ to 12 inches—to meet the need.

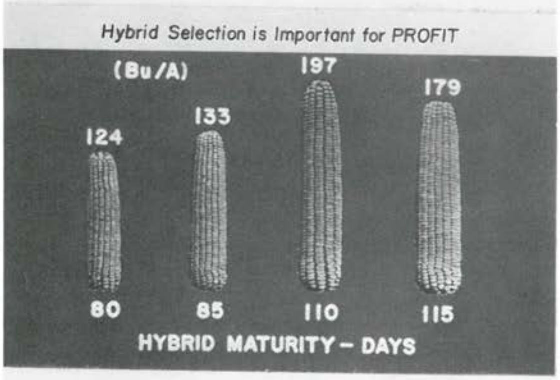


SLIDE 12—Plowdown pays off in better yields—sometimes 8 to 10 more bushels per acre then fertilizer disced in. Plowdown puts the nutrients deep in moist soil to give crops extra feeding and cushion between rains. Be sure your tillage gets fertilizer deep enough to give FULL-season nutrition.

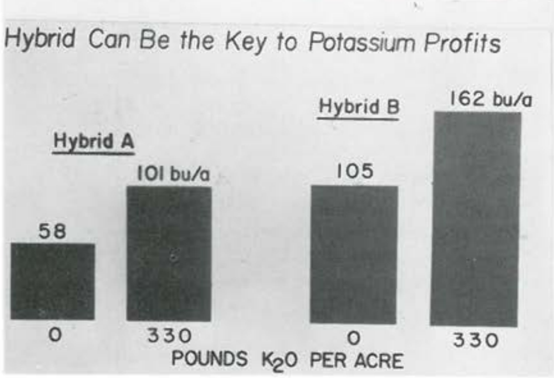


SLIDE 13—Starter (row) fertilizer is more important on cool soils . . . especially on low to medium fertility soils. Early planted corn has responded to row-placed fertilizer even on high fertility soil. Sod planting and minimum tillage make row fertilizer very important. You can sideband maintenance P and K and micronutrients on high fertility soils, except for silage.

SLIDE 14—Minimum tillage boosts corn profits. Reduced spring tillage saves soil moisture . . . reduces land preparation costs . . . saves time, labor, equipment, soil tilth, and soil. It may demand a moldboard plow to incorporate lime and fertilizer periodically.

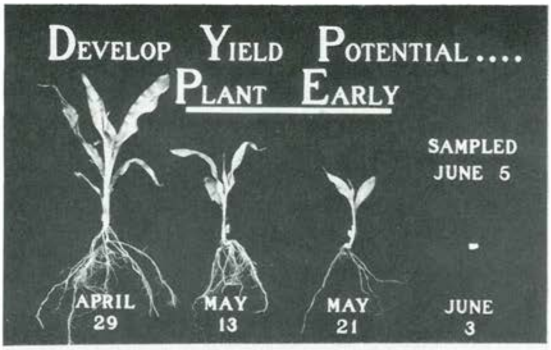


SLIDE 15—Right hybrid can mean more profit. High-yield capacity, disease resistance, maturity time—all these traits mean much to yield. In this study, selecting a hybrid of adapted maturity meant 73 bu/A MORE corn. And it took advantage of a good fertilizer program. (Minnesota)

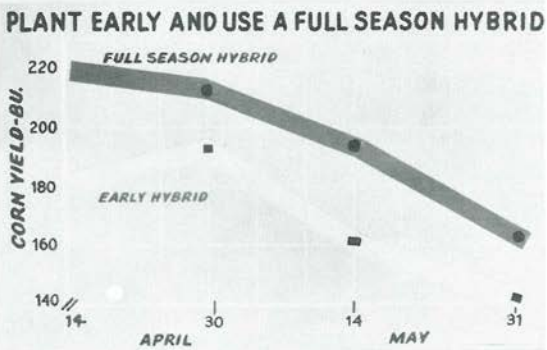


SLIDE 16—Hybrid can be the key to fertilizer profits. Both these hybrids responded well to 330 lbs K_2O added with adequate N and P on this productive medium K soil. The potash increased Hybrid-A a respectable 43 bu per acre—but was barely profitable because the hybrid reached only 101 bu per acre. The same amount of potash increased Hybrid-B a strong 57 bu per acre, to a profitable 162 bu yield level. Figure $100 per acre production costs and dollar corn. Fertilizer added $43.80 per acre to the farmer's returns with the RIGHT HYBRID. (Wisconsin)

