Better Crops

WITH PLANT FOOD

January-February 1965 Do Not Remove 20 Cents

KUALITY BUILDS TOMATO PROFITS! SEE PAGE 4

Better Crops WITH PLANT FOOD

The Whole Truth—Not Selected Truth
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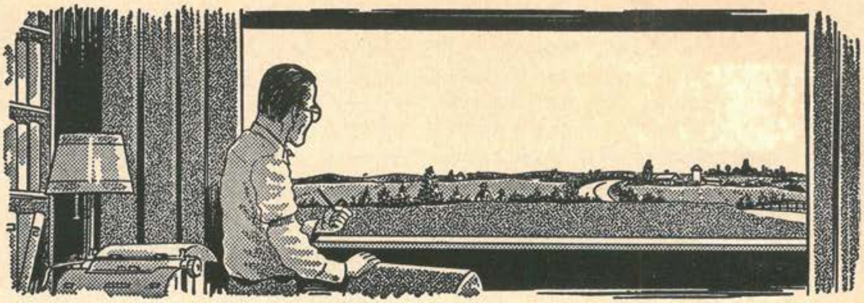


Farm Forums Not For Robots

By Jeff McDermid

(Elwood R. McIntyre)

The fun of listening to rough and ready country debates has almost vanished from our forums.

I hope the advance of civilization and the renaissance now slated for us will not lay its paralyzing finger of conformity upon the voluntary vocal assemblies of the soil.

RAW, ROBUST DIVERSITY

Beginnings of our rural forums were diversified. They smacked of religious fervor and emotional pitch in one way, and a raw but robust form of political science in another. As settlers moved westward, this independent, outspoken spirit followed the Conestoga wagon and the trailside campfire, and roosted snugly in the rafters of log cabins, ready to fly to the aid of him who stood in need of succor or reform.

I have at hand autobiographies of Rev. Peter Cartwright and Rev. Alfred Brunson, two rural forum leaders who rewarded men of native zeal by naming them deacons and church wardens, with power to keep the altar fires blazing all along the circuit.

In recognizing the speech-stimulating influence of the early revival meeting and the lyceum society, one should not overlook the heart-warming though elementary influence exerted in this direction by the pioneer storekeeper. Here was born the best beloved of our Yankee spokesmen—the cracker barrel philosophers.

TUCKED IN ODD CORNERS

There remain but few of these welcome places, tucked away in odd corners of our farm zones, where the postoffice still intrigues the waiting residents and the store offers the last resort to opinionated observers.

We should encourage merchants

who cling to outmoded fixtures if for no other reason than to preserve this proving ground for vigorous vocabularies and freedom of native expression. To leave it all to the 4-H Clubs and Future Farmers may seem wiser to the majority who prefer streamlined merchandising—yet these worthy old institutions serve a purpose in awakening our vocal virility to the boiling point.

SLAVES OF CONFORMITY

Today we are too conscious of precedent, of conforming, of being like others, of talking mostly of material gadgets and demonstrating purely technical methods. Thus we submerge imagination and primitive philosophy, lest it be irrelevant or immaterial to this year's farm program.

Along with this standardized expression, we have cut down the frequent use of strong, simple and forceful Anglo-Saxon words and idioms, the kind with which our Scotch-Irish forebearers hewed out a wilderness and used to win elections and fight Indians, the kind a Winston Churchill used to help stimulate men to keep their freedom!

When I began making the rounds of meetings as a rural reporter, we had farmers' institutes, farm-week short courses, and conventions held by cooperative creameries and stock-shipping locals, plus the state conclaves of the United Farmers or some other prominent group.

And oratory had an urge to be vocal under varied incentives—the desire for new knowledge, the risk of mutual business undertakings, and the propaganda in behalf of the farming profession facing a competitive and an indifferent industrial world.

Naturally they got all mixed up sometimes in a scrambled dish of opinions, because the bravest of these leather-lunged delegates after a long silent spell afield came down to uncork pent-up theories and air grievances galore. So we had a jumble of politics and economics, some religious quotations and market quotations in the same speech, and plenty of prejudice and stubborn invective.

SCAPEGOATS TO THE SHAMBLES

Scapegoats were led to the shambles. Chief among these in my bailiwick were the State College of Agriculture and the Federal Department of Agriculture, as well as any and all laws and regulations that had been passed at the behest of agrarian pressure or advanced by legislators with honeyed intentions toward the grangers.

Those stout old debaters and floor-hoggers sweated harder at forensic forays in those turbulent times than they ever did at their threshing bees.

Serious, original, witty and caustic, they removed the hides skillfully, rubbed in the salt, and stretched the skins on rigid frames to make a regular tanning job complete.

My only wonder as I sharpened my pencil to keep up with their sharper phrases was why in thunder they always scalped and flayed their erstwhile friends and agricultural associates, and let a whole woodsful of worse varmints escape their guns and traps.

Like the guy in the fable, "They shot the wrong dog and the sheep-killer got away."

SHUNNED BY ACADEMICS

Most of these impromptu diatribes of farm forums were studiously shunned by radio reporters and frowned upon by the faculty of the State Colleges. But seated up front at the rickety old pine table under the rostrum edge, where drops from the water pitcher and oratorical brows kept us well humidified, we craved a reporter's chance to quote the best of such spasmodic thrusts.

The only kind of farm meeting I used to avoid, as far as a seat down front was concerned, was the old style institute where they toted in specimens of fowl maladies and pig infections. Here was a time when the extension agent and the research man earned his money—and how!

With sleeves rolled to the elbow and with gestures as deft as a magician, these zealous workers in behalf of an unsullied livestock world diagnosed until the nose could stand it no longer.

It was a boon to mankind and to reporters in particular when some smart college gent invented the *lantern slide system* of exhibiting cases of animals far gone with everything imaginable. More folks could see it from where they sat and not have to come closer to inspect things, with the usual disagreeable consequences.

MAY BE A TRIFLE LATE

Some cognizance has been taken of late by the State Colleges on the value of rural discussion. They may be a trifle late in noting its worth and influence and encouraging farmers to do all the talking, instead of themselves—but let's give them credit for upholding forums anyhow.

We see circulars and leaflets going the rounds from the extension services telling farm folks *how to discuss!* They declare there are always two sides to a question and maybe three in an emergency, and suggest that the county agent be named for moderator. If he is right deft and diplomatic, the county agent will refuse the honor.

Thus even at the risk of bringing someone with snake medicine into the sacred precincts of a meeting run along academic lines, I favor a full stew pot of controversy. I sometimes fear the Colleges have often sought to stifle this tendency, yet I don't think we can get a workable sort of "farm religion" without a pow-wow.

There is a distinct handicap to holding old time speech fests these days, what with all the telephones, television and radios in existence. The town meeting ceases to be an event any more. There's too much other alleged comedy on tap at the turn of the dial. I hope we don't dial ourselves into speechless, thinkless robots.

A LONG WAY TO GO!

According to U.S.D.A. figures, there are only five major crops grown in this country for which fertilizer is used on more than half the acreage planted.

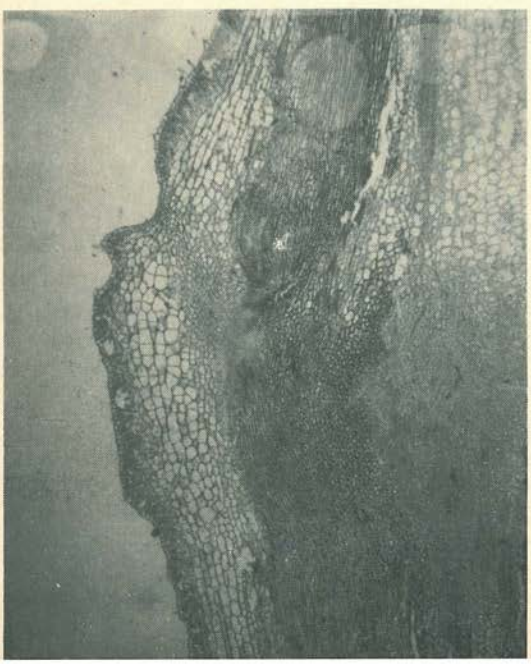
These crops and the percentage of acreage fertilized are tobacco (75%), Irish potatoes (73%), sugar beets (72%), corn (64%), and cotton (58%). Between them they accounted for about 38% of total fertilizer consumption.

Among those crops with less than 50% of their acreage fertilized were wheat (34%), sorghum (13%), soybeans (12%), hay and cropland pasture (10%), barley (7%), oats (1%), and other pasture land (1%). These crops accounted for only 19% of the total fertilizer used.

NO K

THE SEPARATION LAYER in the stem of the tomato fruit is wide and weak when the tomato needs K.

400 lbs. K



Tomatoes TELL Potassium NEEDS

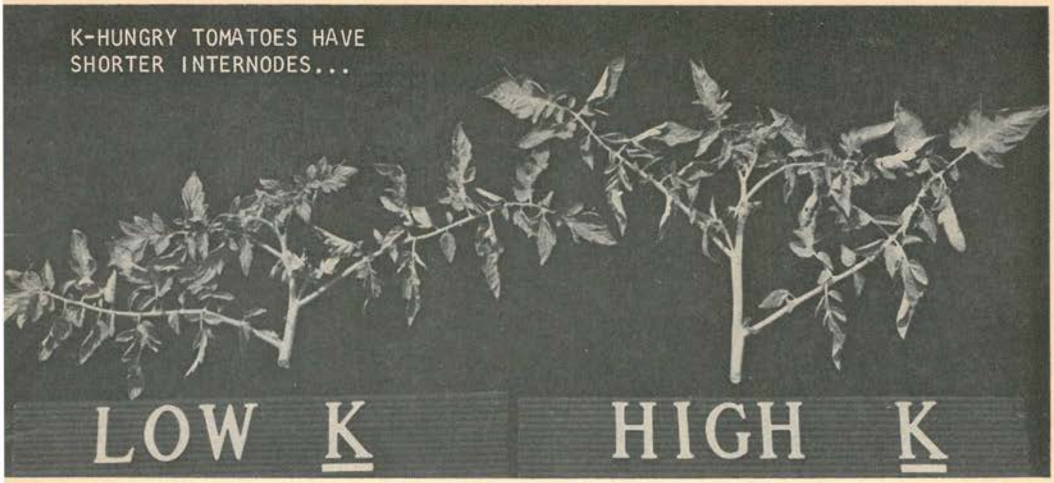
GIRLS MAY NEVER TELL

. . . BUT TOMATOES **WILL!**

A TALE OF K NEEDS

BY GERALD E. WILCOX

HORTICULTURAL DEPARTMENT PURDUE UNIVERSITY



. . . ESPECIALLY WHEN THEY **NEED** POTASH

Through an inherent urge to reproduce their kind, tomatoes will produce fruit even when they are starving for potassium (K)—but fruit of low quality.

When grown on soil containing only 110 lbs. per acre exchangeable potassium, tomatoes showed K hunger throughout the growing season. The results of K hunger followed this pattern:

1 DISTINCT COLOR CONTRASTS showed up within five weeks after transplanting — the deficient plants darker green than those on the K-fertilized plots.

2 TERMINAL LEAF DEVELOPMENT decreased, giving K-deficient plants a Christmas tree effect.

3 PLANT STEMS were slender on the K-deficient plants.

4 ASHEN GRAY MARGINS showed up on older leaves around first of September, followed by rapid leaf loss which exposed the fruit to sunburn, a factor against quality.

5 FRUIT DROPPED from K-deficient vines as it ripened, a direct effect of this plant food deficiency.

But what about tomato *yields* and K *removal* on soils of different potassium levels? Turn over this page for some examples of scientific tests. →

MINING or BUILDING YOUR SOILS?

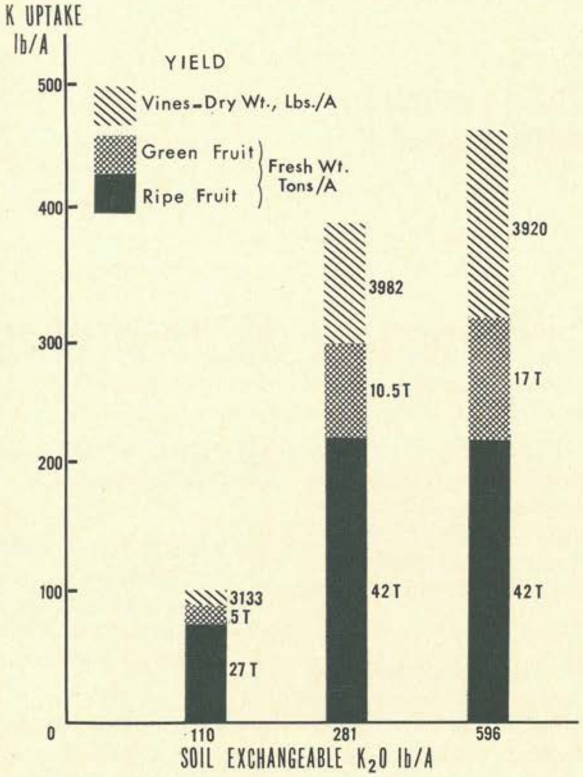
Does your tomato crop remove more nutrients from the soil than your fertilization program returns? Does your program merely replace the nutrients your crop removes—or does it *build* your soil for high yields?

From yields on soils of different potassium levels, we found interesting K removal and uptake facts that can affect profits:

1 On soils of 110 lbs. exchangeable K_2O per acre, 27 tons per acre of low quality fruit removed 78 lbs. K per acre. Total uptake: 103 lbs. K in vines and fruit.

2 On soils of 281 lbs. K_2O per acre, 42 tons ripe fruit per acre removed 227 lbs. K. Total uptake: 396 lbs. K in vines and fruit.

3 On soils of 596 lbs. K_2O per acre, 42 tons of tomatoes contained 231 lbs. K. Total uptake: 470 lbs. K in vines and fruit.

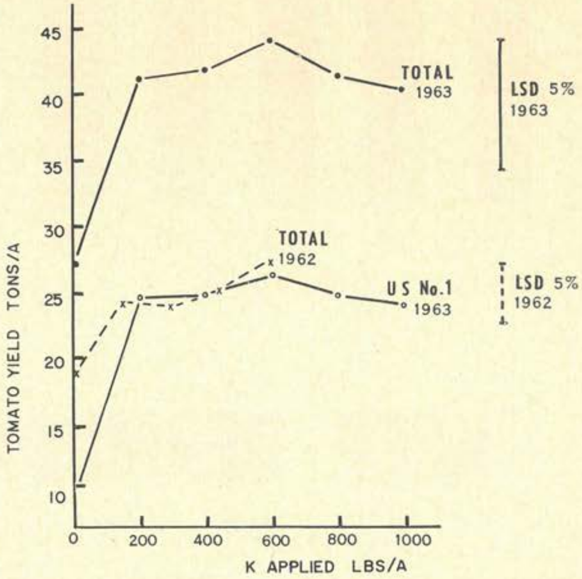


This bar chart shows relative K uptake and removal at the different soil K levels. Note these facts:

1 *That the fruit's K composition* held constant at the two higher soil K levels.

2 *That more green fruit* at the end of the season resulted from the highest K level.

3 *That vine weight* held constant at the two higher soil K levels, but K composition was highest at the 596 lb. soil K_2O level.



TOP TOMATOES DEMAND TOP POTASSIUM

In 1962 on Miami silt loam containing 180 lbs. per acre exchangeable K_2O, the application of 150 lbs. per acre K produced 29 tons per acre fruit.

In 1963 on Miami silt loam containing 110 lbs. per acre exchangeable K_2O, the application of 200 lbs. per acre K produced 42 tons per acre fruit.

When you produce in the 30 to 40 tons per acre range, your total K uptake in vine and fruit runs 396 to 470 lbs. K per acre—actual removal in ripe fruit from 162 to 216 lbs. K per acre.

