Better Crops

WITH PLANT FOOD

Spring 1967 25 Cents

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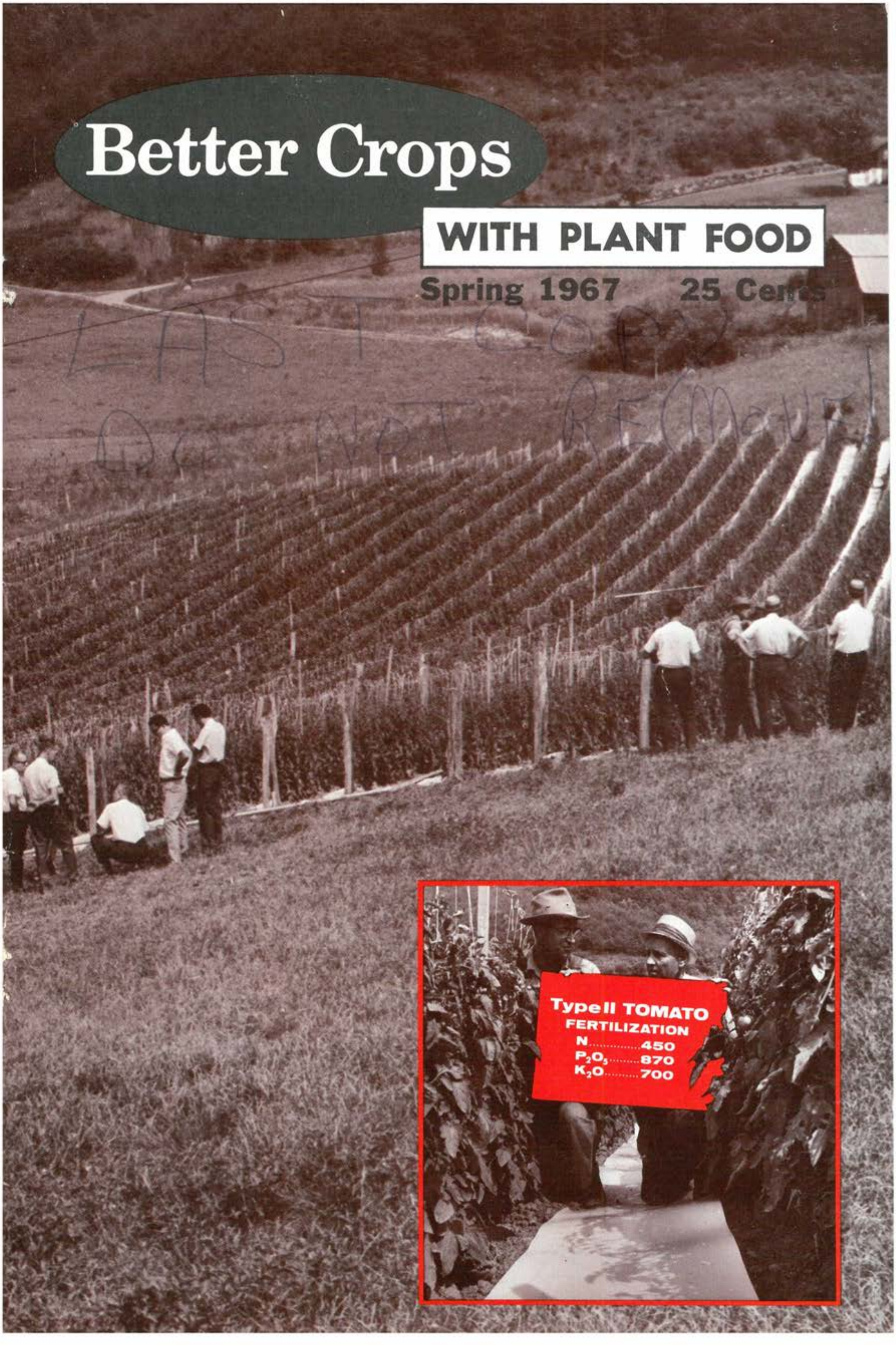

ON THE COVER . . . Proper fertilizer rates have played a big role in pushing gross income to $6,000 per acre on some tomato fields of Haywood County, in North Carolina's Land of the Sky.