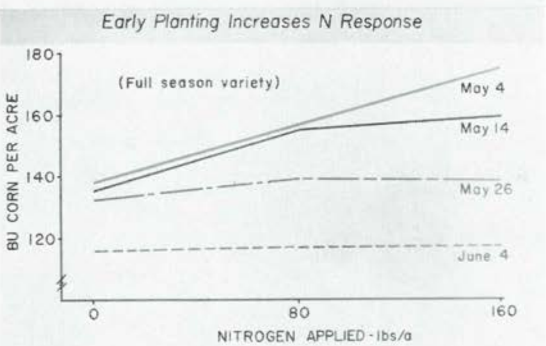
SLIDE 17—Why do top farmers shoot for early planting? For profitable corn! Plant by late April or certainly by May 10 in Northern and Central U.S. . . . earlier farther South . . . to get fullest use of the long days around June 21. It means EFFICIENT plants.



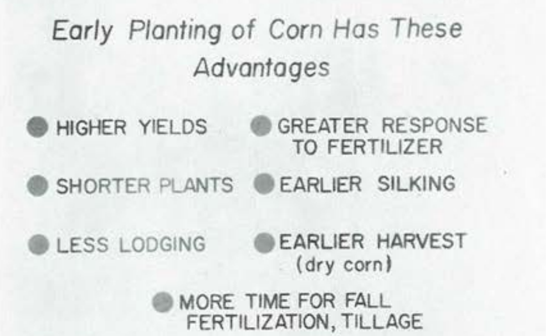
SLIDE 18—Plant a full season hybrid early, many advise . . . as this profit-making example shows (Illinois). Some shorter season hybrids may be just as productive . . . giving early harvest . . . more time for fall fertilization and tillage, important for next spring's fast start and year-after-year profits. It takes nerve to plant on time. Be ready to use best dates for your area. Winter-toolshed planter-time and hybrid selection are important keys.

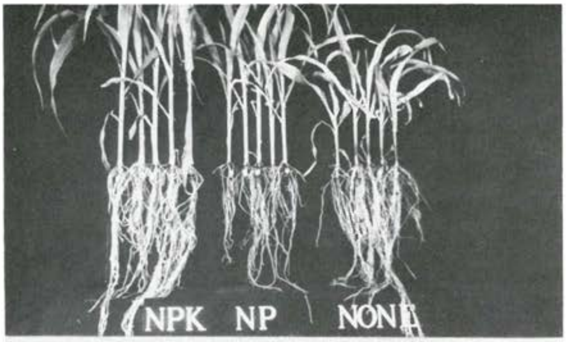


SLIDE 19—Early planting makes best use of nitrogen . . . as this trial shows. Corn planted May 4 gave 60 bu/A MORE than a June 4 planting under the same 160-lb N treatment after clover sod. (Illinois)



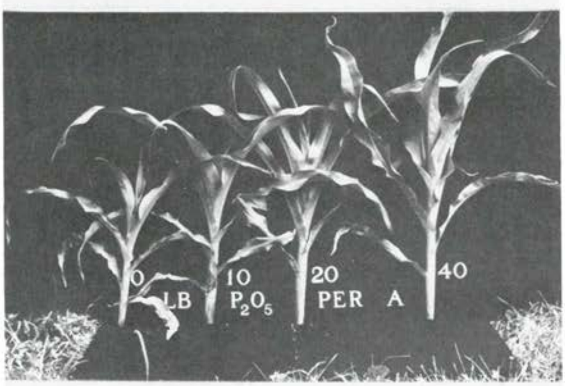
SLIDE 20—Early planting will build the farmer's profit potential . . . through higher yields (without added cost) . . . shorter plants, with less lodging . . . better response to fertilizer . . . earlier silking . . . earlier harvest of dry corn . . . more time for fall fertilization and tillage.



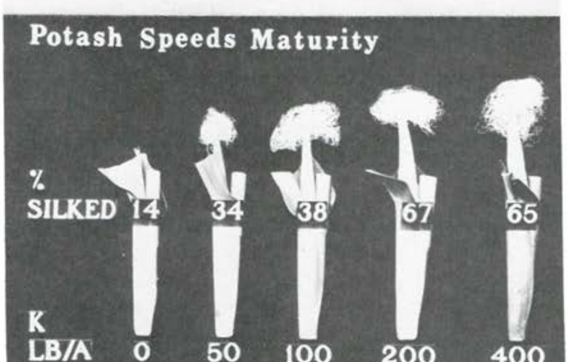


SLIDE 21—Proper nutrition shows up early. The young corn plants on left weigh over 3 times more than those on right. Corn with a sure, balanced diet grows rapidly, matures earlier.