So, just to replace the K removed demands 300 to 400 lbs. muriate of potash per acre—*for top yields on low-K soils.* A soil *building* program would demand 500 to 600 lbs. muriate of potash per acre rates. REMEMBER: Broadcast and plow down high K rates for best results.

THE END

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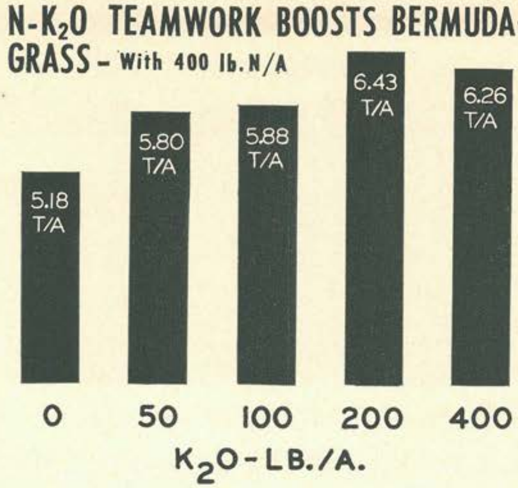


FIGURE 1

KEEP BERMUDAGRASS

BY C. B. KRESGE AND A. M. DECKER

UNIVERSITY OF MARYLAND

High-yielding bermudagrass, like a growing child, needs added protection against cold and disease. An important form of protection is proper K fertilization.

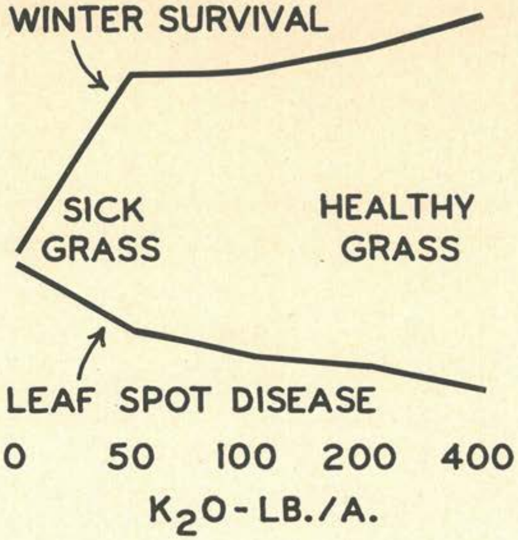
To keep bermudagrass healthy, a proper balance of N to K is required. As higher N rates are applied to produce more forage, more K must be made available.

Maryland research on Midland bermudagrass showed . . .

1 That bermudagrass responded best to 400 lbs. N per acre when teamed with 200 lbs. K_2O per acre—to get high yielding, high-N forage feed.

2 That leaf spot disease **decreased** and winter survival **increased** as more K_2O was applied to bermudagrass.

FIGURE 2



HEALTHY WITH POTASH

FOR TOP LEVEL YIELDS
WINTER-DISEASE RESISTANCE
HEALTHY FEED

Midland bermudagrass was established at the northern extreme of its cultivation—about 39° 15′ latitude.

All possible combinations of the following rates of N and K_2O were applied: 200, 400, and 600 pounds of N and 0, 50, 100, 200, and 400 pounds of K_2O per acre. Forage yields were measured for 3 years. Index readings were made of winter survival and *Helminthosporium* leaf spot disease incidence. At the end of the 3 years, the soil was tested for available K.

Nitrogen as NH_4NO_3 and K as KC1 were topdressed in 4 and 2 split applications, respectively, each year. A single application of 150 pounds of P_2O_5 as superphosphate per acre was topdressed annually. The grass was harvested when it reached a height of 8 to 15 inches, leaving a stubble of about 1 inch. Four cuttings were made each in 1960 and 1961 and 3 in the drier year of 1962.

FOR OPTIMUM YIELDS

Figure 1 shows yields from plots receiving 400 lbs. N per acre per year. Each value is the average dry matter yield for 3 years.

The 2 to 1 ratio (N to K_2O) gave the highest yield of any ratio tested—also

MINERAL CONTENT OF FORAGE RECEIVING 400 LB. N/A. (3-YEAR AVE.)

K_2O applied annually	N	P	K
lb./A.	....	%	....
0	3.14	.321	1.01
50	3.04	.308	1.29
100	3.06	.303	1.41
200	**2.97**	**.309**	**1.77**
400	3.00	.299	2.23

TABLE 1

generally true at the 200- and 600-pound rates of N per acre.

Maximum yield at the 200-lb. N rate occurred with between 100 and 200 lbs. of K_2O (4.85 to 5.18 tons per acre).

At the 600-lb. N rate, 6.39 and 6.65 tons were obtained with 200 and 400 lbs. of K_2O per acre, respectively.

It is evident that 200 lbs. N was *not enough* and that 600 lbs. N was *too much* for most efficient production at this location.

DISEASE RESISTANCE

Since bermudagrass is a perennial usually established for several years' use, its ability to persist year after year is extremely important. Lush, green growth caused by N fertilization makes the "mouths" of disease organisms water. Apparently they can attack this succulent growth much more successfully than they can attack pale, tough grass with insufficient N.

The *Helminthosporium* leaf spot disease attacked the bermudagrass each year of the study.

Disease was most severe on the high-N grass *but only when K was deficient*. Figure 2 shows how 1962 leaf spot decreased as K rate increased. Severe disease incidence indicated that low-K plants were weak to start with. Very likely these plants became even weaker by season's end.

WINTER SURVIVAL

How did these plants survive the winter? Until 1963, winters during the experiment period were not severe enough to cause detectable damage. But in January and February of 1963, the combination of near zero temperatures and inadequate snow cover caused considerable winter-killing.

The most severe killing occurred on plots receiving 400 and 600 lbs. N per acre. But at these high N rates, *winter survival increased as K_2O increased*. Figure 2 emphasizes that K helped keep the grass healthy enough to resist disease and winter-killing.

NUTRIENT CONTENT OF GRASS

As the K_2O rate increased, so did the percent K in the plant. See Table 1. Apparently, a K content in harvested bermudagrass of about 1.5 to 2.0% is optimum.

K application did not significantly alter the N and P content of the forage. Slightly higher N and P levels occurred where no K was applied. This was due to stunted growth and nutrient accumulation. Bermudagrass, receiving 200 lbs. K per acre, produced maximum yields at the 400-lb. N rate without significantly diluting the N and P contents of the grass.

N and P contents of 2.97% and .309%, respectively, are considered optimum for forage—*the N representing about 18% protein.* Such values are not only excellent for animal nutrition, but also help keep the bermudagrass healthy.

EFFECT OF ANNUAL FERTILIZER TREATMENT ON AVAILABLE SOIL K_2O AFTER 3 YEARS

N applied Lb./A.	K_2O applied—Lb./A.				
	0	50	100	200	400
	........K_2O in soil—Lb./A..........				
200	63	66	70	**161**	**265**
400	58	63	70	**89**	**185**
600	58	65	75	**95**	**176**
			LOW	**MED TO HI**	

TABLE 2

MINING YOUR SOIL K?

As nitrogen increases bermudagrass yield, more potash is often demanded, obviously removing more K from the soil. So, for healthy grass, we should maintain at least a medium level of available soil K.

Table 2 shows that more than 100 lbs. K_2O per acre per year was required to keep the level of available K_2O in the Wickham silt loam soil above the low range (80 lbs. K_2O per acre is the borderline between low and medium).

At the 400- and 600-lb. N rates, 200 lbs. K_2O was just barely enough. Something between 100 and 200 lbs. K_2O per acre would be needed at the 200-lb. N rate.

REMEMBER:

Midland bermudagrass, receiving a balanced diet of N to K_2O in a ratio of approximately 2 to 1, can produce *healthy,* high yielding forage.

THE END

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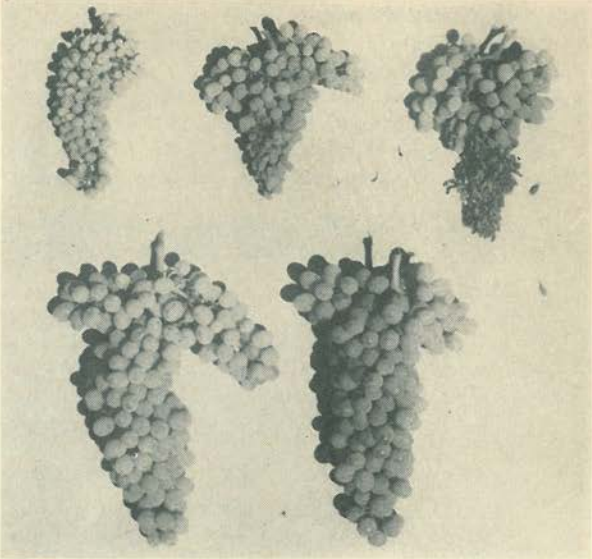
Small clusters of unevenly ripened grapes came from no-potash vines.



Typical bunches from potash-treated vines showed big healthy clusters of evenly ripened grapes.

POTASH NEEDS SHOW ON GRAPE VINEYARDS

Recent vineyard studies in the Fresno area of California's San Joaquin Valley have further shown the need for and response to spot treatments of potassium fertilizer.

Fresno County is noted as California's raisin production center. It is also an important wine and table grape producing area. Here, the Thompson Seedless grape variety reigns, with almost 60 percent of the state's total Thompson Seedless acreage of 210,000.

Although classified as a raisin variety, Thompson is used widely in all three major marketing segments—raisin, wine and table.

A nutritional survey followed by field trials uncovered potassium fertilization needs in localized areas of individual vineyard blocks, though K deficiency is not an extensive vineyard problem.

HOW IT WAS DISCOVERED

This work began by a random survey of 80 representative Thompson Seedless vineyards. We used plant tissue testing in this way:

1. Petioles from opposite flower

NO POTASH

WITH POTASH

BY PETER CHRISTENSEN
FARM ADVISOR

**UNIVERSITY OF CALIFORNIA
FRESNO**

clusters on vine shoots were collected at full bloom in 1960 and 1961 and analyzed for potassium as well as other nutritional elements.

2 Samples were taken from a 10-acre uniform block in each vineyard.

Analysis of these petioles showed only one sample that had a definitely deficient bloom time level below 0.8% potassium, emphasizing the confined nature of vineyard potassium deficiency.

Observations and more intensive sampling within some of these blocks

SIGNS

ON VINES . . .

Treatment was made in March, 1962, by placing potassium sulfate in a concentrated band in the bottom of deep furrows on each side of the vine row.

Though deficiency symptoms began to appear in all plots in early May, 1962, a noticeable change from treatment was observed by mid-July.

Untreated vines continued to show the fading green color, followed by curling and burning at the outer leaf edges.

Leaf fall was premature.

Only mild symptoms persisted in an occasional vine treated with potash.

ON FRUIT . . .

Large differences in fruit quality was also observed by late July.

Clusters on K-deficient vines tended to be small and compact with unevenly ripened berries.

Many clusters began shriveling from the tips—and even entire clusters failed to mature properly and completely dried up.

Potash-treated vines recovered completely by the second year.

TABLE 1—FERTILIZATION BOOSTS YIELDS, 1962–63 Grape Harvests Show
Trial Average—6 Reps.

Treatment	Harvest Weights				Berry Sample Analyses*					
	Av. Cluster wt.-lbs.		Av. Yield/ vine-lbs.		Av. Berry wt-gms		° Balling		Total Acid	
	'62	'63	'62	'63	'62	'63	'62	'63	'62	'63
CHECK	0.65	0.47	23.8	15.4	1.24	1.29	20.3	22.6	0.53	0.59
5 lb. K_2SO_4/ vine (in 1962 only)	0.86	0.96	34.6	37.9	1.38	1.69	20.3	20.3	0.55	0.64
Percentage increase, K over check	**32%**	**104%**	**45%**	**146%**	**11%**	**31%**	**0**	**−10%**	**3.8%**	**8%**
Significant level	**1%**	**1%**	**1%**	**1%**	**5%**	**1%**	**—**	**1%**	**N.S.**	**1%**

*200 berries from each 30-vine plot.

indicated that deficiencies rarely involve over 1 to 3 acres in an individual vineyard block.

MARKED YIELD INCREASES

Several such deficient vineyard locations were selected for further study in 1961. By confining treatment only to those areas showing *visual vine deficiency symptoms*, rather striking improvements in grape yields and quality resulted from potassium treatment.

An outstanding example is a young, full-bearing Thompson Seedless vineyard near Herndon where a treatment of 5 lbs. of potassium sulfate per vine was compared to untreated vines. Marked yield increases from fertilization were measured the first year after treatment, as shown in Table 1.

Yield increases the second year after treatment were even more pronounced, indicating added benefit from vine improvement of the preceding year. Yield increases came primarily from increased berry and cluster weights.

The fruit from potash plots showed higher acid but lower soluble solids readings (°Balling) the second year. Here, the larger crop probably delayed the rise in soluble solids readings. But the *total sugar* production of the K-treated vines was much higher because of the higher yields involved.

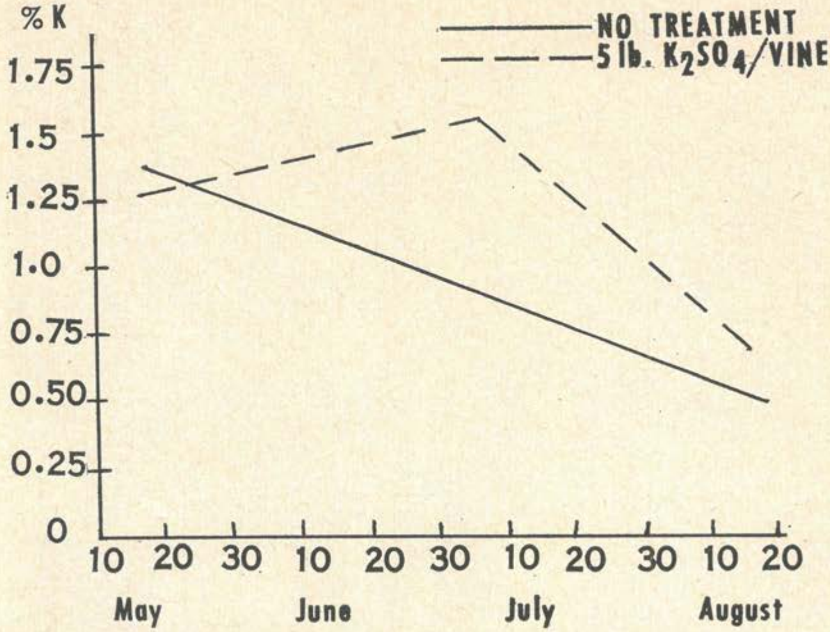
RECENT RATES POINT HIGH

Earlier potassium fertilization studies in Fresno County had been rather discouraging—usually involving larger blocks where much lower rates of potassium were applied in a mixed NPK fertilizer. No benefits from such potassium applications could be found.

But more recent studies by Dr. James Cook, University of California Department of Viticulture and Enology, pointed to the need of high potassium sulfate rates (minimum of 1,500 lbs. per acre) for correcting most California vineyard soils.

It was also found important to spot-treat only where plant tissue analysis and visual deficiency symptoms confirmed deficiency.

Cut areas of 1-foot or more during



VINE POTASSIUM LEVELS IMPROVED markedly with potash treatment by mid-summer 1962, as shown by periodic sampling and testing of vine petioles. Note: first sample taken at full bloom . . . petioles from most recently matured leaf position.

land leveling has been commonly associated with vineyard potassium deficiencies in Fresno County.

For example, in the Herndon trial vineyard, the cut areas with the exposed subsoils showed potash hunger symptoms, while the vines on the fill-areas had normal foliage. Responses to potassium fertilization have been particularly successful in these instances of potassium deficient soils.