It is an amazing story, beginning on page 2. A story of fantastic success with vine-ripened tomatoes in a county that thought its agricultural economy had just about had it only 10 years ago.

Farmer Clarence Caldwell (above), examining some of his quality yield, is typical of growers adapting to the new crop. This BETTER CROPS report is based on an excellent bulletin prepared by V. L. Hollaway, County Extension Chairman, and Eugene McCall, Haywood County Agricultural Agent, and TVA Test-Demonstration Supervisor D. D. Robinson who rushed pictures to us through A. C. Davis of TVA. This program is worth noting.

Better Crops WITH PLANT FOOD

The Whole Truth—Not Selected Truth

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Tomatoes Build PROSPERITY

Better Crops Interpretation
Of N.C. Extension Bulletin 21

FROM SELLING tomatoes and OTHER vegetables, Haywood County (N. C.) farmers received only $60,000 in 1956. By 1965, they were receiving $1,449,400 from tomatoes ALONE—and were shooting for a $2,000,000 farm income by 1971.

What happened? Well, for one thing, they increased plant nutrient use from 450 to 1,400 lbs. per acre. Yields climbed from 18 to 30 tons per acre. Sales jumped from $1,800 to $3,501 per acre. Average farm income rose 130%.

But that's getting ahead of the story. In the beginning, many said, "There's no way left to increase our farm income." So it is a story of a changing attitude—of a negative outlook converted to a positive approach.

When county leaders—Extension staff, farm business, and professional folks—decided to look at their agricultural situation in 1956, they were jarred by what they found:

- **A farm income averaging only $1,218 per farm.**
- **Less than half of the 2,826 farms classed as commerical.**
- **Less than one fifth of those with sales of $2,500 or more.**
- **The average farm size 55.8 acres, of which 9.7 was potential cropland.**
- **Limited expansion, at best, for their major enterprises: dairying, beef cattle, and burley tobacco.**
- **Horticultural crops accounting for only $48,000 in farm sales, with apples as the leading**

minor enterprise.

Four big factors stood in the way of improved farm income:

1—Limited land for crop and livestock production.

2—Little knowledge or interest in new enterprises.

3—A market structure geared only to existing crops and livestock.

4—Little knowledge of enterprises that might use scarce resources more efficiently to give highest income.

The County Extension staff studied the problem carefully with the program projection committee. With the help of subcommittees and commodity leaders, they decided to do three things:

. . . study the working requirements and potential economic returns of every idea each enterprise group proposed.

. . . encourage committee members and lay leaders to help define problems, set goals, and develop programs.

. . . provide production and marketing facts, when possible.

In winter 1956-57, the Committee on Vegetables and Small Fruits went into action, searching for ways to increase income. One promising crop seemed to be vine-ripened (or trellised) tomatoes being grown very successfully in Florida.

Committee members visited Florida producers to look at all production and marketing facets. How would this crop adapt to western North Carolina? What was its market potential? What about mechanization costs? How much return per unit of resource? What were the best cultural practices?

A year of careful probing brought encouraging news to Haywood farmers—and a 13-acre demonstration plot on which they could SEE what they were TOLD. Questions began to flood the Extension agents, some they couldn't answer:

Something RIGHT

WHEN A COUNTY increases a crop yield 66% and the sales of that crop 94%, something RIGHT is happening.

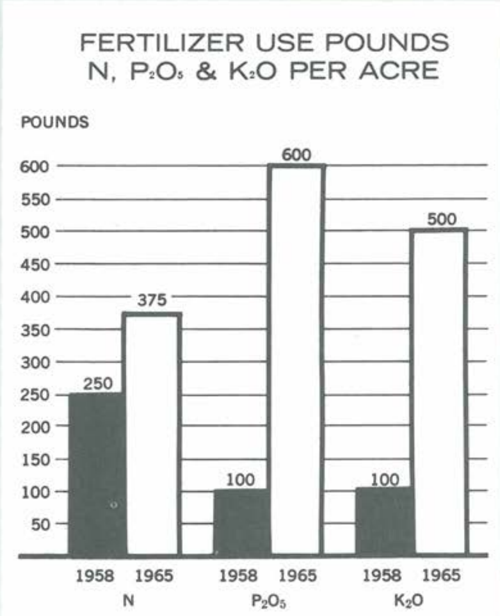
Haywood County (N.C.) growers have been doing something right in their tomato production—no doubt, a combination of right practices. Among them are their latest fertilizer recommendations for irrigated trellised tomatoes on medium-potash soils:

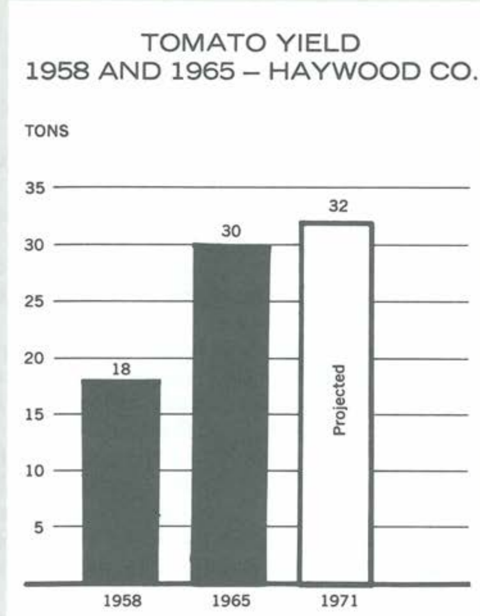
325 lbs. N
550-1,000 lbs. P_2O_5 (depending on soil test level)
450 lbs. K_2O

This compares with 225 lbs. N, 150 lbs. P_2O_5, and 300 lbs. K_2O recommended just a few years ago.

Where did the new recommendations come from? From experiences of top-level farmers and tests at a new Experiment Station created to meet the people's demand for more studies on tomatoes and other vegetable crops.

Special fertility demonstrations have helped isolate and define areas needing emphasis. Demonstrating different rates of nitrogen, phosphorus, and potassium has influenced fertilizer usage greatly on tomatoes. Now, demonstrations are pointing to micronutrients in tomato production.





FROM FERTILIZER . . . TO YIELDS

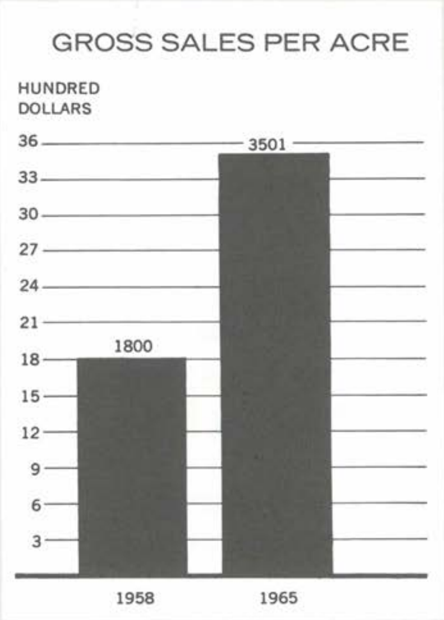
- **What was the best variety for the climate?**
- **How should the plants be spaced and trellised?**
- **How much fertilizer and what rates of N, P_2O_5, and K_2O should be used at planting and for topdressing? How often should topdressing be applied?**
- **How can diseases be identified and controlled?**
- **When should tomatoes be picked and how should they be packed for market?**
- **Should the crop be irrigated—if so, how much?**

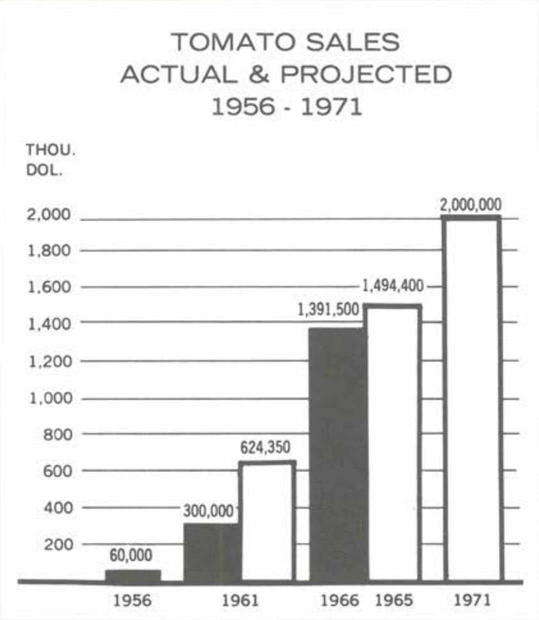
The agents faced tough problems. North Carolina research results were very limited with such a new crop. Findings from other states were subject to local conditions. They consulted N. C. State University Extension specialists and soon launched demonstrations to find best varieties and fertilization rates.