SLIDE 22—Be sure to use enough nitrogen. It gives corn that dark green color . . . speeds up plant processes . . . insures better grain development . . . more and drier corn at harvest. Preplant or sidedress it early.

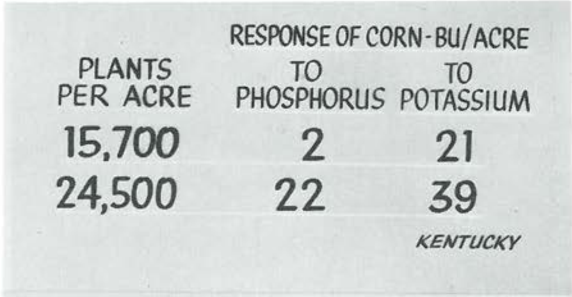


SLIDE 23—Use phosphorus for important early growth. Its effect on young corn is clear here. It influences plant energy exchanges and cell development, so important to yield potential . . . and advances maturity.

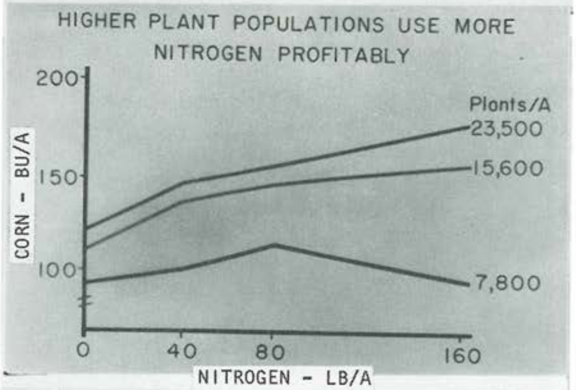


SLIDE 24—Use potash to speed maturity. Corn needs plenty of it . . . to keep leaves green and working . . . to help plants use N and P more effectively in starting early ear development, in accumulating plenty of dry matter . . . in keeping the process going as long as possible. Note how potash advanced silking and ear development on a high-K soil. Most profitable yields came from 120 lbs K_2O yearly. (Illinois)

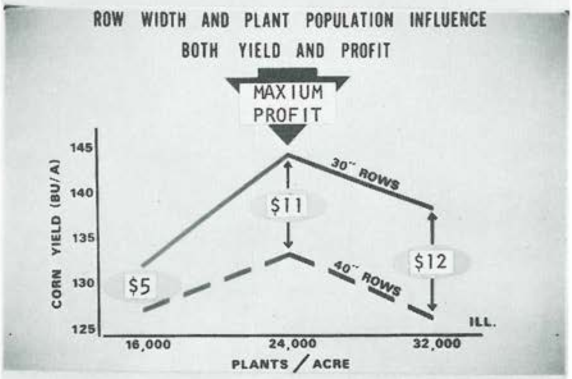
SLIDE 25—Higher plant populations boost profits from P & K. Here P boosted yields 2 bu/A, K 22 bu/A at 15,700 plants per acre. But at 24,500 plants, the phosphate boosted yields 22 bu/A, potash 39 bu/A. Average populations in major corn producing areas barely exceed 17,000 plants per acre. (Kentucky)



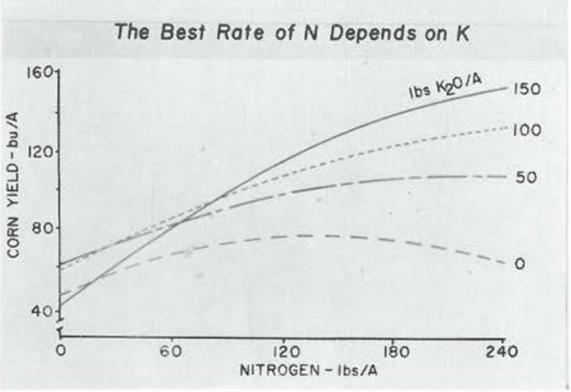
SLIDE 26—Higher populations can profitably use more fertilizer. Yields climbed only 21 bu/A by increasing population without additional N. But the combination—higher population PLUS higher N—boosted yields an impressive 88 bu/A. (Illinois)