CHECK ALL LIMITING FACTORS

Occasionally we see symptoms of potassium deficiency where the soil seems to be adequately supplied.

This problem has been associated with poor root growth or activity that may limit the vines' ability to remove potassium from the soil.

Contributing factors have included (1) the root pests nematode and phylloxera; (2) moisture stress; (3) poor root environment such as compacted soil; or (4) overcropping.

Here responses to potassium fertilization have been erratic. These limiting factors must be corrected along with trial applications of potash.

THE END

TYPICAL SYMPTOMS OF CORN STUNT DISEASE show up on a corn plant in this way:

1 Extremely short upper internodes, giving the stalk a bunched effect.

2 Yellow stripes are showing in the younger leaves—and this yellowing may increase in extent and intensity.

3 Excessive tillering and root development, as shown in this plant pictured by Mississippi Extension Service on June 1, 1964.

BY J. W. McKIE
MISSISSIPPI SATE UNIVERSITY

CORN STUNT DISEASE

The continued spread of corn stunt disease is a serious threat to corn producers in the Mid-South and possibly the nation.

Corn stunt is a virus disease potentially more destructive than any other known corn disease.

The disease was first identified in Hinds and Yazoo Counties, Mississippi, in 1962 along a small area of the Big Black River. Infection varied from practically every stalk in a field showing severe symptoms to only a few scattered affected stalks in other fields.

By mid-1963 corn stunt disease had spread, mostly northward from this area, and was positively identified in 33 Mississippi counties. It had also spread to adjoining states and up the Mississippi River toward the Mid-West.

FIRST IN CALIFORNIA

First observed in California in 1942 and Texas in 1945, corn stunt has been observed in Mexico, Central and South America. Transmission studies in 1946 established that the disease was a virus and was carried by two species of leafhoppers—Dalbulus maidis and Dalbulus elimatus.

Entomologists had been unable to collect these particular insects from infected fields in Mississippi until the late summer of 1964. This could indicate we have native insects capable of acting as carriers (vectors) of corn stunt virus.

The rapid spread of the disease and the recurrence in the same field in successive years indicates a perennial native host plant in which the virus can over-winter.

SO LITTLE IS KNOWN

The main problem in establishing a program of control or eradication of this costly disease is that so little is known of the virus. Agronomists, entomologists and plant pathologists have launched a major attack on corn stunt.

Their primary approaches are: (1) identifying insects capable of carrying this virus from plant to plant, (2) locating a genetic source of resistance so that breeders can develop corn lines that will resist the disease.

Research scientists with the Mississippi Agricultural Experiment Station have planted more than 1200 corn varieties and lines in evaluation plots in fields that were severely infected in 1963. Several commercial seed companies also have variety evaluation studies in these areas.

Insects are being collected from these known areas of infection and studied to learn if insects other than known vectors can transmit the virus.

SYMPTOMS TO LOOK FOR

Corn stunt disease observed under field conditions in Mississippi was described by scientists in this manner:

"The first unmistakable symptom may become apparent in plants 30 to 40 days old. First symptom appears as a faint chlorotic or yellowish irregular striping of the leaves, particularly in the whorl. The yellowing may increase in extent and intensity.

"Many plants at this early stage may show stunting—in some, reddish purple streaking was apparent. Severely affected plants may be barren, or they may produce ear shoots with silks but no pollen.

"In 1963, excessive secondary root growth was usually characteristic of late season infection when accompanied by other symptoms. Root development may involve several internodes above the soil surface."

ON THOUSANDS OF ACRES

Yazoo County has been the hardest hit county by corn stunt disease. In 1962 several hundred acres were infected. In 1963 Yazoo County Agent Walter White reported over 1000 acres of corn were a total loss from corn stunt and losses ranged from 10 percent to 75 percent on another 4000 acres. In 1964 County Agent White reports that he observed symptoms of corn stunt disease in practically every area in his county.

Corn in the upper two-thirds of Mississippi is much more severely infected with corn stunt disease than the southern part of the state. Nearly every field in the northern third of the state has some plants showing symptoms of corn stunt disease.

Corn stunt disease did not severely affect the *total* corn yield in Mississippi in 1964. This was due to several factors, including ideal growing conditions experienced in the heavy corn producing areas of the state. Many hybrids grown in this area show some degree of resistance.

Our research scientists working on genetic resistance to corn stunt are very encouraged with their first year findings. To take full advantage of these encouraging findings, this research needs considerable financial support.

The most important thing needed by the farmer is a variety or varieties resistant to corn stunt disease.

THE END

WHAT A COW!

A minister walked into a little Western town tavern in the course of his welfare work and ordered a glass of milk. By mistake he was served a spiked eggnog.

After drinking it to the last drop he raised his eyes upward and was heard to say: "Lord, what a cow!"

* * *

Babies haven't any hair.
Old men's heads are just as bare.
Between the cradle and the grave
Lies a haircut and a shave!

Today's mighty oak is just yesterday's little nut that held its ground.

* * *

"Yes sir," bragged the proud father, "I've got three sons in college. One is at Georgia Tech, one is at MIT and one is at Vassar."

"But Vassar is a girls school," his friend protested.

"Is that a fact!" exclaimed the father. "No wonder that boy never comes home on vacation."

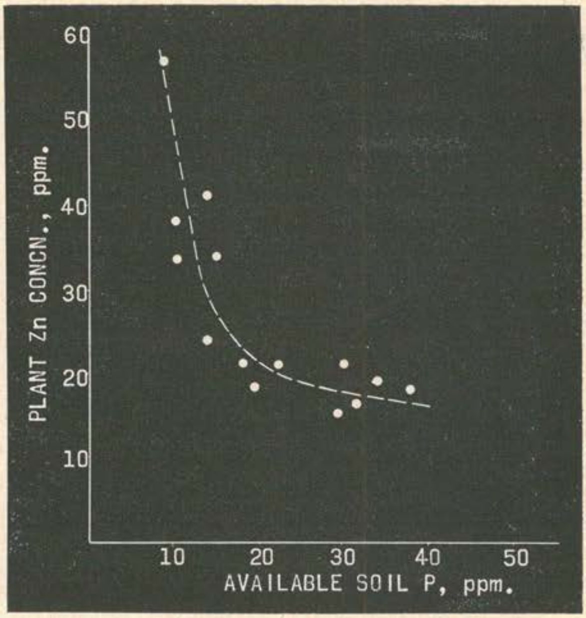


Figure 1—Zinc concentration of non-fertilized corn grown on fourteen slightly acid to alkaline soils in the greenhouse (excludes the only strongly acid soil in the original group of fifteen).

Phosphorus-Zinc Relations In Corn & Sorghum Production

R. A. OLSON D. D. STUKENHOLTZ C. A. HOOKER
UNIVERSITY OF NEBRASKA, LINCOLN

With rapid development of fertilizer use in Nebraska after World War II, it was soon noted that starter fertilizers containing P did not always provide the beneficial effect intended on corn and sorghum production.

In fact, yield *reduction* to the P was noted as regularly as yield increase in field experiments of 1951-1960. Laboratory study of soil samples from these field experimental sites showed soil P level to be closely associated with the paradox at hand (Table 1):

Soils of high available P supply more often than not produced less grain with the starter P than without. This yield depression was accentuated when a small amount of N was included with the starter P, a practice that has been commonly found to enhance crop utilization of the starter P.

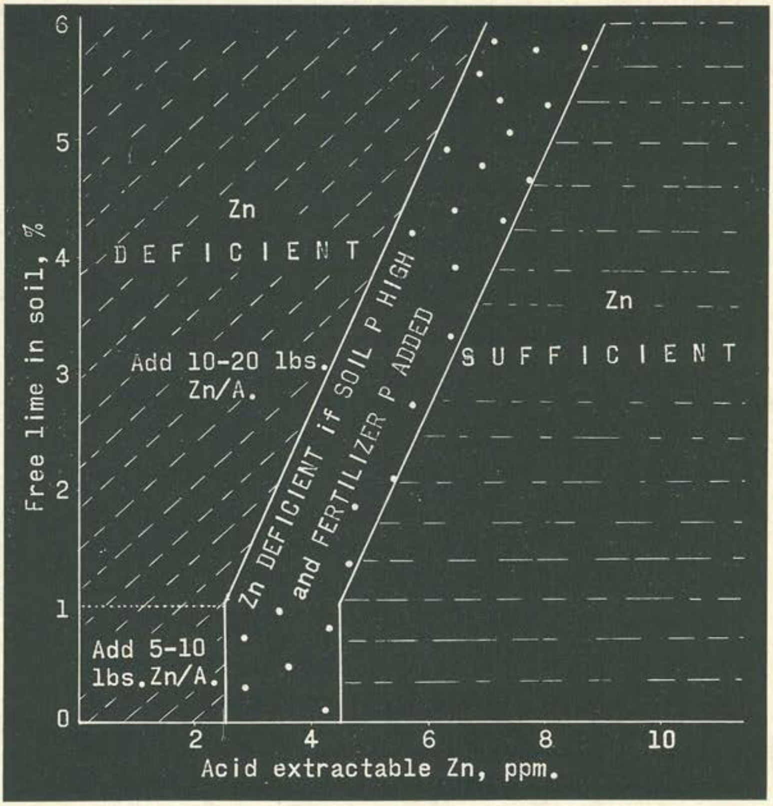


Figure 2—Zinc recommendations for corn and sorghum based on soil test for zinc.

It was evident that a different soil P calibration scheme would be required for corn and grain sorghum than for small grains, since the latter had given no evidence of such negative effects. This proved to be true, for some soil test values in the high range for corn were still in the low range for small grains (Table 2).

Critical review of the field response and laboratory test values further showed a difference between irrigated and non-irrigated row crops—the irrigated requiring supplemental P at somewhat higher soil P test values than non-irrigated for maximum yield results.

P AND Zn MUTUALLY ANTAGONISTIC

In certain instances among these experiments, chlorotic symptoms were apparent in corn plants that had received starter P, but not in plants without P. Was P disturbing the normal trace element nutrition of the plant, probably Zn in particular? To study interaction of

TABLE 1—EFFECT OF SOIL P ON RESPONSE OF CORN AND GRAIN SORGHUM TO STARTER PHOSPHORUS.

Response and no. of expts.	Average soil P (Bray and Kurtz no. 1)	Average yields due to N+P+K/A.		
		N only	0+13+0 +N	10+13+0 +N
	ppm.	bu/A.	bu./A.	bu./A.
Increase to starter (30)	11.8	78	85	86
Decrease to starter (32)	24.0	90	85	82

the two elements in corn growth, a greenhouse experiment was conducted on 15 widely varied soils of the state.

This study showed that added N enhanced the plant uptake of Zn, but added P notably reduced plant Zn concentration (Table 3). The small rate of 8 ppm. P banded beside the row caused plant Zn content to decline 31% on the average with this group of soils, and the heavy mixed P treatment cut Zn concentration almost in half. Such a sharp drop in concentration resulted partly from dilution caused by greater yield from the P treatment, but not entirely. Note how the greatest total Zn yield came with N only treatment despite a lower average yield than where P was added. It may well be that the greater Zn uptake through N resulted partly from diluted plant P concentration.

A plot of results for the individual experiments (as in Figure 1) shows the intimate relation between available P level of the soil and Zn concentration of the non-fertilized corn. As soil P increased up to about 20 ppm. P, plant Zn concentration declined sharply. Above 20 ppm. P, the rate of Zn decline with increasing P was much less abrupt. It would seem quite probable that plant Zn concentration, already approaching a critical level at the higher soil P levels, would be modified to a state of deficiency with additional fertilizer P.

Companion greenhouse experiments showed that a given rate of P resulted in a greater plant P concentration and lower Zn concentration when banded than when mixed with the soil. They also showed the mutually antagonistic relationship between the two elements—applied P reducing Zn uptake *and vice versa*.

HIGH SOIL K HELPS

These greenhouse experiments also showed that soil K level influences the degree to which applied P repressed plant uptake of

TABLE 2—CALIBRATION OF SOIL PHOSPHORUS TEST (BRAY AND KURTZ NO. 1) WITH DIFFERENT CROPS AND MOISTURE REGIMEN

Soil P level	Irrigated corn (37 locations)		Non-irrigated corn and sorghum (50 locations)		Small grains (139 locations)	
	calib. range	yield response to P	calib. range	yield response to P	calib. range	yield response to P
	ppm. P	**bu./A.**	**ppm. P**	**bu./A.**	**ppm. P**	**bu./A.**
Low	**0–10**	**+12.8**	**0–5**	**+10.0**	**0–15**	**+6.0**
Medium	**10–15**	**+ 3.0**	**5–10**	**+ 2.7**	**15–24**	**+2.5**
High	**15–25**	**− 1.2**	**10–15**	**0.0**	**24–30**	**0.0**
V. high	**>25**	**− 4.0**	**>15**	**− 3.0**	**>30**	**0.0**

soil Zn. The higher the exchangeable K saturation of the soil the less P reduced Zn uptake and vice versa. The mechanism responsible for this observation is not known, but the effect is considered nonetheless real.

APPLIED Zn MAY ALLEVIATE HIGH SOIL P 'PROBLEM'

Twenty-six field experiments with corn and grain sorghum during the past four years further reveal the significance of soil P level in the P-Zn relationship to crop production (Table 4). These experiments were conducted on soils representative of the Nebraska areas in which they were held, in no case heavily cut with exposed calcareous subsoil material of the type commonly associated with Zn deficiency.

There was no suggestion in these yield data of Zn need with the eight locations (mostly non-irrigated) of low soil P level, while applied Zn appeared to have a beneficial effect when soil P was high. Among the latter eighteen experiments, three showed significant Zn response, largely responsible for the apparent mean benefit to Zn. The surface soil P level at these locations averaged 24 ppm., with modest to very high amounts of available P in the lower horizons as well. In none of these situations was there positive response to applied P, while in one case there was significant reduction due to P—this was counteracted by applying Zn.

A 1963 experiment on an irrigated calcareous sandy soil in Morrill County, Nebraska, gave even more striking evidence of the critical balance between P and Zn in the nutrition of the corn crop. Though the corn fertilized with N yielded only 50 bu./A., 13 lbs. of

TABLE 3—INFLUENCE OF SOIL TREATMENTS (N & P) ON YIELD AND COMPOSITION (P & Zn) OF CORN GROWN IN THE GREENHOUSE (15 SOILS)*

Measurement	Soil treatment, ppm. N+P+K			
	Check	40+0+0	5+8+0 band plus 35+0+0	0+64+0 mixed plus 40+0+0
Yield, g./pot	**5.0**	**9.8**	**12.9**	**15.2**
P concn., %	**0.18**	**0.15**	**0.15**	**0.33**
Zn concn., ppm.	**27**	**29**	**20**	**16**
Zn yield, micrograms	**135**	**285**	**258**	**243**

*Data from Langin, E. J., Ward, R. C. et al. Soil Sci. Soc. Amer. Proc. 26:574–578. 1962.

starter P reduced the yield to 26 bushels, and 6 lbs. Zn along with the P resulted in a yield of 85 bu./A. Unquestionably both P and Zn were deficient for optimum yield in this situation, but adding only P disturbed Zn utilization so much that yield declined sharply.

WHERE DOES THE Zn INTERACTION OCCUR?

Our investigations suggest that the antagonism between these two elements is physiological in nature, and probably occurs at the root surface. If the detrimental action of applied P on soil Zn uptake were a result of immobilization of Zn in the soil, then the maximum loss in soil Zn availability should have occurred with mixed application of a given rate of P. This did not prove to be the case, rather banded P which gave highest P concentration of the crop was associated with minimum Zn utilization. Moreover, soils incubated for four weeks with modest to very high rates of P mixed in the soil showed no reduction in weak acid extractable Zn.