It was teamwork education between N. C. State University and TVA, mostly on test-demonstration farms or as special fertilizer practice demonstrations on other farms. They used new fertilizers and special TVA-developed grades.

Interest in vine-ripened tomatoes caught fire. Many educational methods were used to create this interest:

- **TOMATO TRAINING SCHOOLS.** Since 1958, each of these schools has attracted 200 or more farmers, once or twice a year.
- **TOMATO FARM TOURS.** Between 10 and 12 tours have attracted some 20 farmers to each program. The county has also sponsored tours for Extension agents, foreign specialists, and farm people from other states.
- **NEWSPAPER and RADIO REPORTS.** The program has spon-





. . . TO SALES

sored 45 feature articles and 50 broadcasts yearly to promote recommended production and management practices.

And personal contact—between professional workers and farmers—has been a major educational tool, as always.

During the second year, the growers formed a marketing cooperative, with 65 members and $63,000 capital. Today 400 members support a capital outlay exceeding $100,000. And three other marketing facilities have been built in the county.

In addition to dollars-and-cents results reported in the lead of this story, the Haywood County tomato project has reaped another result: human leadership development.

In 1965, the county claimed the second-ranking 4-H vegetable judging team and the highest scoring individual in America. Four of the first 11 members of the Tomato Marketing Cooperative Board of Directors were test-demonstration farmers, serving with business and industrial leaders to create a genuine spirit of economic teamwork.

. . . TO THE FUTURE

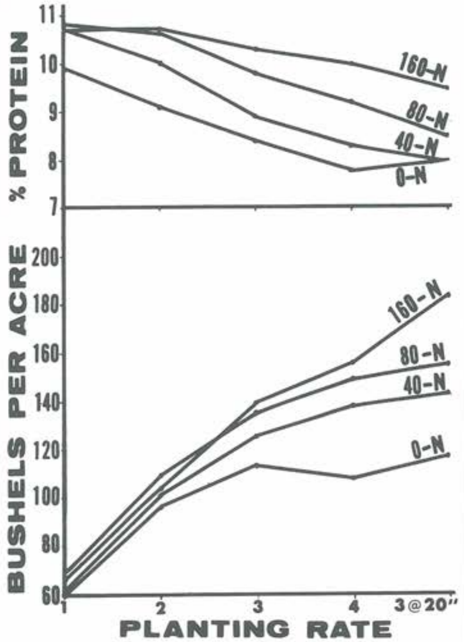
What about the future? The tomato enterprise is spreading. In 1965, 1,382 producers grew more than 1,100 acres for a gross income of $2,720,194 in the 15 Tennessee Valley counties. It took 14 tomato marketing facilities to serve them. The Valley counties are shooting for $5,646,000 by 1971.

The future looks bright for tomato farming in western Carolina, led by a group of Haywood County folks who couldn't believe there was "no way left to increase their farm income."

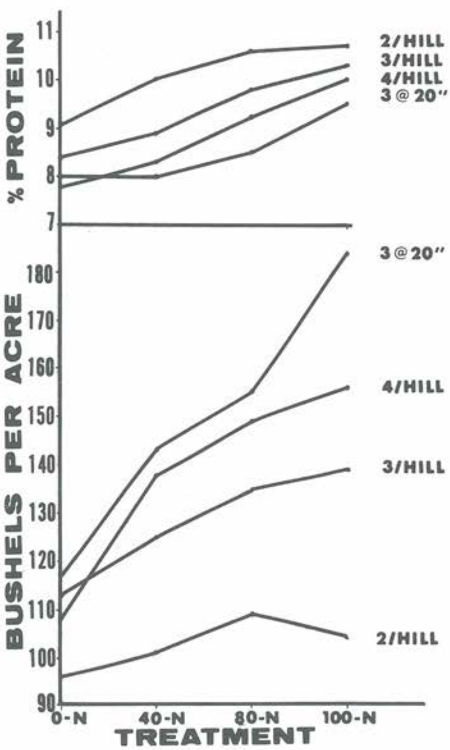
THE END

BOOST CORN YIELD POTENTIAL

E. B. EARLEY
UNIVERSITY OF ILLINOIS



BY INCREASING PLANTING & N



MANY FACTORS work together to insure top corn yields. Table 1 shows how soil fertility (including variable nitrogen), planting rate, and excellent seasonal conditions teamed up for good yields.