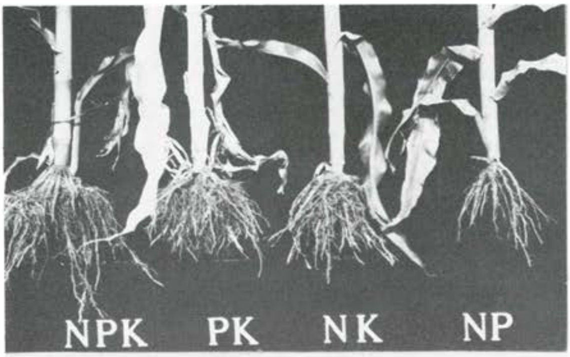


SLIDE 27—Watch your row width. It's important. Some growers have increased yields and profits up to 60% by selecting right row width and proper population. Going to closer rows with some hybrids—say from 40 to 30 inches—improves plant distribution and yields. Profits rose $6 per acre by going from 40″ to 30″ rows and 16,000 to 24,000 plants per acre. (Illinois)



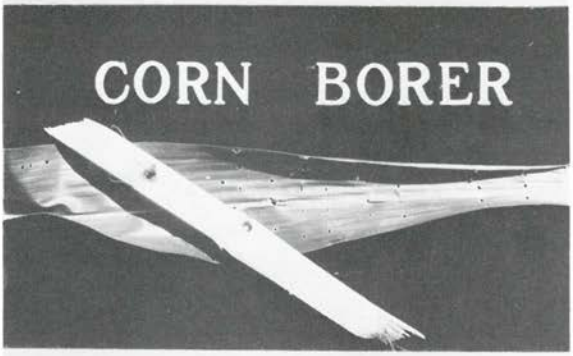
SLIDE 28—The best rate of N depends on K. When N was added to K-deficient soil, the best N rates boosted yields to only 100 bushels with 50 lbs K_2O. But when 150 lbs K_2O was applied, 240 lbs nitrogen was profitable—getting over 150 bu—A and still going up! More nitrogen calls for more potassium to get the most out of today's high-yield crops. (Illinois)



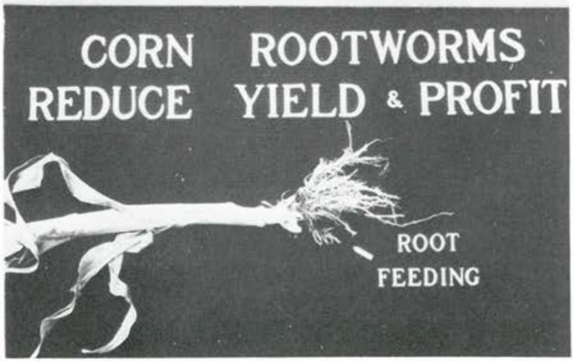


SLIDE 29—Keep a close eye on nutrient balance & needs. Note how nutrient hunger affects leaf color, root and brace root development, stalk size and color. Well-fed corn stretches soil moisture and gets the most out of every inch of water. Prevent imbalance or hunger. Your profit may well be in the balance.

SLIDE 30—Don't let imbalance cause your crop to lodge. This corn lodged badly, on potentially productive soil testing medium K, when N and P were applied without adding K (Wisconsin). A well-planned fertilizer program can help prevent this.

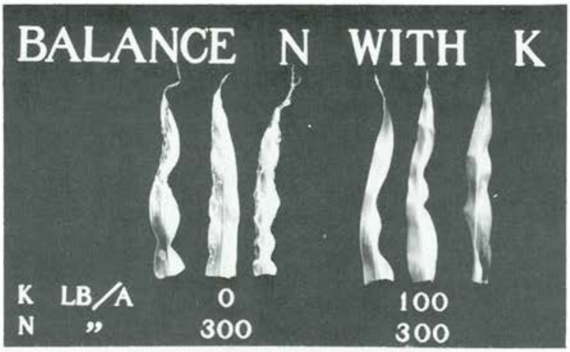


SLIDE 31—Control corn borer if you're going for top-profit yields. It contributes to stalk rot and lodging. Some states suggest borer treatment when 30% of the plants show leaf feeding.