Sectioning the plants produced in later P x Zn greenhouse experiments indicated that leaves, nodes, internodes and roots alike were reduced proportionately about the same in Zn concentration by fertilizer P. This suggests that it is not internal precipitation of Zn in the plant with resulting impeded translocation which is measured.

Rather, the detriment has come previous to this point, presumably at the root surface.

ROLE OF SOIL TESTING

A soil test has been calibrated for Zn which takes into account soil Zn, P, and lime concentrations (Figure 2). This procedure is similar to that first used by Washington researchers, involving 0.1

TABLE 4—INFLUENCE OF N, P AND Zn ON YIELDS OF *CORN* AND *GRAIN SORGHUM* IN FIELD EXPERIMENTS AS RELATED TO SOIL P LEVEL (1959-63)

Treatment[1]	Yield, bu./A. when soil P test was 10 ppm. or less	More than 10 ppm.
	(Bray & Kurtz no. 1)	
	8 expts.	**18 expts.**
Check	**59**	**84**
N only	**77**	**95**
N+P	**81**	**93**
N+P+Zn	**81**	**98**

[1] N sidedressed when plants were 6-18 inches in height at rates of 60 to 120 pounds N/A. depending on moisture supply; P and Zn applied at planting as starter, usually at the rate of 10 pounds of P and 5 or 10 pounds Zn/A.

N HC1 as extractant. Undoubtedly the present calibration will be modified in time as additional experimental evidence is accumulated.

For the present we are reasonably satisfied that 2.5 ppm. soil Zn represents bare sufficiency for corn and sorghum on soils without free lime. With about 5% free lime, at least 6 ppm. soil Zn is required. Likewise a high level of soil P shifts the response line a couple of divisions into the normally sufficient zone if fertilizer P is to be used.

These observations stress the importance of soil testing in modern agriculture. The need for adequate balance of nutrients coming from soil and fertilizer must not be forgotten, especially with intensive cropping of alkaline soils containing free lime. Soil testing will pick up imbalances that tend to build up and can be used to prescribe corrective measures before yields are reduced.

CONCLUSION

Since applied Zn readily corrects the low Zn concentration of plants imposed by high P, it may be suggested that Zn application should be standard procedure whenever fertilizer P is used. Certainly such a recommendation would over-simplify the issue and in many cases cause unnecessary expense to the farmer.

Very possibly this could result in further nutrient imbalances, perhaps eventual Zn toxicity in acid soils.

But from these studies, it does seem appropriate to advocate Zn use (1) when lime and/or available P contents of soil are high, (2) when the soil is compacted and low in organic matter content, (3) when additional P is applied for corn and sorghum.

THE END

FERTILIZER MADE THE DIFFERENCE between these 10-year-old stands, pointed out by Gulf County Agent C. R. Laird

FOREST FERTILIZATION?

Why Not . . . When It PAYS OFF!

CONDENSED FROM W. L. PRITCHETT IN **FLORIDA RESEARCH REPORT**

I was recently asked by one of our county agents if I thought forest fertilization would ever be economical in Florida—and I answered him, "Why not?"

This is a comparatively new area of research. Except for fertilization of forest nurseries, little interest had been shown in fertilizing forest soils until the past few years.

The first recorded studies of forest fertilization in Florida were initiated by the University of Florida in 1945. In these experiments with slash pine on Leon fine sand, significant volume increases of up to 65 percent were obtained from colloidal phosphate at rates of from 0.5 to 2.0 tons per acre.

OUTSTANDING RESPONSE

Another test was started on Bladen fine sandy loam in 1953, using a 2-12-

12 fertilizer at rates of 1 ton per acre to slash pine seedlings. The response to the fertilizer was outstanding. Eleven years later, trees that received fertilizer at planting time averaged 38.6 feet in height and 6.2 inches in diameter, while unfertilized trees stood an average of 17.6 feet, with 2.7 inch diameter.

Such striking results no doubt had some influence on the recent upsurge of interest in forest fertilization.

Other factors contributing to current interest are the facts that no sizeable areas of virgin forest are available for future consumption and new wood must be produced on cutover lands and abandoned fields.

Stumpage prices probably will continue to increase, and improved fertilizer materials and application techniques support the possibility of more effective and profitable growth response on many infertile sites in the future.

During the past eight years, approximately 40 fertilizer experiments in slash pine plantations and seed orchards have been conducted by the Forestry and Soils departments of the Florida Agricultural Experiment Stations with the cooperation of pulp and paper companies.

8 OUT OF 10 PAY OFF

On flatwoods soils (Leon and associated series), phosphorus and nitrogen fertilizer applications have given statistically significant responses in 8 out of 10 tests.

Growth responses in about half these trials have been sufficiently great to make fertilization economically feasible at the present price of timber. This requires about a 20 percent increase in growth—though this figure should come down as stumpage prices increase.

The most consistent growth increases have been obtained from phosphorus applications to young trees on flatwoods soils.

In nine experiments on the principal forest soils in Florida, additional response was obtained from a combination of nitrogen and phosphorus over phosphorus alone. However, nitrogen used alone gave little or no growth response.

Minor elements or lime have not consistently increased tree growth.

Iron applications benefitted growth only when a deficiency had been induced by excessively high soil pH. Limestone, used along with nitrogen, phosphorus, and potassium, gave an additional increase in tree growth in only one experiment.

Slash pine has a low tolerance to fertilizer salts. Broadcast applications of fertilizers exceeding about 300 pounds of nitrogen or potassium per acre may cause "burn" and suppress growth of *seedlings* transplanted to sandy soils. Also, much of the fertilizer material may be lost by leaching before the root systems of the trees use it.

REDUCING DANGERS OF SALTS

The dangers of excessive fertilizer salts may be reduced by using less soluble materials, deep placement and delayed applications.

Placing fertilizer in the slit about 6 inches from the roots, at the time of planting, appears the best method of fertilizing young trees.

If it is not convenient to make a deep localized placement at planting time, fertilization should be delayed. By the time the trees are 1 or more years old, fertilizer can be broadcast from an aircraft or placed in bands between the rows.

We are now entering an era when we can expect to see fertilizers applied to forest trees in certain areas of the state as a recommended practice. These areas will probably be prepared sites, on the less fertile of the flatwoods soils of central Florida and the saltgrass flats of western Florida.

THE END

SUGAR CANE DRAWS HARD ON THE SOIL

FROM LOUISIANA **FARM & RANCH**

ALL SOILS of Louisiana on which sugar cane is grown require annual applications of nitrogen, and many soils require annual applications of phosphorus and potassium.

The degree of availability of N, P and K in soils is related to some extent to the total amounts of these nutrients in the soil. Most of the soil nitrogen is a constituent of the soil organic matter. Under Louisiana conditions only a small portion (about 3%) of the soil organic matter decomposes during any growing season.

During a normal year the nitrogen made available for crop use upon decomposition of soil organic matter is not sufficient in either total quantity or rate of release for optimum growth rate of sugar cane in Louisiana.

The amount of total phosphorus in soils used for growing sugar cane in Louisiana is relatively low when compared with the rate of removal by sugar cane.

The amount of total potassium in these soils is medium to high.

With the present relatively optimistic world-wide outlook for sugar production and its favorable effect on the sugar industry in Louisiana, many sugar cane farmers are producing sugar cane on land continuously without including one year out of three or four for fallow or for the growing of a soil building crop.

MEET NITROGEN NEEDS

The amount of N removed each cropping year in cane and trash plus the amount normally lost by burning trash from a 30-ton per acre yield is approximately 80 pounds of N per acre. To maintain a balance between N lost from the soil and N added, full consideration must be given to gain of N in the soil from fixation of N by nonsymbiotic soil organisms, gain from rainfall, loss due to leaching, loss in runoff water and loss from oxidation and reduction processes which occur in the soil.

A general increase of N in the crop was found as the rate of N in N-only treatments increased. Some tendency toward a balancing effect on uptake of N by P_2O_5 and K_2O in fertilizers was noted.

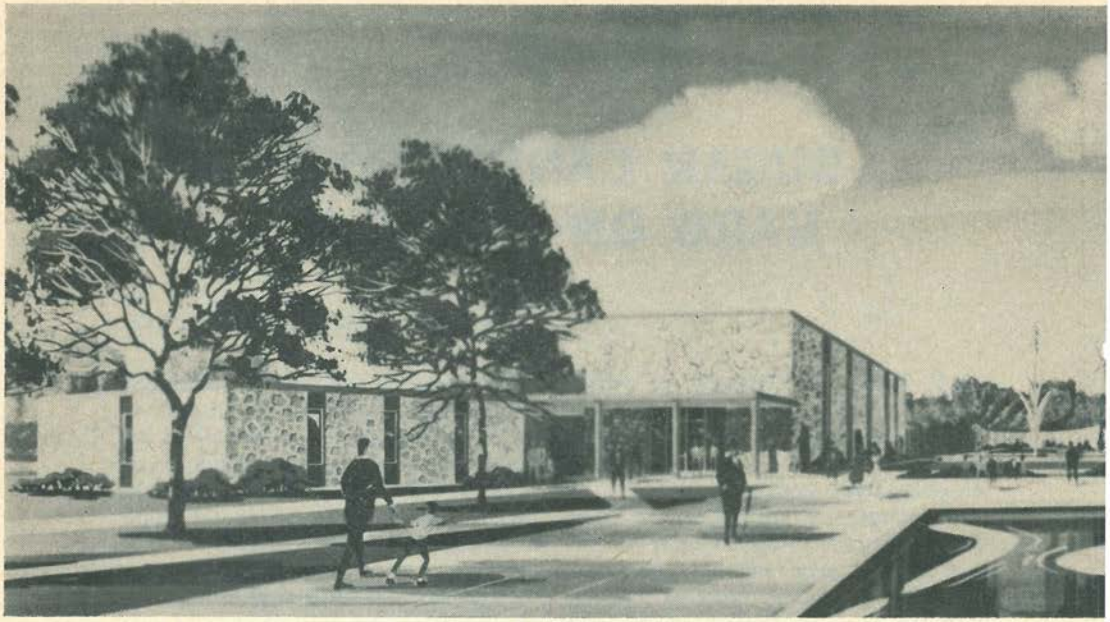
MEET PHOSPHATE NEEDS

Nitrogen in N-only fertilizers had a general lowering or dilution effect on P_2O_5 in sugar cane. Additions of P_2O_5 to the fertilizers resulted in yield responses to P_2O_5 in the fertilizers but did not cause consistent differences in P_2O_5 content of sugar cane. It was concluded that the amount of P_2O_5 in the soil can be maintained by additions of P_2O_5 to the soil in amounts equal to amounts removed in the millable cane and trash. It was further noted that the total amount of P_2O_5 in some soils cropped to sugar cane is seriously low when compared to the rate of removal by the sugar cane crop. Even in the more fertile soils P_2O_5 may become depleted within three or four decades.

MEET POTASH NEEDS

The K_2O content of sugar cane was found to decrease as the N in the N-only fertilizer treatments increased. Additions of K_2O to the fertilizers resulted in relatively consistent increases in yields and in K_2O content of sugar

Turn To Page 30



THESE FOUR STONE STRUCTURES, depicted by art, show the first of the 10 buildings which will eventually border a quadrangle at the Agricultural Hall of Fame and National Center 12 miles west of Kansas City. The Center will tell the world the story of American agriculture in terms the non-farmer can understand—and APPRECIATE.

AGRICULTURAL HALL OF FAME & NA

A vast complex of buildings devoted to the past and future of agriculture is getting its roots down on a 275-acre site 12 miles west of Kansas City.

The Agricultural Hall of Fame and National Center is no longer just a dream. The first building is up.

National is the correct word because the Hall of Fame complex is to be an institution that will not only tell the story of agriculture in every area of our nation but will also draw visitors from every state and over the world.

The Center is not to be just one structure housing a collection of paintings or statues of famous farmers. Plans call for a series of buildings where the whole remarkable story of American agriculture can be told: of the beginning, of today, of tomorrow.

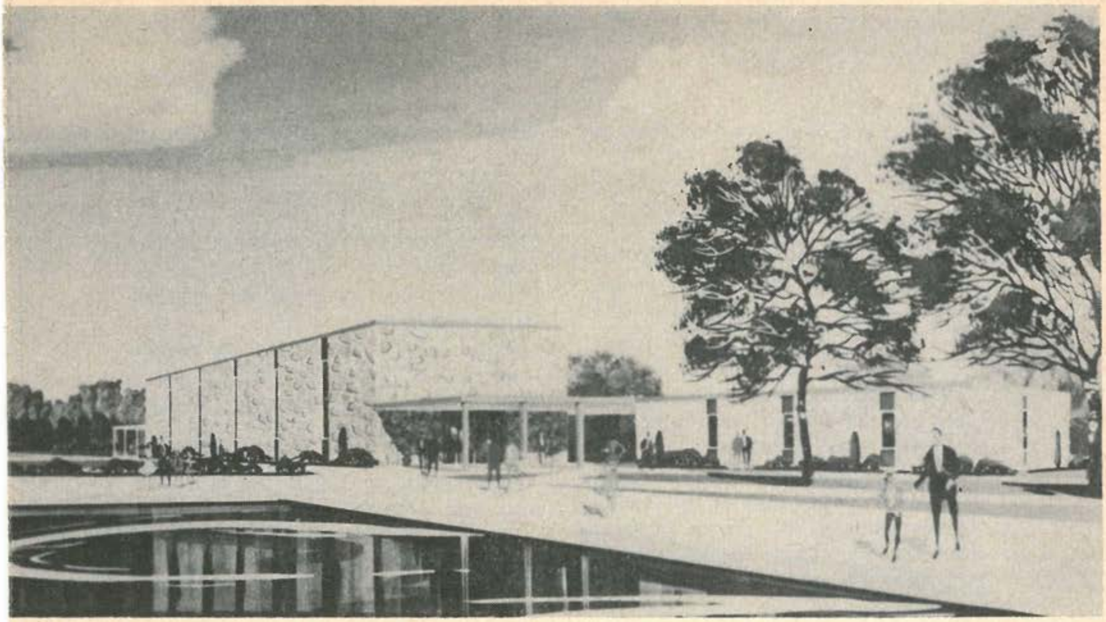
AMAZING CHANGES

Basic to the idea of the Hall of Fame is the knowledge that agriculture has changed greatly in recent years. Also, fewer and fewer people have a direct contact with farming.

Thus one main purpose of the project will be to focus attention on the contribution agriculture has made to America, from the pioneer days to the present.

How does it happen, for instance, that fewer than 10 per cent of the population of this country (the farmers) can make Americans the best fed people in the world?

This is one story which the Hall of Fame hopes can be portrayed for visitors and it explains, too, why the Hall setup will not be designed principally



RODERICK TURNBULL
KANSAS CITY **STAR** FARM EDITOR
IN **THE STAR**

TIONAL CENTER

In a day when a group of school children credited the supermarket or the milkman as the source of their milk—but not a single one thought to mention the cow!

for farmers, but for the non-farming 90 per cent of the people who do not have daily contact with agriculture. It is why, also, that Hall of Fame sponsors believe that it will be a nationwide tourist attraction.

In fact, one feature will be a children's miniature farm, to acquaint today's urban generation with farm animals and operations.

HALLS OF SPECIFIC PHASES

The plan for the Hall of Fame complex calls for a series of 10 buildings around a huge courtyard. Each building will be constructed as funds become available.

First Hall will serve a combination of purposes—a display area for agriculturally related industry, early sections of a library for use in study and research, the start of a museum, space for meetings, and an administration office.

Among the first structures to follow will be a Hall of States, where each of the 50 states will be accorded space for displaying its products and other items identifying it in the national scene.