These data may be summarized as follows:

1. For each planting rate, except one and two plants per hill at 40 inch spacing, yield of grain per acre increased as the amount of applied nitrogen increased from 0 to 160 lbs per acre. Largest increases in grain yield from increased nitrogen occurred at highest planting rate.

2. For each level of applied nitrogen, yield of grain per acre increased as planting rate increased. Largest increases in grain yield from increased planting rate occurred at highest nitrogen rate.

3. A higher planting rate and nitrogen would have given an acre yield somewhat above the 184 bushels received.

This research project was supported by a grant from Funk Bros. Seed Company, Bloomington, Illinois. Yield and percent protein data from this study were published in the 1948 proceedings of the bybrid corn division of the American Seed Trade Association.

TABLE 1. RELATION OF PLANTING RATE AND APPLIED NITROGEN TO YIELD AND COMPOSITION OF CORN GRAIN OF FUNK'S G-94
Urbana, Illinois

Plants per hill and per acre	Factors studied	PK[a] + lb. N/A.[b] No N	40 N	80 N	160 N	Av.
1 at 40"[c]	Yield, bu./A.[d]	60	62	69	67	64
	Protein, lb./A.	281	315	352	341	322
(3920)	Protein, pct.[e]	9.9	10.7	10.8	10.7	10.5
	Oil, pct.	4.6	4.6	4.5	4.5	4.6
	Phos., pct.	.27	.29	.29	.27	.28
	K, pct.	.33	.33	.33	.32	.33
2 at 40"	Yield, bu./A.	96	101	109	104	102
	Protein, lb./A.	414	479	549	530	493
(7841)	Protein, pct.	9.1	10.0	10.6	10.7	10.1
	Oil, pct.	4.5	4.7	4.7	4.8	4.7
	Phos., pct.	.26	.26	.26	.26	.26
	K, pct.	.32	.32	.32	.33	.32
3 at 40"	Yield, bu./A.	113	125	135	139	128
	Protein, lb./A.	452	530	621	690	573
(11,761)	Protein, pct.	8.4	8.9	9.7	10.5	9.4
	Oil, pct.	4.6	4.8	4.6	4.6	4.6
	Phos., pct.	.28	.24	.25	.25	.26
	K, pct.	.32	.32	.32	.31	.32
4 at 40"	Yield, bu./A.	108	138	149	156	138
	Protein, lb./A.	405	543	661	737	586
(15,682)	Protein, pct.	7.8	8.3	9.3	10.0	9.0
	Oil, pct.	4.4	4.5	4.7	4.7	4.6
	Phos., pct.	.27	.24	.24	.24	.25
	K, pct.	.32	.29	.31	.30	.31
3 at 20"	Yield, bu./A.	117	143	155	184	150
	Protein, lb./A.	433	541	634	829	609
(23,522)	Protein, pct.	7.8	8.0	8.6	9.5	8.6
	Oil, pct.	4.5	4.5	4.6	4.6	4.5
	Phos., pct.	.28	.25	.23	.23	.25
	K, pct.	.33	.32	.31	.30	.31
Average:	Yield, bu./A.	99	114	123	130	
	Protein, lb./A.	397	482	563	625	
	Protein, pct.	8.6	9.2	9.8	10.3	
	Oil, pct.	4.5	4.6	4.6	4.6	
	Phos., pct.	.27	.26	.25	.25	
	K, pct.	.32	.32	.32	.31	

a 600 pounds per acre of 0-14-7 plowed under on Flanagan silt loam.
b Ammonium nitrate equivalent plowed under.
c Corn rows 40 inches apart.
d No. 2 corn containing 15.5 percent moisture and average of 2 replications.
e Percent nitrogen x 6.25.
All chemical analyses are reported on the moisture-free basis.