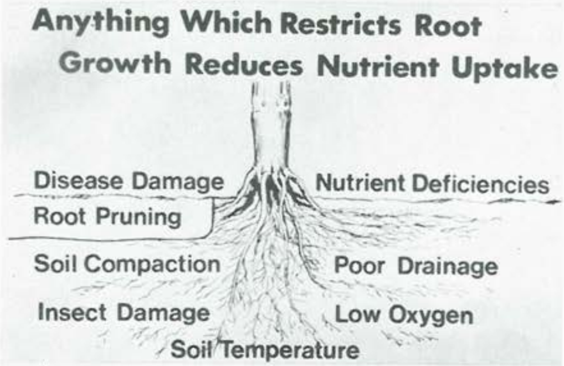


SLIDE 32—Control rootworms if you want to raise yields and profits. Fertilizer will not correct this problem . . . though it may boost root regrowth. Rootworms reduce yields greatly and make the corn hard to harvest. Rootworm control is the answer.

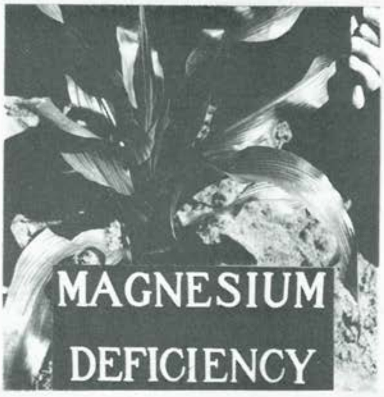
SLIDE 33—Fight disease with right nutrient balance. Potassium helps reduce certain leaf diseases, especially at high nitrogen rates. It happened on this high-K soil. (Illinois). Much leaf spot showed up on the area receiving 300 lbs N alone. But when 120 lbs K_2O was added with the nitrogen, disease symptoms left and yields climbed 17 bu/A. Any treatment that makes corn healthier should make it more disease resistant. Diseases and/or insects could become an increasing problem with minimum tillage that leaves residue exposed.



SLIDE 34—Anything that restricts root growth reduces nutrient uptake—such as nutrient hunger . . . excess moisture or poor drainage . . . root and lower stalk diseases . . . root damage from cultivation . . . soil compaction . . . insect damage . . . low soil temperature. Since many of these factors are interrelated, they may influence nutrient balance.



SLIDE 35—Guard against magnesium shortages on acid soils and soils low in exchangeable magnesium. Note striping and drying up of lower leaves here. Correct with dolomitic aglime containing Mg and/or a soluble magnesium-bearing fertilizer. Magnesium helps keep leaves green and functioning.



SLIDE 36—Watch for sulfur needs to show on coarse-textured and low-organic soils and under minimum tillage in cool seasons. Sulfur-hungry corn is light green and looks short of N, BUT typical N symptoms do not develop. Note how the lower leaves remain green. Nitrogen-sulphur balance may become critical. Correct with row and/or broadcast fertilizer containing sulfur.

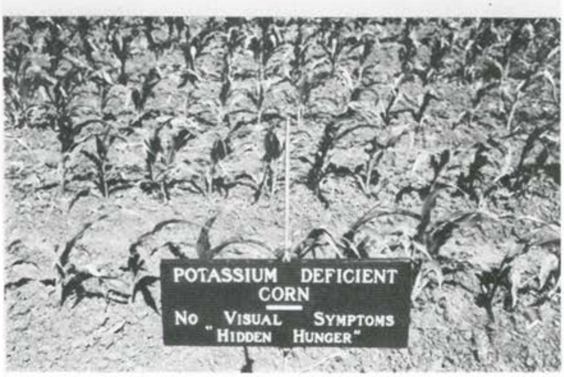
SLIDE 37—Keep an eye out for zinc deficiency . . . the micronutrient most likely to be deficient in corn. Note the broad white stripes on either side of the green along the leaf midrib. Leaves tear easily along these stripes which may turn reddish purple on the lower leaves. On high-phosphorus soils with high pH, guard against zinc hunger when soil levels are marginal. Ten lb of zinc plowed down will correct for several years . . . or less amounts applied yearly in row fertilizer.

SLIDE 38—Why does corn silage need special attention? Because the WHOLE crop is removed . . . another 40 to 50% of the crop's total dry matter . . . gaining another third of the nutritional value produced. Putting the whole crop through your livestock can boost profits. Corn silage harvested at late dent is top food for beef and dairy cattle.