Then will come a Hall of Industry, in which agricultural industry will demonstrate not only the development of farm equipment from pioneer times to the present, but will project the machinery, processing equipment, chemicals and other things that may be expected in the even more modern age of the future.

AND AN AUDITORIUM

Other buildings which will surround the courtyard will include a museum and a library. Eventually, also, there will be an auditorium seating 600 or more persons.

Rather urgent inquiries now being received at the Hall of Fame office here in Kansas City, mostly from farm organizations and agri-business groups, concern the possibilities of holding meetings at the hall site or in Kansas City. Some of these groups evidently feel that the auditorium should be expedited.

Despite the official name, "Hall of Fame," probably the last building to be erected will be one to house statues or other means of honoring those men who have made the greatest contributions to agriculture. However, in the interim these men will be given recognition in other buildings as space is made available.

Plans for the future include restaurant facilities, an Indian village, operational rural village, an outdoor amphitheater and horticultural, crop and forestry plots.

An admittance fee to the hall complex will provide maintenance funds.

As now envisioned, the cost of completing the Hall of Fame and National Center will be about 5½ million dollars.

THE END

SIMPLE WISDOM

MATURITY: what is it? "Maturity: to be able to stick with a job until it's finished; to be able to bear an injustice without wanting to get even; to be able to carry money without spending it; to do one's duty without supervision." (From *Echo*.)

THE BEST EXECUTIVE is the one who has sense enough to pick good men to do what he wants done, and self-restraint enough to keep from meddling with them while they do it.

Theodore Roosevelt

From Page 27

cane. The amount of K_2O removed each cropping year in cane and trash by a 30-ton per acre yield was found to be approximately 105 pounds. The total amount of K_2O in soils cropped to sugar cane was found to be medium or high. However, the amount of available K was found generally to be too low for optimum yields.

Early in the growing season rates of absorption of nutrients studied were found to be relatively faster than rates of production of dry matter, but near the end of the season dry matter production continued after little or no additional nutrients were absorbed. During the three month period June, July and August, approximately 75% of the N, 82% of the P_2O_5 and 85% of the K_2O were absorbed.

Fertilizer experiments in the field involving relatively large plots of approximately 0.1 acre each were conducted annually with sugar cane within the sugar cane area. One fertilizer test site on a recent Mississippi terrace soil and one site on a recent Mississippi alluvial soil were chosen during each of the years 1960, 1961 and 1962 for special sampling necessary for dry matter and nutrient composition study. General soil samples were taken from each site chosen for analysis.

WHAT LEAVES THE FIELD

It was concluded that approximately 2.0 pounds of N, 1.0 pound of P_2O_5 and 3.5 pounds of K_2O leave the sugar cane fields in the cane and trash per ton of millable cane.

THE END

With all conditions favorable, an airplane can spread fertilizer for about $1 per acre per hundred pounds according to Paul J. Stangel, University of Wisconsin soils scientist who reported his studies done cooperatively with Tennessee Valley Authority (TVA) and West Virginia University.

About 3 million acres of cropland are fertilized by air every year in the United States. About 90 per cent of this acreage is in the rice fields of Texas, Louisiana, Arkansas and California.

The area of greatest potential, Stangel thinks, is in the steep hills of the Appalachians. Pilot studies on 5,000 acres there looked good, and another 3-5 million acres of steep land in that area could be fertilized by air.

EFFICIENCY CAN SOLVE IT!

Keeping costs down is the big problem because aerial application requires expensive equipment and trained personnel. But large volume and efficiency can solve this.

AERIAL FERTILIZATION PAYS!

. . . WHEN DONE WITH **EFFICIENCY** AND **VOLUME**

The study in West Virginia showed:

1 Only high analysis fertilizer should be used.

2 A week's work—about 1,500 acres—should be concentrated in one area.

3 Loading must be quick and efficient, handling dry fertilizer in bulk and liquid with tanks and pumps.

4 A landing strip must be no more than 2-4 miles from the fertilizing area.

5 Winds must be less than 8 miles per hour.

6 Fields should be large, of regular shape and located close to each other.

In the West Virginia study, high winds and rain were major factors in slowing progress in spreading fertilizer by air. Since poor climatic conditions existed in the spring at the time this study was conducted, it appears that it would be best to spread fertilizer in the fall when flying conditions are generally good.

Under bad weather conditions, where field size is small and ferry distance for fixed wing aircraft great, the helicopter can apply fertilizer cheaper than fixed wing aircraft.

$3 RETURNED FOR EACH $1 SPENT

Farmers in Appalachia who have fertilized by air say they got returns of $3 per acre for every dollar spent on the fertilizer program.

American agronomists are getting much of their information from New Zealand where aerial fertilization is well established. New Zealand farmers apply nearly half of their phosphate fertilizer by air. They use aircraft to put on 70 per cent of the bulk fertilizer they use. Costs of application there are about one-third of the American costs because of the volume.

There are many unanswered questions about aerial fertilizing in this country, Stangel explains. Can it be applied cheaply enough to use in the Southeast? Can it save the marginal farm from extinction? Can it be used for seeding grass or putting on chemicals? And will these farmers accept the idea of fertilizing their forages?

WISCONSIN NEWS

Will We Soon Be Farming The OCEAN Bottom?

HENRY FERGUSON

IN THE NATIONAL **FUTURE FARMER**

A CENTURY ago, husky mountain men and lean plainsmen probed the unknown prairies to open the way for settlers who were shortly to begin flowing westward. Today a new breed of courageous and highly trained explorers is roaming the uncharted parts of another primitive region, preparing for what may be the strangest migration in the history of the world. Their theater of operation is the sea—our last frontier on this crowding globe.

Advance elements of scientists have already scouted the outer limits of this new realm and found it suitable for man's abode. There is food to be had for the taking; crops can be grown with no more difficulty than on land; the mineral resources are beyond belief.

A COLONY IN 25 YEARS?

The mysterious kingdom under the sea is immense in size, occupying four times the area of land on the globe. It has towering peaks higher than Mount Everest, huge ditches that dwarf the Grand Canyon, vast undulating plains, broad plateaus, and high sheer cliffs. There are jungles and live volcanoes, endless caverns and mysterious grottos. Yet, great as its expanse is, it is quite likely that two thirds of this vast area will be colonized by humans within the next 25 years. It is hoped that the first underwater city will be a reality within the next decade.

The French oceanographer, Jacques-Yves Cousteau, is one of those individuals pioneering this colonization. In 1963 he sent seven of his associates to the bottom of the Red Sea to spend a month at a depth of 50 feet. The team lived, worked, ate, and slept in a squat, aluminum house shaped like a starfish and anchored by chains and weights to the floor of the sea near Port Sudan.

The crew enjoyed air conditioning and had comfortable accommodations for cooking, sleeping, bathing, and working. There were even foam rubber settees for relaxing.

During working hours, the men left

. . . where we may see ocean creatures mining ore, men herding whales like cattle, and underwater farms where tractors cultivate seaweed.

their quarters by escape hatch, swam to an adjoining garage where their torpedo-shaped motor scooters were housed, and spent six hours a day exploring and photographing sea life.

The U. S. Navy has sent a team of four men to spend several days in a 40-foot-long laboratory 192 feet below the surface of the Atlantic Ocean near Bermuda. The lab had electric lights, bunks, a lavatory, fresh-water shower, cooking facilities, heaters, and a workbench. The men could venture as much as 1,000 feet from their quarters.

Scientists even have in mind for the future a gill-like mechanism which men may wear under their arms, enabling them to absorb oxygen directly into their bodies like a fish.

WHY SUCH EXPERIMENTS?

What is the motivation behind these experiments? It is the fact that the population explosion is causing our globe to become uncomfortably crowded. The United States, for instance, now contains 190 million people; between now and 1980 this

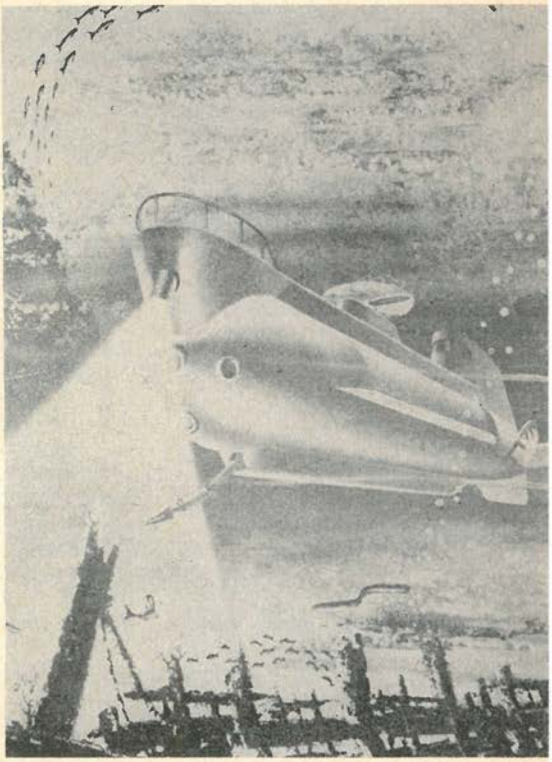


figure is expected to increase by about four million a year. It may be possible to ease this situation by creating cities at the bottom of the seas where people can live.

Many citizens of this new world will be engaged in stock raising, farming, and the introduction of new types of marine life to our dinner tables. Eventually we may be eating such things as

Turn To Page 37

CONVERT SOIL TESTS into PROFITS

BY VIRGIL ADAMS, NEWS EDITOR
COOPERATIVE EXTENSION SERVICE, UNIVERSITY OF GEORGIA

Having a soil test made is one thing. Doing what it recommends is quite another.

Georgia farmers have increased their use of this tool. In 1957 they sent about 19,000 soil samples to the University labs. The number of samples reached about 50,000 by 1962 and leveled off there in '63 and '64.

But P. J. Bergeaux, Extension Service agronomist, realized that mere numbers is a poor indication of the success of the state's soil fertility program. He wondered if farmers were following soil test lime and fertilizer recommendations and, if they were, what effect this was having on per acre yields and income.

So he devised a questionnaire and asked county agents to send it to randomly selected farmers.

Nearly 900 farmers responded. Mr. Bergeaux summarized the results and came up with a rather interesting evaluation of the soil test program.

SOME STRIKING RESPONSES

For one thing, he is convinced farmers are sold on the idea. Ninety-eight percent said they thought soil testing to be of value in their farm programs.

But this many are not following the recommendations. The survey showed that 51 percent take soil test advice on corn, 64 percent on cotton, 64 percent on oats, 76 percent on peanuts, and 81 percent on pastures. This averages out to a pretty respectable 68 percent.

But are farmers who follow the recommendations any better off than those who don't? Based on the farmers' own experiences, they are.

1 FROM LIME

In an effort to determine the value of liming according to soil tests, Mr. Bergeaux compared gross income per acre (less lime and harvesting costs) between farmers who followed and did not follow the recommendations.

On peanuts . . .

$8.50 **MORE** income per acre

Peanut farmers who *did not* lime made 1,276 lbs. per acre and realized an income, after paying for the lime and harvesting, of $118. Farmers who *did lime* made 1,400 lbs. and had an income of $126—or $8.50 more income per acre.

On cotton . . .

$11 **MORE** income per acre

The difference on cotton was even greater. No lime resulted in 442 lbs.

of lint per acre and an income of $122. Farmers who limed made 492 lbs. and realized an income of $133—an $11 increase over the non-limed.

On permanent pastures . . .

$2 **MORE** income
per acre

On permanent pastures yields were based on tons of hay per acre. Pastures receiving no lime made 2.15 tons, and those receiving lime made 2.40 tons. The income difference, above lime and harvest costs, was $2 per acre in favor of liming.

Mr. Bergeaux pointed out that in this study the lime cost was prorated over a 3-year period, because liming isn't necessary any more often than every third year.

2 FROM FERTILIZER

When it came to soil test fertilizer recommendations, Mr. Bergeaux worked up a three-way comparison. He compared yields and income (income after deducting fertilizer and harvesting costs) of (1) farmers who used less fertilizer than recommended, (2) those who followed the recommendations exactly, and (3) those who used more than the soil tests called for.

On peanuts . . .

$9.55 **MORE** income
per acre

The results on peanuts were as follows: Farmers who used less fertilizer than recommended made 1,342 pounds per acre and had an income of $118.80.

Abiding by the soil tests resulted in 1,406 pounds and an income of $122.20.

Using more than the tests called for resulted in 1,504 pounds and an income of $128.35.

So, the farmers who followed the recommendations made $3.40 more per acre than those who used less fertilizer than called for. Those who used more than recommended made $9.55 more.

On tobacco . . .

$363 **MORE** income
per acre

Tobacco farmers who chose to use less fertilizer than their soil tests recommended were really hurting. They made 1,366 pounds per acre and had an income of $602.00.

Those who followed the tests made 1,838 pounds and $815—$213 more.

Farmers who used more fertilizer than recommended came up with 2,188 pounds and an income of $965—a $363 per acre increase over those who didn't follow the test results.

On cotton . . .

$39.50 **MORE** income
per acre

When less fertilizer than recommended was used on cotton, the yield was 371 pounds, the income $88.

Following the recommendations brought a $39.50 increase in income by producing 534 pounds of lint and $127.50 above fertilizer and harvesting costs.

Those who used more fertilizer than recommended used too much in the case of cotton. Going beyond what the soil tests called for resulted in four less pounds per acre (530) and a reduction of $6.95 in income ($31.55).

On corn . . .

$16.50 **MORE** income
per acre

Corn yields for farmers who used less, followed, and used more were 44, 59, and 72 bushels respectively. Income, in the same order, was $33.30, $43.35, and $49.80.

Following recommendations meant a $10.05 income advantage over using less fertilizer than recommended.

Farmers who used more than recommended enjoyed a $16.50 income advantage.

On oats . . .

$12.86 **MORE** income per acre

Following recommendations paid off on oats, but going above recommendations didn't.

Farmers who used less than the amount advised by the soil tests produced 38 bushels per acre and had an income of $18.45.

Following the advice pushed yields up to 61 bushels and income to $31.25—an increase of $12.86.

But the yield dropped to 60 bushels, and the income advantage to $7.50, when recommendations were enlarged upon.

As Mr. Bergeaux pointed out, these figures show that following soil test fertilizer recommendations was profitable on all crops. Tobacco gave the highest returns per dollar invested in fertilizer.

Using more fertilizer than recommended resulted in more income for all crops except cotton and oats. Mr. Bergeaux said this is not surprising. He explained that soil test fertilizer recommendations are aimed at the high-medium yield expectancy.

"We realize," he concluded, "that farmers with above-average resources can afford to use higher rates than recommended."

THE END

DON'T GET STUCK!

Let an alfalfa seeding fail and you're stuck with a heavy cost—from $12 to $15 per acre for tillage and seed alone.

And the production you lose while you're starting over makes it even worse.

One key to successful alfalfa is knowing the lime and nutrient shortages of the soil from the beginning. And soil testing is the key to finding these needs and thereby protecting that alfalfa investment.

A University of Minnesota extension soils specialist, Curt Overdahl, says the test is important for more than establishing alfalfa. If you have a good stand, you want to maintain it. And that means a soil test to find the most economical fertilizer rate.

WATCH FOR K AND P NEEDS

For example, research has shown that on sandy soils potassium may be the missing element. Such soils often need rates as high as 400 pounds of 0-0-60 per acre for best yields. (That means 60 pounds of potash.)

On fine textured soils, however, phosphorus may be the limiting factor.

But a soil test tells still more. The recommendation with test results gives some advice on the need for boron, and maybe even some tips on best varieties and time of cutting. Alfalfa handled properly and cut at the right time may produce an extra cutting.

Alfalfa is a hungry crop, Overdahl explains. A 4-ton yield takes out 40 pounds of phosphate, 180 pounds of potash and 130 pounds of calcium and magnesium.