4. For each planting rate, pounds of grain protein per acre increased as applied nitrogen increased. Also largest increases in grain protein per acre from increased nitrogen occurred at highest planting rate.

5. For each level of applied nitrogen, pounds of grain protein per acre increased as planting rate increased, with few exceptions. Also, largest increases in grain protein per acre from increased planting rate occurred at highest nitrogen rate.

6. For each planting rate, percent grain protein increased as applied nitrogen increased with few exceptions.

7. For each level of applied nitrogen, percent grain protein decreased as rate of planting increased, with few exceptions. But the decrease in percent grain protein with increased planting rate was smallest at the highest nitrogen level. **Therefore, highest protein grain of a given hybrid is produced by applying enough nitrogen to get maximum yield of grain.**

8. The relationships of planting rate and nitrogen application to yield of grain per acre and percent grain protein are graphically illustrated on page 6.

9. Percent oil in corn grain was not appreciably affected by planting rate or nitrogen. But percent phosphorus and percent potassium were slightly modified by these two factors.

You can build potential for a high acre corn yield. Adjust soil fertility and planting rate high enough to take full advantage of good to excellent seasonal conditions, since these occur more frequently than poor seasonal conditions.

Although results like these occur only under very favorable seasonal conditions, they should help farmers attain higher acre yields of corn under average seasonal conditions.

THE END

MAY LICK IT YET

FARMERS may lick the alfalfa weevil yet. Experiments in Virginia show that flaming the weevil is a very successful control method.

Also, weevils are not likely to build up resistance to this method. The nicest thing is that the job can be done during the winter when you are not so busy, says James M. Moore, agricultural economist at Virginia Tech.

This method is so new that most cost figures are just estimates. However, he thinks these estimates are close enough for farmers to make decisions. The new equipment needed is a fuel tank to supply the L.P. gas and the burner rig. These two items will cost about $1,050 to $1,100.

The annual cost of owning this equipment will be around $180. If you use it on 100 acres of alfalfa that is $1.80 an acre. The cost for the 25 gallons of fuel per acre will be about $4. Add to this 30 cents per acre for tractor operating cost and you can flame an acre for about $6.10.

If alfalfa hay is $35 a ton that is about 340 pounds worth of hay. If you use the burner on 200 acres the cost will be about $5 an acre or about six bales worth of hay.

The burner takes a 12-foot swath at 2.5 miles per hour. Considering stops, this is about 3.5 acres an hour. This means that most burners could be used on more than one farm. Here is a place where custom work or joint ownership of a machine could be quite profitable. However, if you are doing custom work another 50 to 80 cents per acre should be added to the above costs to pay for fixed cost of the tractor and your labor.

One burning will not eliminate all the weevils for the entire year, but it has been pretty successful in protecting the first cutting. A spray may be needed on later ones.

A bonus to this control method is the weed control. Fields that have been sprayed have less weeds. This improves the quality of the hay and increases its value.

VPI News

GIVE US MORE SQUARES!

A FARMER lives in an environment that is as old and as proved and as well established as life itself—his work and his life reject many of today's accepted social theories.

The farmer is like a scientist or a doctor or a chemist or a mathematician. The rules of his environment are inflexible. The sun comes up each day in the east and goes down in the west. It doesn't change—never has and never will.

Life has an order about it on a farm just as the physicist describes the order of our universe. Basic things don't change. It takes just so long for a seed to germinate or a tree to grow. Without water and fertilizer, his crop will fail.

If the frost is too severe, he loses his crop. If he does a poor job of pruning, or of thinning, or of husbandry, he suffers for it.

For the farmer there is no compromise for hours of heat—no compromise with work to be done. Nature is consistent and rewards those who work hard and intelligently and punishes those who neglect their duties.

In such an environment there is no security other than in hard work and good management. In such an environment there is no such thing as something for nothing. The modern tendency toward non-involvement doesn't fit in his environment and it was in precisely such an environment that our country was founded.

Charley Brower talked about squares a few years ago, and I think his comments fit.

To a farmer, the word "square" has a meaning that goes back to Mark Twain's day.

It means you give a man "a square deal" if he is honest. You give a man a "square meal" when he is hungry.

You stand "four square" for the right as you see it, and "square" against everything else.