30+ TON SILAGE NUTRIENT REMOVAL
lb/Acre

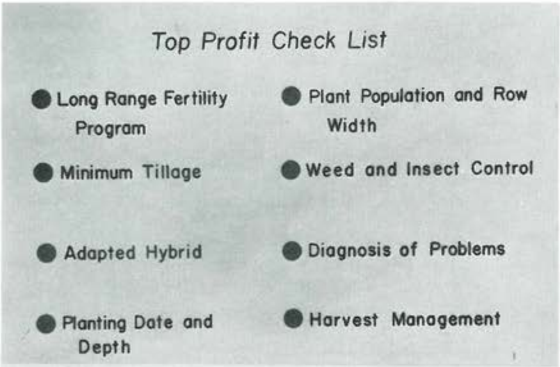
	Total	Grain	Stover
N	260	170	90
P_2O_5	125	90	35
K_2O	260	60	200

SLIDE 39—Putting the whole crop through your animals removes a big NPK load. To keep this profitable feed profitable, you must increase your maintenance fertilizer rates and keep them built up. This is especially true for potassium. A 30+ ton silage crop shows why.



Slide 40—Watch for hidden hunger! This crop shows NO signs of hunger. Yet fertilizer applications have boosted yields above a check yield of about 150 bushels. Plant tests in the lab or tissue tests in the field can help spot "hidden hunger" for you.

SLIDE 41—Is there a sure program for top-profit corn? Nothing's sure but taxes and death. But you might check these points: Long-range fertility . . . minimum tillage . . . adapted hybrid . . . planting date and depth . . . plant population and row width . . . weed and insect control . . . problem diagnosis . . . harvest management—and improve the probability of growing top-flight corn.



SLIDE 42—The plant is the final judge. Whatever fertilizer program or production system you devise, the yield gives the verdict—profit or loss. Set aside a small area to shoot for 200+ bushel corn or 30+ ton silage. Have a goal and a PROFIT plan!

SLIDE 43—Top management insures top profits from adequate fertilizer use. Higher fertilizer rates pay their biggest dividends when the WHOLE management package is applied. Do you have a goal for your test field this season—for your whole farm? If not, set a goal today.

THIS SLIDE SET (Corn: Grow Top Profits) contains 44 color slides. You can order the set and script in booklet form on next page . . . PLUS two other booklets (and slide sets, if desired) that narrate and illustrate fast facts toward efficiency on soybeans and alfalfa. All three booklets are great for mailing broadly in your area . . . great for supplying audiences after a showing . . . ORDER TODAY NEXT PAGE.

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Three new 20-page booklets of narrative and pictures that illustrate each point with field action or chart.

ALFALFA BOOKLET

Has been called "one of the most compact, yet complete messages on alfalfa." It wastes no words . . . yet it fully documents why alfalfa pays . . . how to establish a good stand . . . how to manage the seeding year right for best early yields . . . how to manage established stands for longest possible life . . . and how to harvest for fullest return.

SOYBEAN BOOKLET

Buries old myth that soybeans do not respond to fertilizer. It wastes no words showing how soybeans can get real hungry. Compares soybean and corn fertilization results. Documents nutrient uptake. Describes and illustrates different deficiency symptoms. Proves why today's soybean grower can't afford NOT to fertilize enough for his bean crop.

CORN BOOKLET

Gives steps to top-profit production. It wastes no words spotlighting factors that can hold you back. Describes best nutrient placements and tillage. Documents value of right hybrids and early planting. Emphasizes nutrient teamwork for top yields from high populations. Advises pest control and minimum root damage. Urges special attention to corn silage.

SLIDE SCRIPT BOOKLETS & SLIDE SETS

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ALFALFA-A CASH CROP	______	______	___$8.00	35
SOYBEANS-FERTILIZE THEM	______	______	___$7.00	36
CORN-GROW TOP PROFITS	______	______	___$8.00	44

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CITY________________ STATE________ ZIP________

ORGANIZATION________________

TABLE 11—NITROGEN ALONE MAY NOT BE BENEFICIAL TO SOYBEANS (Wisconsin)

	33 Lb N	No N
Control	39.3 Bu/A	44.5 bu/A
200 Lb K/A	46.1	47.4

TABLE 12—MOLYBDENUM (Mo) AND INCREASING SOIL pH INCREASE SOYBEAN YIELDS (Tennessee)

	Without Mo	With Mo	
Soil pH	Bu/A	Bu/A	Increase %
5.6	32	41	28
5.7	34	43	26
6.0	37	40	8
6.2	40	42	5
6.4	42	41	

FROM MUNSON, PAGE 13

perhaps need to be made in the test, but the recommendations are generally adequate.