MINNESOTA NEWS

From Page 33

sea slugs—which the Chinese already consider a delicacy—and a huge marine worm which is able to accumulate edible protein faster than a fish.

Many vegetable foods will come from the sea. Many companies are already experimenting with seaweed and microscopic floating plants known as algae. The latter is highly nutritious and grows faster than land crops. A wheat farmer who is lucky to get a ton of salable grain from an acre would find it easy to raise from 25 to 50 tons of algae to an acre of sea.

The "oceanauts" will be working on activities such as climate-changing and fish-herding. They will be searching the sea for minerals and attempting to find out what happens to sound waves in the deep. The scope of their activities will be enlarged shortly through use of the Aluminaut, a 50-foot submarine now being built by Reynolds Metals Company, which is designed to explore the ocean depths to 15,000 feet. It will be equipped with sonar, TV camera for detailed observation of the ocean floor, and robot hands to obtain specimens.

Columbus Iselin of the Woods Hole Oceanographic Institution, dean of U. S. oceanographers, thinks we may be able to get sea creatures to do our underwater mining for us. Huge areas of the ocean floor are littered with lumps of high-grade metal ore—some of them as much as 50 percent pure metal—iron, manganese, nickel, copper. In the deep they are as big as basketballs. Many scientists feel these metal lumps are produced by microscopic sea creatures that secrete indigestible metals. If this is true, Iselin believes these tiny organisms can be bred on undersea farms and the metals harvested like a crop.

OCEAN FARMING TO COME

In 20 or 30 years ocean farming may play a big part in feeding the world. By the end of the century, according to one estimate, we'll each be eating four or five sea-food meals a week instead of the present average of less than one. Some scientists believe it also may be possible to breed whales as we now breed cattle.

Cousteau is presently constructing a working model of an undersea village. Three prefabricated buildings will be lowered to the bottom of the ocean and assembled to form quarters for the first major experiment in undersea living. Air will be pumped from the surface, and the buildings will be connected by closed-circuit TV and telephones. One of the buildings will be a garage and repair shop for the underwater tractors used to pull submarine trains to various sites being investigated.

Cousteau hopes to eventually construct a village where undersea residents will live in dry, gas-filled houses on the bottom much like householders ashore. Small nuclear plants will extract the necessary oxygen from sea water.

Cousteau looks on the sea the way Daniel Boone once looked on Kentucky—as a fine place to colonize. He feels that settlers will one day move to the bottom of the ocean as they once migrated to the great areas of the West. New generations of youngsters will be born there, go to school, work, marry, and raise their own families. They will return to their former homeland on the earth's surface only to visit. New nations will exist beneath the waves.

"Our present experiments," he explains, "are the beginning of the big invasion. There'll be cities, hospitals, theaters, even street cleaners. Man has no choice, with human population increasing so rapidly."

The animal that became man deserted the sea some 300,000,000 years ago. Now it seems that he may be completing a great cycle, returning to his original home beneath the waves.

THE END

PLAN YOUR FARM FARM YOUR PLAN

W. CONRAD SEARCH
MICHIGAN STATE UNIVERSITY

L. S. ROBERTSON
SHIAWASSEE COUNTY, MICHIGAN

Plan your farm—farm your plan.

This is the basis for an educational program designed for the farmers in Shiawassee County, Michigan.

This is also sound advice for every farmer regardless of location. Profitable farming is an intensively planned operation. It must be as well planned as any industrial program.

Today's farmer is using planning rooms, sometimes locally called offices, kitchens, or even dining rooms. They are areas large enough for a family conference, orderly enough to obtain adequate file space and desk space, but small enough to be dedicated to the specific purpose of farm planning.

USE SOIL SURVEY MAPS

The Soil Survey Map is an excellent tool to use to learn more about the soils on a specific farm. The Soil Conservation Service, the Office of your County Agricultural Agent, and the Agronomy or Soils Department of your land-grant college can help farmers interpret the Soil Survey Maps.

These organizations have some very basic information on soils throughout the state. They help bring the research of the Agricultural Experiment Station to the farmer for planning his own farm business.

KNOW YOUR SOIL

In farm planning, the planner must consider the capabilities of his soil. The value of the crops your soil is capable of producing determines, to a great extent, the potential of the farm business. Good farm management occurs only when the farm resources, including the soil, are utilized to their greatest extent.

The role that soil plays is too often underestimated. Farmers must understand the fact that 75 bushels of corn per acre on land capable of producing 125 bushels is poor soil conservation. It is hard on soils and income.

USE TECHNICAL ASSISTANCE

The Soil Conservation District Offices can give assistance in farm planning. Through their close tie with the Soil Conservation Service of the United States Department of Agriculture, they help the farmer get technical assistance in making soil and water conservation plans.

The Soil Conservation Service Work Unit can also assist in preparing a land use map based on the Soil Survey and in making engineering plans and in preparing the basic conservation plan for the farm.

PLAN TOTAL FARM FERTILITY

Developing a plan of intensive, safe soil use also means carrying out a complete soil fertility program.

Modern soil testing, based on soil samples collected according to soil type, represents the easiest, most scientific method for determining how much of what kind of fertilizer to use.

County Agricultural Agents can help plan fertilizer programs that fit the needs of the soils on the farm. Many Agents offer complete soil fertility planning assistance: (1) soil sampling on the farm by trained soil samplers, (2) testing soil samples in a modern laboratory, and (3) preparing custom fertilizer recommendations with the aid of electric computers.

The County Agricultural Agent can then discuss the fertility program with the farmer. Such a soil testing program often includes a record book of the latest soil fertility and management information. In Shiawassee County, the program even helps the farmer evaluaate the *outcome* of his various crop and soil management practices.

TELFARM BRINGS COMPUTER TO FARM

Good farm planning also means *recording* the happenings on the farm *each day*. Today's farmer takes time to record expenditures and receipts, as well as the field production records. Electronic computers are now used to take the drudgery out of record keeping.

In Michigan the TELFARM program of the Cooperative Extension Service helps the farmer's planning program by computing his expenses, income, and management factors each quarter.

Such information provides the farm planner with a basis for analyzing his business. It helps guide future planning. It provides financial and inventory records for tax management and tax reporting. A program using such computers provides a statement of where funds come from and where they go!

MORE CREDIT . . . for the man with a plan

The program also provides a basis for the farmer and his credit agent to prepare wise credit plans. To activate a program often requires money. Borrowing money is much easier for a man *with a plan*—easier than for a man with an emergency.

Here are the keys:

1 Begin by understanding the capabilities of your soil.

2 Use each kind of soil intensively but safely.

3 Base your fertilizer program on scientific soil testing.

4 Fit your livestock, buildings, labor, and equipment to the land.

5 Use a modern record keeping system and analyze your farm enterprise activities.

THE END

A must in a day when the farmer can no longer store all his facts, figures, and plans in his overalls pocket.

Tennessee tests show

FOR PROFITABLE CORN YIELDS

. . . soil test to know best potassium RATES and PLACEMENT to use.

W. L. PARKS, W. M. WALKER, AND J. A. ODOM—IN **TENNESSEE FARM AND HOME SCIENCE**

FIGURE 2

ON HIGH-TESTING PLOT, corn shows healthy, vigorous crop—obvious good growth and maturity of the plant.

If you seek high yields at minimum cost, practice soil testing.

It's a good tool for choosing right fertilization rate and placement for your crop. Tennessee corn tests with different rates and methods of potassium applications prove the point.

The Editor

Potassium fertilizer rate and placement test using corn as a test crop was conducted on a Hartsells loam at the Plateau Experiment Station in 1963. The soil pH was 6.0 and the phosphorus test was high (40 pounds available P per acre).

The experimental area had previously been in a corn-wheat-red clover rotation experiment that had received different rates of potassium fertilization. Therefore, different soil levels of available potassium had been established during this rotation period of 9 years.

THE TREATMENTS

Potassium rates of 0, 30, 60, and 90 pounds of K_2O per acre were applied broadcast and banded in the row on areas testing very low, low, medium, and high in available potassium; the average soil test values were 70, 120, 168, and 288 pounds of available potassium per acre, respectively.

Uniform broadcast applications of 80 pounds of P_2O_5, 150 pounds of N, and 20 pounds of zinc sulfate per acre were applied over the entire area and disked into the soil before planting. The broadcast potash applications were also disked into the soil.

The banded applications of potassium were placed beside and below the seed. The corn variety Dixie 29 was planted on May 7, 1963 and was thinned to a uniform stand of 15,000 plants per acre.

THE RESULTS

The corn plants 77 days after planting on a very low testing soil are shown in **Figure 1.** Potassium deficiency

FIGURE 1

ON VERY LOW-TESTING PLOT, corn shows extreme potash hunger—retarded growth, marginal burning of lower leaves.

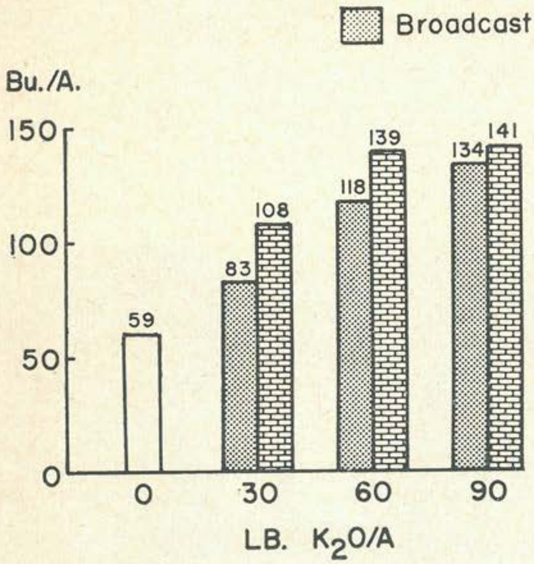


FIGURE 3

ON VERY LOW-K-TESTING HARTSELLS LOAM

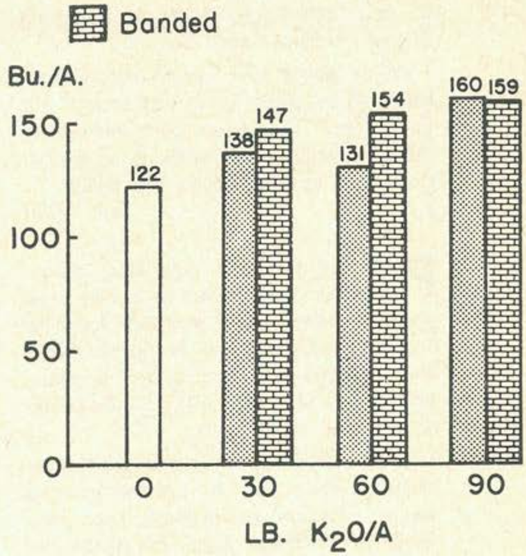


FIGURE 4

ON LOW-K-TESTING HARTSELLS LOAM

CORN

symptoms as indicated by the marginal burning of the lower leaves are evident. This plot yielded 50 bushels per acre.

Corn plants on a high testing soil are shown in **Figure 2.** This picture was also taken 77 days after planting. When compared with **Figure 1,** it shows the influence of available potassium level on the growth and maturity of the plant. This plot yielded 141 bushels per acre.

The corn was harvested on October 11 and the corn yields for the various treatments are shown in **Figures 3, 4, 5, and 6,** and in **Tables 1 and 2.**

A significant response to potassium was found where the soil tested very low and low. A significant response to potassium was obtained on the medium testing soil but there was no significant difference among the different levels of added potash at this soil test level. There was no response to potassium where the soil tested high.

The data in **Figures 3 and 4** show that on low and very low testing soils potassium applied at a specified rate

TABLE 1—AVERAGE CORN YIELDS FOR DIFFERENT RATES OF POTASSIUM AT FOUR SOIL TEST LEVELS

Lbs. K_2O/A	Very Low	Low	Medium	High	Avg. for all levels
			Bushels per acre		
0	59*	122	136	152	117
30	95	143	158	158	139
60	128	143	153	153	144
90	119	159	162	154	148
L.S.D. (.05)	27	23	N.S.	N.S.	9
(.01)	41	N.S.	N.S.	N.S.	13

*Yields are averages for broadcast and banded applications.

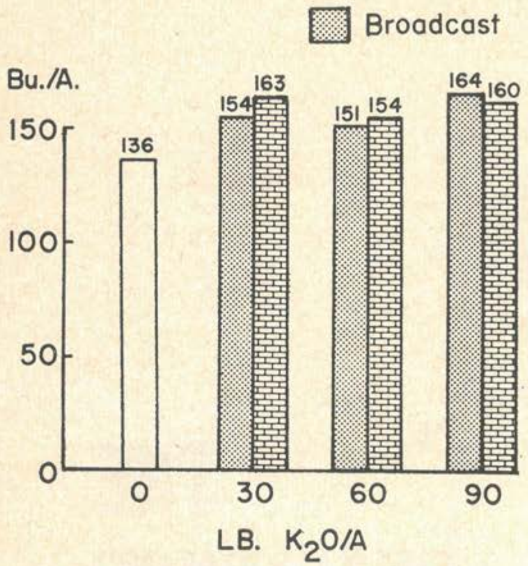


FIGURE 5

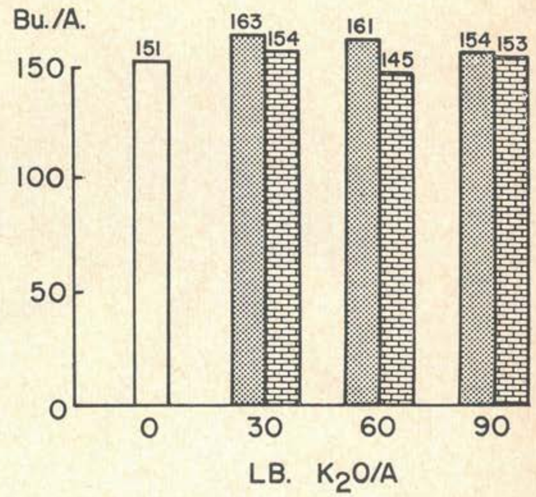


FIGURE 6

YIELDS ➡ ON MEDIUM-K-TESTING HARTSELLS LOAM / ON HIGH-K-TESTING HARTSELLS LOAM

in the row gave higher yields than potassium applied broadcast. This relationship is generally true for most soil fertility conditions—small amounts of fertilizer applied on low and very low testing soils are more efficiently utilized if applied in bands beside and below the row.

Figure 5 shows the yield response obtained from the two methods of application on the medium-testing soil. It is evident that a response was obtained to the first 30-pound increment of potash. However, no additional response was obtained with higher rates of potassium at this soil test level. It is also evident at this soil test level that the method of applying the potassium was less important since banded and broadcast applications gave essentially the same yield for all plots receiving potassium.

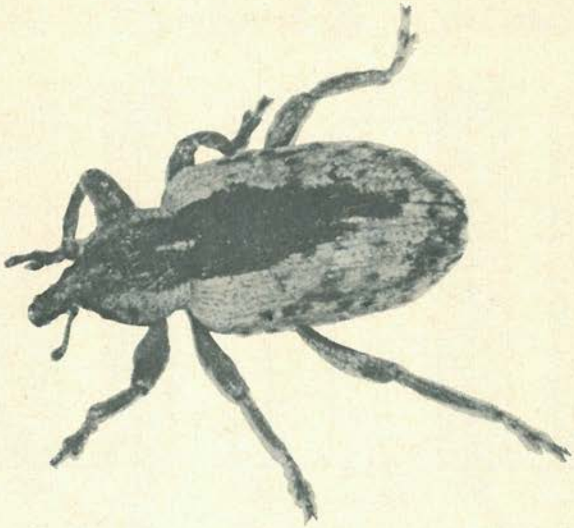
In the plots testing high there was no significant response to applied potassium fertilizer, and thus no significant difference between the two methods for applying potassium (**Figure 6**).