For known sulfur-deficient areas also inadequate in K, a sulfate form of S—such as, potassium sulfate or potassium-magnesium sulfate—should be used. For soybeans on low-testing soils, 20-25 lbs of S broadcast or 10 lbs of row S should be adequate. For longer term increases in availability of soil S, elemental S can be applied. However, elemental S conversions are usually too slow for responses the first year of application.

✓

MICRONUTRIENTS — These nutrients are just as vital as P and K to top soybean yields—the right amounts in the right places at the right time.

MOLYBDENUM—if soils are below 6.0, one should definitely consider a molybdenum seed treatment. Even if yields are not increased, the quality of seed may be improved. **Table 12** shows the relationship between soil pH, Mo treatment, and yield.

deMooy at Iowa State University has had yield increases from applied Mo—as great as 16 bu/A—on a southern Iowa soil of pH 5.8. But applying Mo to soybeans on high pH soils actually depresses yields.

Currently, we do not test soils for Mo. Soil pH is your best guide.

IRON—Most of the micronutrient research in Minnesota and Iowa has been on iron (Fe) problems. Iron chlorosis on high pH or calcareous soils has long been a problem in soybeans. Different varieties tolerate wide ranges of Fe chlorosis when grown on the same soil.

Varieties such as Hark are very susceptible to chlorosis while lines of Chippewa parentage are Fe efficient. The problem stems from the ability of the variety's roots to reduce and take up iron. The problem is also influenced by the pH of the soil. The higher the pH, the worse the chlorosis on susceptible lines.

Either iron-chelate or ferrous sulfate sprays can be used to completely correct the problem. Iron-EDDHA chelate sprayed on soybean leaves at 0.1 lb of Fe/A (1.7 lb of product) very early in development can correct the problem. You may have to spray several times during the season.

Usually a surfactant is used to improve the application and absorption. The suggested amount of surfactant is 0.5 percent by volume, after the solution is prepared. With ferrous sulfate, it should be applied at the rate of 2 lbs/A (10 lbs of material).

ZINC—Many states run zinc determinations on soils. Zinc problems are usually associated with high pH, alkaline soils which are high in phosphorus and/or low in organic matter or soils which have been leveled for irrigation.

Table 13 shows the test levels set by Wisconsin.

Minnesota has a fairly large area in the west-central part of the state listed as a probable zinc deficient area.

Table 14 shows the relations and suggested recommendations, based on results.

An application of 10 lbs Zn per acre will usually last three to four years.

MANGANESE—Good soybean response to Mn has been shown in Wisconsin, Ohio, Indiana, and Illinois. Yet **Table 15** shows how a row-applied fertilizer (P) was as effective as applied Mn. The acidifying effects of the P fertilizer increased the availability of soil Mn. This Wisconsin research was conducted by Dr. Gyles Randall, who is now at the Southern Minnesota Branch Experiment Station at Waseca.

Just because your yields are high doesn't necessarily mean you won't get a response to Mn. **Table 16** shows remarkable efficiency from row and foliar manganese-sulfate applications.

For foliar Mn EDTA sprays, the timing and number of sprays can be important. **Table 17** shows results from a Wisconsin site. (Note the check yield was far from a "poverty" yield.)

Wisconsin only recommends Mn when the Mn soil test is less than 20 lbs/A and the soil organic matter is less than 60 T/A. They suggest 5 lbs of Mn in row fertilizer or foliar application of Mn.

TABLE 13—ZINC SOIL TEST LEVELS & Zn RECOMMENDED IN WISCONSIN

Zn Test Level	Zn Soil Test—Lb/A	Zn—Lb/A Recommendation
Low	0—5	2 row or 4 broadcast (Zinc Sulfate)
Medium	5.1—10.0	
High	10.1 and above	

TABLE 14—ZINC SOIL TESTS AND RECOMMENDATIONS (Minnesota)

Zn Soil Test—ppm	Relative Level	Zn—Lb/A
Less than 1.3	Low	8—10 broadcast PD (20—60 lb. $ZnSO_4$)
1.3 to 2.0	Medium	
Over 2.0	High	

TABLE 15—Mn-DEFICIENT BEAN YIELDS AND Mn LEAF CONCENTRATIONS WERE INCREASED BY EITHER Mn OR ROW APPLIED P FERTILIZER (Wis.)