The average corn yields for the different potassium rates and for the different methods of applications at each of the four soil test levels are shown in **Tables 1 and 2.** THE END

TABLE 2—AVERAGE CORN YIELDS FOR DIFFERENT METHODS OF POTASSIUM APPLICATION AT FOUR SOIL TEST LEVELS

Application Method	Soil test level: Very Low	Low	Medium	High	Avg. for all levels
			Bushels per acre		
Broadcast	89*	137	154	158	134
Banded	112	146	150	151	140

*Yields are averages for all potassium rates.



THE CHALLENGE and OUTLOOK

Alfalfa is a billion and a half dollar crop in the United States. Its potential value is double this amount! It is grown in every state of the union except Alaska.

But the alfalfa weevil—generally considered number one problem in alfalfa production today—is challenging the "queen of the forages" in some areas.

How big a blow will this enemy be able to deal a crop with the strength of alfalfa? This question concerns farmers and industry groups as well as college and U.S. Department of Agriculture specialists.

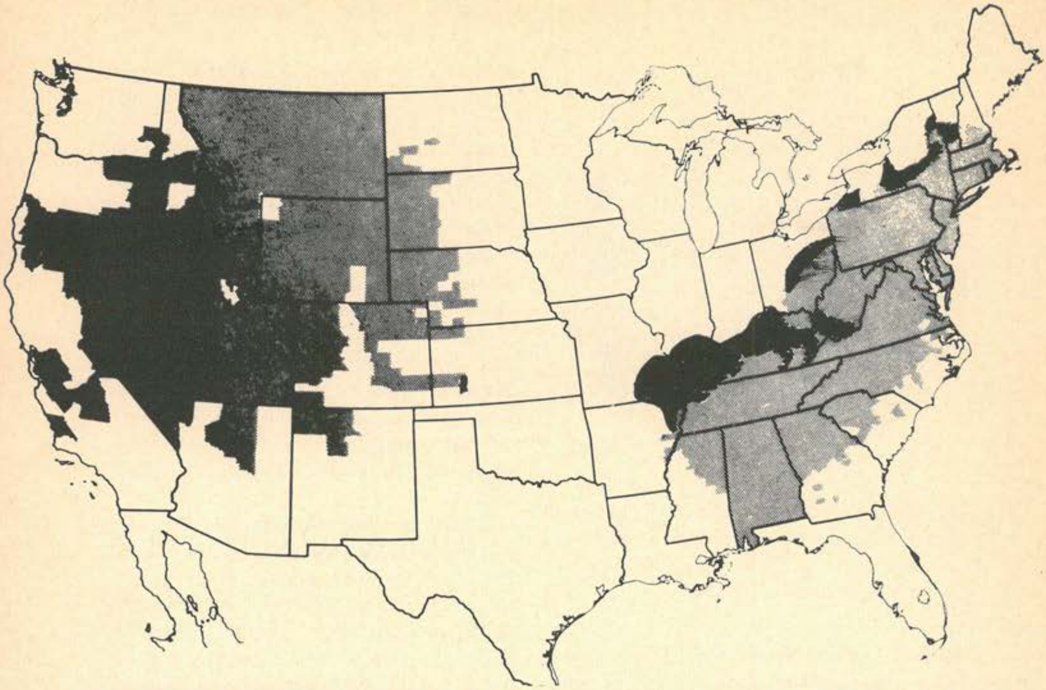
To get opinions and information helpful in answering the question, Agronomy Department Heads in all states were contacted by questionnaire. They in turn called on entomology specialists and other colleagues for information. All 50 states responded. U.S. Department of Agriculture specialists were also most helpful. The excellent cooperation of these people made this report possible.

STRENGTH TO SURVIVE

Over the years, alfalfa has not been without its problems. Part of the proof of its worth, in fact, is its capacity to weather the storms.

Best known and probably most destructive was bacterial wilt, first discovered about 1925. The first resistant varieties were available a little over 20 years ago. Since that time, breeding programs have turned out a number of improved varieties with a high degree of resistance to wilt. Today the problem is of little consequence when recommended varieties are used.

Spotted alfalfa aphid has been a pest across the southern two-thirds of the United States, especially west of



THE ALFALFA WEEVIL, identified 6 decades ago in Utah, first showed in the East in 1952 in Maryland . . . now occurs in 40 states, infesting 15% of total acreage.

A NATIONAL SURVEY

For ALFALFA

By R. E. Wagner
Eastern Director
American Potash Institute

the Mississippi. It can now be controlled by growing resistant varieties. These are only two of the pests alfalfa has been able to fight off successfully.

ANOTHER ENEMY SPREADS

Now another enemy is at work—the alfalfa weevil! It is really not new. First identified in Utah in 1904, it has spread to most parts of the United States since then.

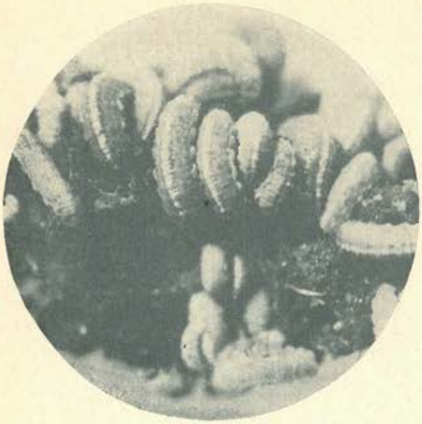
Presently there are about 30 million acres of alfalfa in this country (Table 1). It is estimated that more than 4½ million of these acres are weevil infested—*at least 2 million of these seriously affected by this pest* (Table 2).

In the East, the weevil was first identified in Maryland in 1952. While this apparently is the same species as the one in the West, it is at least a different strain or biotype.

Spreading rapidly after its discovery in Maryand, it now is found in all states east of the Mississippi except Wisconsin, Michigan, Maine, and Florida. The only other states of the entire country in which it has not yet been identified are Minnesota, Iowa, Oklahoma, Texas, Alaska, and Hawaii.

Thus, the weevil now occurs in 40 of the 50 states and infests 15 per cent of the total acreage.

The area of most severe damage now centers in Delaware, Maryland,



SO FAR, it has moved south and west about 80 miles a year from its Eastern origin, but only 25 to 30 miles a year to the north and northwest.

Virginia, and North Carolina. However, all southern states east of the Mississippi except Florida are subject to extensive damage.

From the southeast half of Ohio up through southern Vermont and New Hampshire, damage is on the increase.

Last year for the first time, the weevil worked its way into the edge of Arkansas and this year it continued its march into Missouri and the southern tip of Illinois and Indiana.

Just how fast the weevil might work its way northward into the Corn Belt and other northern states is a question. Up to this point, the insect has moved south and west about 80 miles a year from its point of origin in the East, but only 25 to 30 miles a year to the north and northwest.

Generally speaking, damage has been more severe in the South where egg hatching and larval feeding extend over a longer period of time. Also, overwintering in the North is more difficult. Presumably, the higher egg mortality tends to hold weevil numbers in check somewhat.

CONTROL NOT EASY

Even though the weevil has been around a long time, it is a new threat. In the past two years, this insect has shown a high degree of resistance to heptachlor in many areas. Then in the spring of 1964, a federal ban was placed on the use of heptachlor and other hydrocarbons on alfalfa.

These two things dealt a severe blow to heavily infested areas. Heptachlor, while not the only chemical that will control weevil, was a most effective and dependable one until the last couple of years. Used in fertilizer mixtures for fall application, it was a convenient control method for the farmer to use with only one application necessary.

Other available chemicals (including Malathion, Methoxychlor, Diazinon, Guthion, Parathion, and Sevin) are reasonably effective under right conditions. But often just the right conditions do not prevail, causing control to be erratic and farmers to become impatient and discouraged.

No chemicals now available give satisfactory kill from fall applications. They must be spring applied. In some locations and seasons, two or more sprayings are required. Farmers do not like to go over their fields more than once or even at all in busy spring periods, especially when growth is heavy.

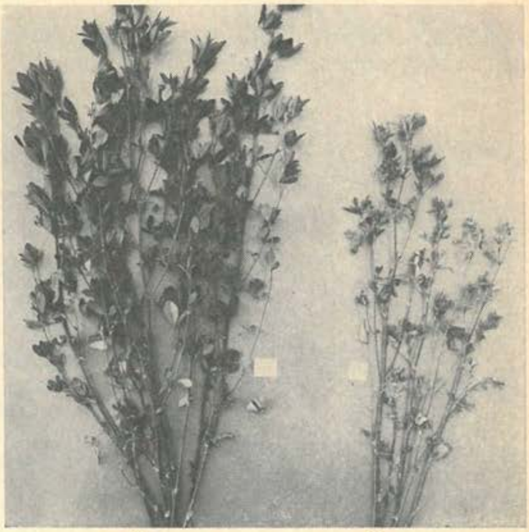
FOR FUTURE CONTROL

Early cutting, combined with insecticides, shows promise of reducing weevil damage in northern areas and in parts of the West. This system is less promising for the South because the weevil starts to work earlier in the spring, much ahead of even an early cutting stage.

Flaming of alfalfa fields in dormant seasons or at a very early spring growth stage to control the weevil is now being studied in Georgia, Maryland, North Carolina, Tennessee, and Virginia. Early work indicates promise —about 65% control on the average —but it is not yet recommended.

Breeding programs to build resist-

TREATED UNTREATED



TREATED UNTREATED

ance to the weevil into alfalfa are underway in Indiana, North Carolina, Tennessee, and at Beltsville, Maryland. Good sources of resistance seem difficult to find. Breeders feel it will be six to eight years before resistant varieties can be developed and seed made available in quantity. It could be somewhat longer.

Most entomologists believe there is not much hope for better chemicals any time soon. Several are under test. Some show promise, but few are outstanding. Even after adequate testing of the most promising ones, they must receive federal clearance which often takes considerable time.

A speed up of development and testing of chemicals would seem the quickest way to relief from the weevil. Such cultural practices as early cutting and flaming should also be intensively studied.

Parasites commonly kill a high percentage of weevil larvae in the West, lessening the severity of damage there. The same parasite common in the West has been released by the U. S. D. A. and is established in all areas of distribution in the East. Other parasites have been released and established. Although they cannot be expected to control the weevil, they can be expected to reduce the problem.

ACREAGE OUTLOOK

The weevil is expected to continue to be more of a problem in the South. The acreage is not large in terms of what is involved in other places, but it is important to the region.

In the eight South Atlantic states (Delaware, Maryland, Virginia, West Virginia, North Carolina, South Carolina, Georgia, and Florida), the acreage would be expected to double to almost 900,000 acres by 1975 *if convenient and effective weevil control methods are available* (Table 3).

However, assuming no better control methods, acreage could fall to about 331,500 acres from its present. Some of these states indicated sharp reductions.

The states of Kentucky, Tennessee, Alabama, and Mississippi collectively predict more than a doubling of acreage by 1975 if weevil can be better controlled, but only 21% increase if

TABLE 1.—Present and Estimated Potential Alfalfa Acreage by Regions (In Thousands of Acres)

Region[1]	Present	Potential
New England	**189**	**920**
Middle Atlantic	1,985	**2,900**
South Atlantic	460	**1,782**
East South Central	549	**3,150**
East North Central	7,878	**12,400**
West North Central	12,064	**22,000**
West South Central	777	**3,340**
Mountain	4,064	**6,103**
Pacific	1,935	**3,052**
U.S.	29,900	**55,647**

REGIONAL KEY

New England: Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut

Middle Atlantic: New York, New Jersey, Pennsylvania

South Atlantic: Delaware, Maryland, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida

East South Central: Kentucky, Tennessee, Alabama, Mississippi

East North Central: Ohio, Indiana, Michigan, Wisconsin, Illinois

West North Central: Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, Kansas

West South Central: Arkansas, Louisiana, Oklahoma, Texas

Mountain: Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada

Pacific: Washington, Oregon, California, Alaska, Hawaii

there is no improvement in control methods.

In Pennsylvania and New York alone, a million acres could be lost by 1975. On the other hand, an increase of a half million acres is predicted if improved control methods are soon available.

New England expects acreage to increase by over 50% if weevil can be checked, but by only half that amount if the same or no better methods must be used.

Although the weevil is new in Illinois and Indiana, these states together with Ohio are sufficiently concerned to expect a substantial decline in acreage. Unless better control is soon realized over a million and a quarter acres could be lost.

There appears to be less concern in other parts of the country. Acreage is expected to increase in the West North Central, the West South Central, the Mountain and Pacific regions to about the same extent with or without improved weevil control.

For the whole country, it is expected that another 6½ million acres of alfalfa will be added by 1975 to the present 30 million, if satisfactory weevil control measures are soon available. But, without better control the estimated increase is only about 2¼ million acres.

IN DOLLARS AND CENTS

According to this survey, the alfalfa hay crop is valued at $1,621,379,000—an average of $54 an acre on nearly 30 million acres (Table 4).

Different regions place quite different acre values on this crop. A combination of factors include: (1) prevailing hay prices, (2) average yields, (3) alternative crops available for feed, (4) the severity of weevil damage.

The first two factors are obvious in their influence. The latter two are of special interest.

In the Corn Belt, where corn is king and a good feed crop, alfalfa is considered less valuable per acre than anywhere else in the country with the exception of states just west of the Corn Belt, namely North Dakota, South Dakota, and Nebraska.

The government supported price for corn has helped to make it an attractive crop to farmers, perhaps even beyond what its own merits command. It is likely to remain so, as long as the price is good. This is indicated by the acreage projections for the region.

As a result, alfalfa gets little attention. In many parts of the region, al-

TABLE 2.—Acres INFESTED and TREATED for Weevils, 1964

Region	Infested (000 Acres)	% of Total Acres	Treated (000 Acres)
New England	53	**28**	34
Middle Atlantic	1,080	**54**	556
South Atlantic	448	**97**	373
East South Central	465	**85**	81
East North Central	200	**3**	75
West North Central	91	**1**	1
West South Central	10	**1**	0
Mountain	2,004	**49**	312
Pacific	190	**10**	105
U.S.	4,541	**15**	1,537

falfa still gets little direct fertilizer, must depend on what is applied to corn or other crops in the rotation. Midwest farmers are among the best in the world, but they are not yet convinced that alfalfa is a valuable enough crop to demand the attention corn gets or treatment for top yields.

An outstanding exception to this is Wisconsin—the nation's leading alfalfa state. It values its three million acre crop at just under $100 an acre—a total worth of more than a quarter billion dollars! Most states of the region say their alfalfa is worth $20 to $50 an acre.

In contrast to the Corn Belt situation, the New England, Middle Atlantic, and South Atlantic states put a much higher value on their alfalfa crop. Most of them feel the crop is worth $80 to $100 or more an acre. Being feed-deficit areas, the market price for good hay is usually higher than in other regions. There is no other single feed crop that has dominated the area over a period of years as corn has in the Corn Belt.

Furthermore—and this seems important—this is the area in which the most weevil damage has occurred. Reduced acreages of the crop and additional threatened losses have awakened many to a greater appreciation of alfalfa's place in good dairy and livestock programs.

The southwestern states of California, Arizona, and New Mexico value the crop in excess of $100 an acre—as high as $169 in Arizona. High yields from irrigation is an important item in these states.

FARMER AND INDUSTRY CONCERN

The outlook for alfalfa is of direct concern to dairy and livestock farmers, to the chemical, machinery and fertilizer industries, and to the seed trade.

For the farmer, alfalfa is a potentially high yielding crop that provides high quality feed at *low cost* and is a *major supplier of protein. The 30 million acres on which alfalfa is grown from coast to coast produce nearly as much protein as the entire U.S. corn grain crop, grown on twice the acreage.*

The seed and farm equipment industries could be strongly affected by declining alfalfa acres.