	Soybean Yield	Mn Leaf Concentration
	Bu/A	ppm
Control	33.0	11
20 Lb. Mn/A (Row)	61.6	15
30 Lb. P/A (Row)	64.2	26

TABLE 16—Mn CAN SOMETIMES BOOST EVEN HIGH YIELDS

	Soybean Yield Bu/A
Control	56.1
$MnSO_4$	
15 lb Bdct.	62.7
5 lb Row	64.8
0.5 lb Foliar	64.7

TABLE 17—TIMING AND NUMBER OF Mn SPRAYINGS CAN INFLUENCE RESULTS (Wisc.)

Mn Lb/A	Times	Date	Soybean Yield Bu/A	Leaf Mn ppm
Control			56.5	14
0.15	1	7-2	66.1	18
	2	6-19, 7-2	68.6	18
	3	6-19, 7-2, 7-17	71.4	23

TABLE 18—PROPER SOIL DRAINAGE WILL IMPROVE BEAN YIELDS (Tenn.)

Soil Drainage Class	Soybean Yield Bu/A
Well Drained	54
Moderately Well Drained	49
Somewhat Poorly Drained	43
S.P.D. to Poorly Drained	41

TABLE 19—BEAN YIELDS MAY BE IMPROVED BY ADDING NUTRIENTS TO DEEPER PLOWING (South Carolina)

Treatment	Soybean Yields Bu/A	
	Norfolk s.1. (5 Yr. Avg.)	Lakeland s. (1 Yr. Avg.)
Undisturbed ck.	33.6	30.0
Plowed 16 inches	42.9	28.6
Plowed 16 inches, 1 Ton Lime + 160 lb. P_2O_5	48.2	53.2

All beans planted with 0+30+36 banded. Topsoil pH6.1. Soil pH near 5.1 at 15-20 inches.

✓

SOIL EFFECTS—Drainage, both internal and external, can be a real problem on many soils. Farming land to create surface drainage and tiling can be of real value.

Table 18 shows how important proper drainage and soil aeration was to soybean yields in a Tennessee study.

Some soils have a water table within a foot of the soil surface during June and July. Beans can't do their best under such conditions.

Soil texture influences the amount of available moisture a soil can store or hold for a crop. A sandy soil, for example, may hold only 5 inches of moisture to a depth of 5 feet, while excellent silt-loam soil, high in organic matter, may hold up to 12 inches of moisture.

Barriers within the soil may be chemical and/or physical. In one case, it may have formed over hundreds of years and roots may not tolerate the chemistry of a zone.

In another instance, physical changes naturally formed may make it impossible for roots to penetrate a zone. Or, a plow pan may have formed from years of traffic and heavy equipment. **Table 19** shows the importance of plowing deeper and changing the nutrient status of a larger furrow slice in South Carolina.

✓

SUMMING IT UP—It takes a lot of judgment to get the job done these days.

With the current energy and fertilizer situation, you may want to encourage growers to apply enough nutrients to last for two years. The cost of application is a bigger factor today—and soybean prices are good.

We must take the time to work carefully with farmers . . . to advise them properly . . . to help them move up the soybean yield ladder to higher profits.

Don't be afraid to use every diagnostic technique available. Be a keen observer. Use soil tests, field tissue tests, plant analyses, and follow-up yield checks to get results.

Soybeans are a very profitable crop. They respond to high levels of management, just as corn does. As we put the better practices together, they interact and the effects are more than additive.

Precision farming is just as important for soybeans as any other crop. Soybeans respond to high fertility and nutrient balance, just as other crops do. Soybeans have a very bright future. **The End.**

GRASS vs. LEGUME BOXSCORE

LEGUMES, especially alfalfa and clovers, produce more milk or beef than many grasses per unit weight of forage consumed—a fact proved in many trials.

Why? They often contain a greater concentration of highly digestible materials than grasses. The following legume-grass boxscore explains some reasons:

FACT—Grasses and legumes tend to contain similar cellulose content.
BUT grasses may contain up to 4 times more hemicellulose (largely indigestible) than legumes.

FACT—Grasses usually have adequate protein when fertilized and managed right, while variety influences TDN and net energy more than it does protein.
BUT legumes are generally high in **protein, TDN,** and **net energy.** Add their **high digestion rate** and you have 4 good reasons for growing legumes with grasses where possible.

PUT FEAR OUT of your heart. This nation will survive, this state will prosper, the orderly business of life will go forward if only men can speak in whatever way given them to utter what their hearts hold—by voice, by posted card, by letter or by press. Reason never has failed men. Only force and oppression have made the wrecks in the world.●

William Allen White, EMPORIA GAZETTE (Kansas), 1922.

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