The chemical industry supplied insecticides for less alfalfa acreage in 1964 than in 1963, partly because fall treatment with heptachlor was discontinued.

If only present methods of control are available to the farmer, the downward trend in acres treated could con-

TABLE 3—Alfalfa by 1975 With-Without Improved Weevil Control

Region	Acres (000)		% Increase over 1964	
	With	Without	With	Without
New England	295	242	56	28
Middle Atlantic	2,525	950	27	−52
South Atlantic	891	332	94	−28
East South Central	1,225	665	123	21
East North Central	8,378	7,478	6	−5
West North Central	15,200	14,525	26	20
West South Central	1,300	1,270	67	63
Mountain	4,630	4,500	14	11
Pacific	2,200	2,200	14	14
U.S.	36,644	32,162	23	8

tinue as alfalfa is abandoned in favor of other crops.

The fertilizer industry's interest in alfalfa is not so much for the fertilizer it presently uses as it is in the promise the crop holds for greatly increased consumption of plant food.

Estimates indicate that just under 844,000 tons of fertilizer were used in 1964 on alfalfa in the United States (Table 5). While this represents a 23% increase over the 1960 usage, the South Atlantic states actually registered a 31% drop. One fertilizer company sold 156 tons of alfalfa fertilizer in a local area in North Carolina during July and August of 1963, but only 28 tons in the same months of 1964.

On 30 million acres, the 844,000 tons average out to only 56 pounds of fertilizer per acre (Table 6). Of course, many of these acres are in the West where some soils are well supplied with phosphorus and potassium. This is far from recommendations in some eastern states which call for as much as half a ton of high analysis fertilizer per acre.

TABLE 4.—Estimated Value Alfalfa, 1964

Region	Total Value (000 Dollars)	Value Acre
New England	$ 14,440	$ 77
Middle Atlantic	144,500	73
South Atlantic	45,812	100
East South Central	62,600	114
East North Central	481,000	61
West North Central	402,750	33
West South Central	51,350	66
Mountain	224,667	55
Pacific	194,260	100
U.S.	$1,621,379	$ 54

Many farmers are following the recommendations. Obviously, much of the alfalfa of the country gets no fertilizer at all. In some states, even in the East, *as much as three-fourths of the alfalfa acreage goes unfertilized in any one year.*

According to the 1959 census, 655,244 tons of fertilizer were used on tobacco. The present survey showed 687,766 tons used on alfalfa in 1960. So the two crops received about the same amount of fertilizer. *There were at that time less than a million acres of tobacco compared to alfalfa's 26 million!*

Another interesting comparison in the amount of fertilizer crops get is between alfalfa and corn. On corn, the total fertilizer used averages out to be 170 pounds per acre—*compared to only 56 for alfalfa!* Actually less than two-thirds of the corn acreage is fertilized, so the rate on the acres that get fertilizer is somewhat higher.

EIGHT TONS PER ACRE!

With the average situation in mind, it is revealing to take a look at what top farmers are getting from alfalfa

TABLE 5.—Tons of Fertilizer Used on Alfalfa In 1960 and 1964

Region	1960	1964	% Increase
New England	32,350	46,200	43%
Middle Atlantic	68,329	65,000	−5
South Atlantic	121,300	83,900	−31
East South Central	27,000	45,500	69
East North Central	155,257	162,000	4
West North Central	149,400	253,000	69
West South Central	19,800	41,600	110
Mountain	52,300	52,650	1
Pacific	60,030	94,030	57
U.S.	685,766	843,880	23

TABLE 6.—Fertilizer on Alfalfa, 1964

Region	Pounds Per Acre
New England	490
Middle Atlantic	65
South Atlantic	365
East South Central	166
East North Central	41
West North Central	42
West South Central	107
Mountain	26
Pacific	97
U.S.	56

when they fertilize and otherwise manage for high yields. A good example is a Kentucky farmer who in 1963 used the equivalent of 1500 pounds per acre of 0-10-30 B and got eight tons of hay per acre on a 14 acre field. Illinois got 9 tons per acre in test plots.

Pictures for this survey provided through courtesy of the following:

Page 44—Dr. Ray Kriner, Rutgers University

Pages 45-46—Dr. C. C. Blickenstaff, Entomology Research Division, U. S. Dept. of Agriculture

Eight tons of high quality hay—or its equivalent as low moisture silage which maximizes quality and feed potential in relation to that produced —would be equal in feed nutrients to at least 200 bushels of corn or 25 tons of corn silage. There would be a considerable *bonus in protein* since one ton of hay contains as much protein as 50 bushels of corn. In terms of protein, then, this 8 tons of alfalfa would be equivalent to 400 bushels of corn!

THE END

Modern philosophy: Anyone who has to be led into temptation shouldn't be allowed to enjoy it.

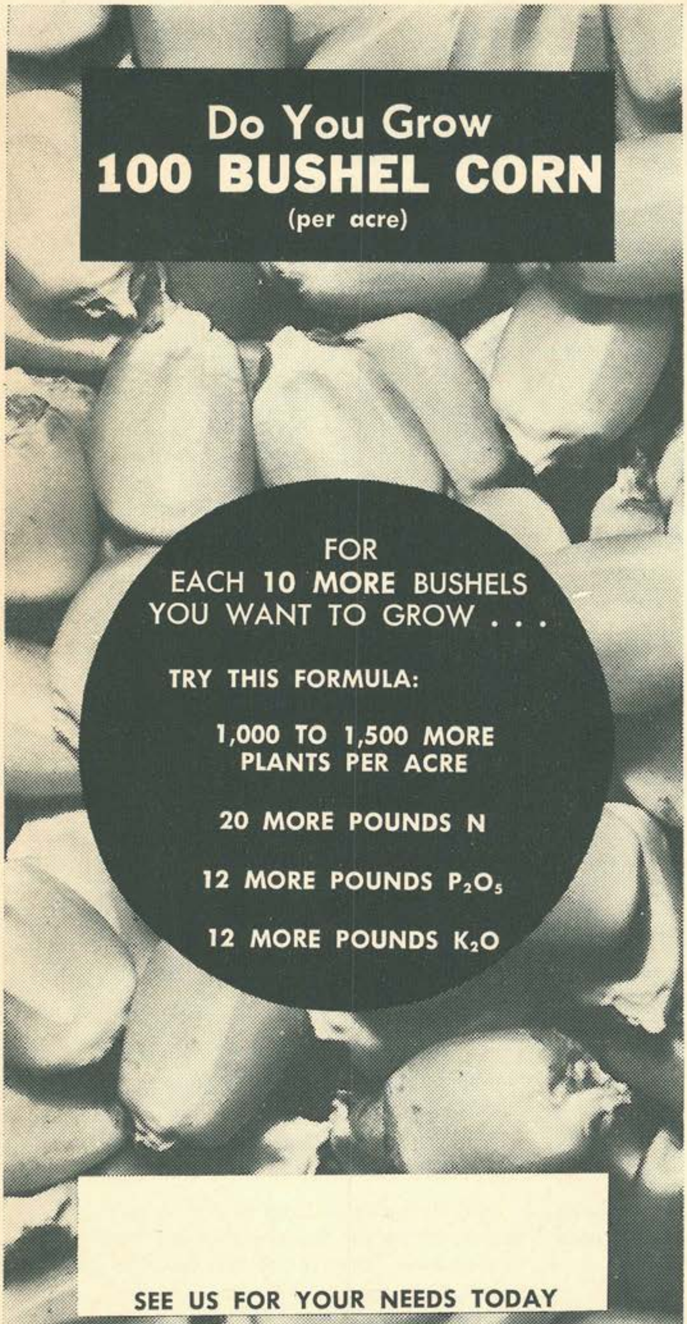
A little boy prayed: "Lord, if you can't make me a better boy, don't worry about it. I'm having a real good time as it is."

We notice that the new Russian leaders have dropped the "we'll bury you" boast. Either they have changed their political attitude, or they found out what American funerals cost.

For every woman who makes a fool out of some man there is another who makes a man out of some fool.

Native ladies of central Africa are dismayed by the topless swimsuit fad in America. They're afraid the National Geographic will stop sending photographers.

What this country needs is fewer steering committees and more good drivers.



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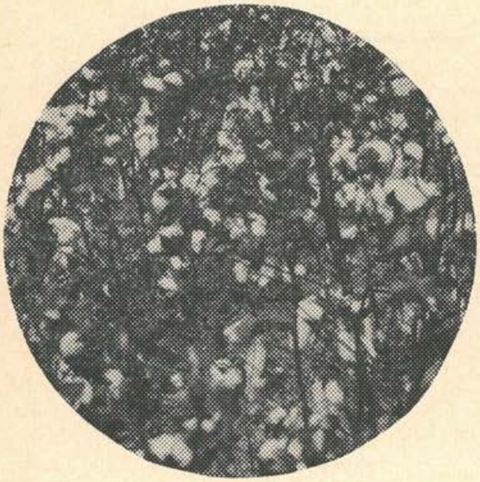

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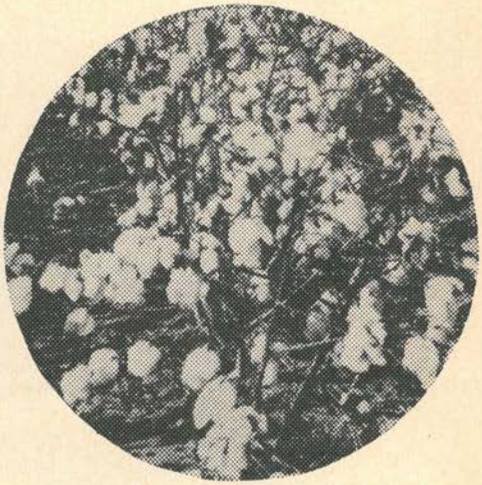

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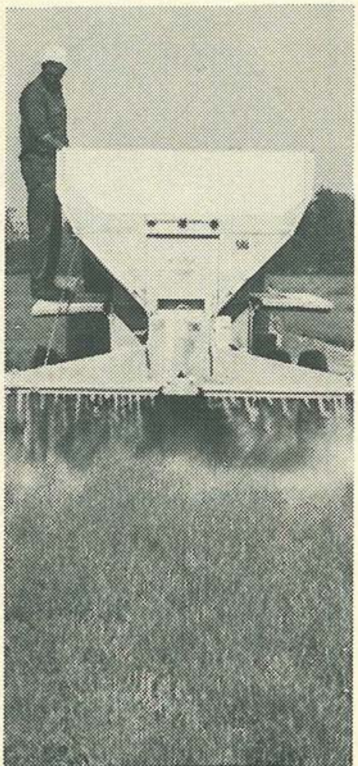

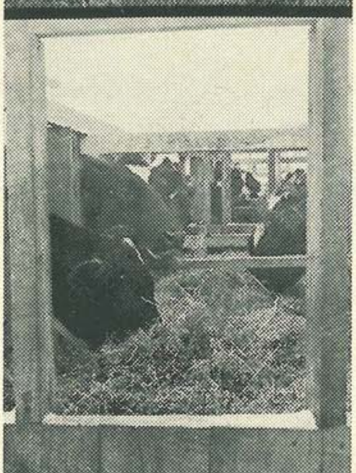

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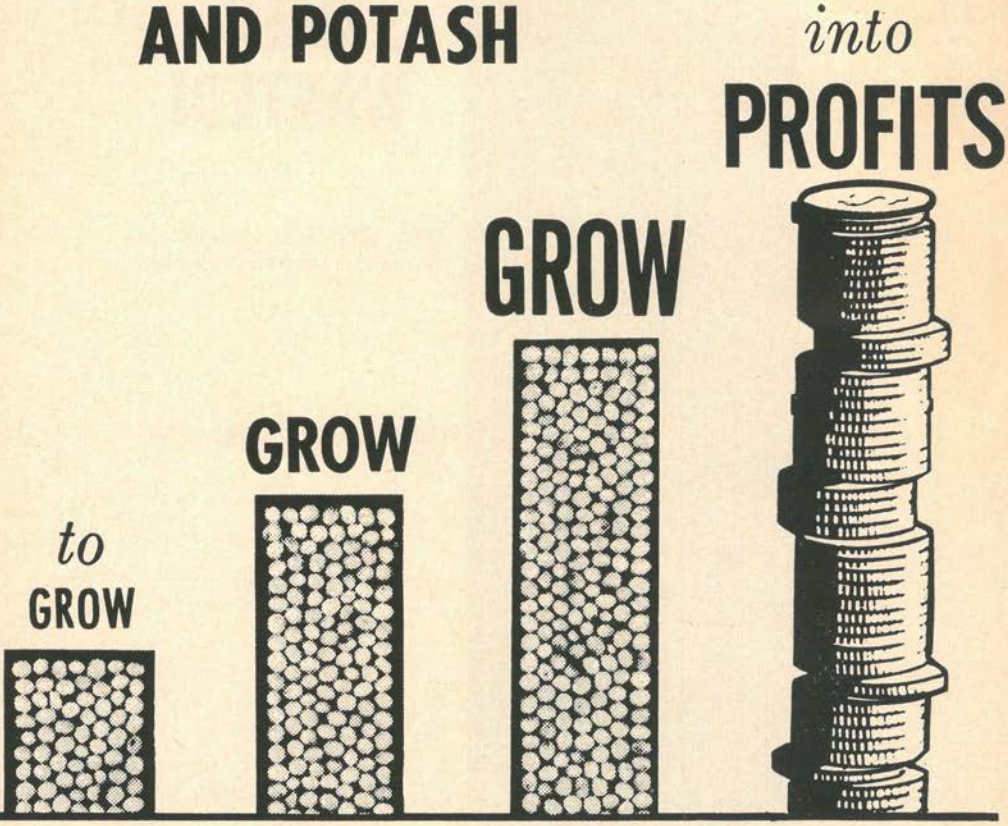

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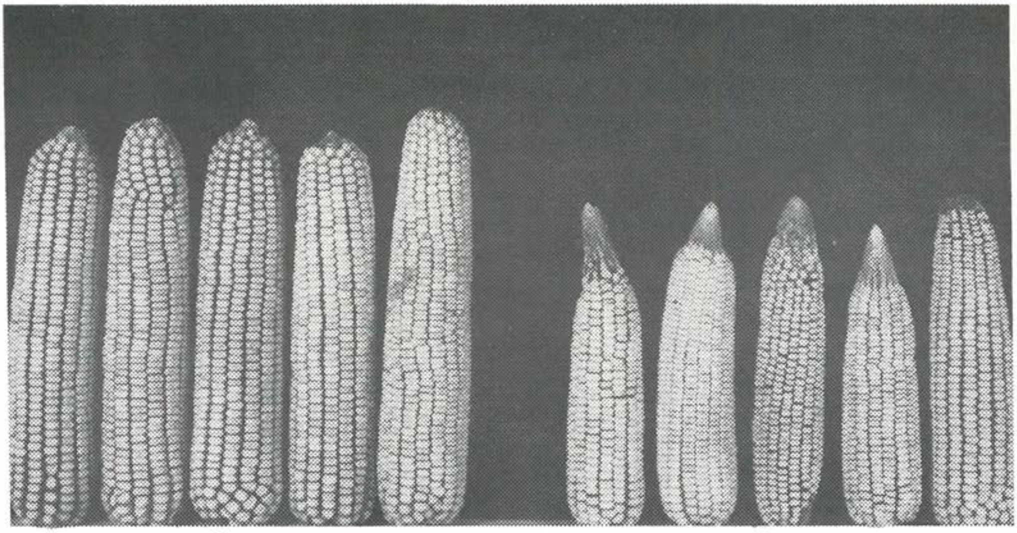

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