When he got out of debt, he was "square" with the world and that was when he could look his fellow man "square" in the eye.

A farmer is disgusted by the modern version of a "square." A guy who never learned to get away with something. A guy who volunteers when he doesn't have to.

A guy who gets his kicks out of trying to do something better than anyone else.

A boob who gets so lost in his work that he has to be reminded to go home.

A guy who doesn't have to stop at a bar on the way home because he's all fired up and full of juice already. A fellow who laughs with his belly instead of his upper lip.

A slob who gets all choked up when the bands play "America the Beautiful."

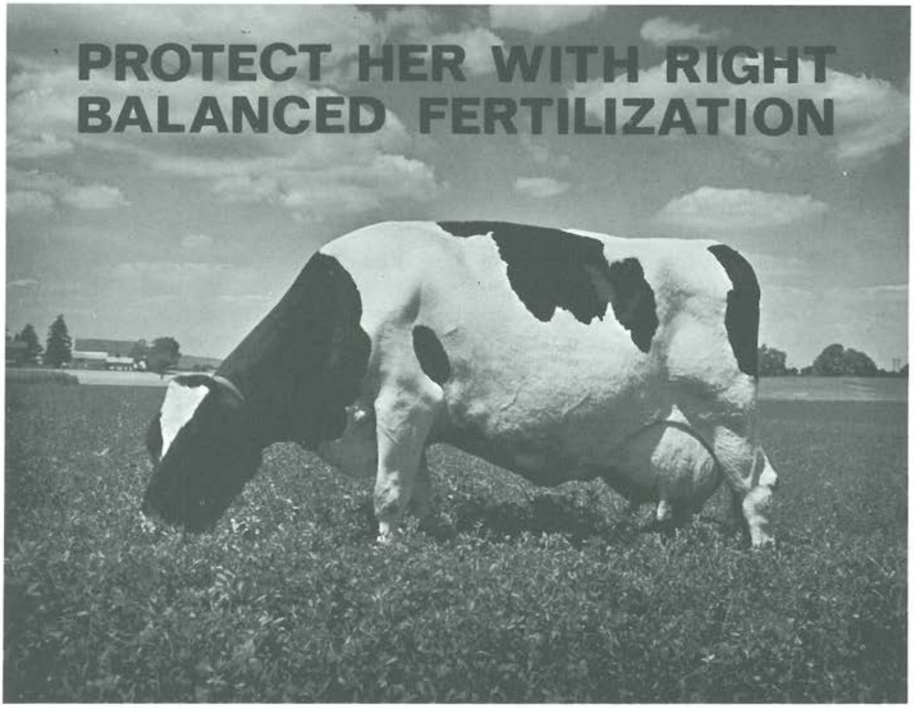
Farmers, as a whole, don't fit too well with the current group of angle-players, corner-cutters and goof-offs.

Too many of them are burdened down with old-fashioned ideas of honesty, loyalty, courage and thrift.

They don't for the most part understand parents who have defended in court their children's right to ignore the flag salute, or the faculties and students who find it distasteful to take a loyalty oath to their country.

The farmer in his environment finds it hard to understand government policies directed more fully toward security of the weak than the encouragement of the strong. Or a business philosophy of surviving by emulating the turtle—grow a hard shell and never stick your neck out.

Bunje in
California Farmer



APPARENT RELATION | ENVIRONMENT POTASH FERTILIZATION PLANT COMPOSITION ANIMAL BLOAT

J. C. BURNS, D. A. HOLT, C. H. NOLLER, C. L. RHYKERD

PURDUE UNIVERSITY

THE GROSS long term effects of temperature, light, and moisture conditions on plants are well documented in plant physiology and crop production reports.

But how short term environmental changes specifically affect plant metabolism are usually not ascertained, at least in field experiments. This is due to no available instrumentation and techniques for continuously monitoring microenvironmental parameters and relating them to plant response.

It has been even more difficult to relate metabolic disturbances in animals consuming forage to specific compositional changes in the plants being consumed and, in turn, to specific environmental phenomena.

In this account, we try to document an animal-plant-environment situation that apparently put stress on the animals. We realize the evidence is circumstantial and causal mechanisms are not elucidated. But the important point is that frequent herbage testing and continuous mon-

Contribution from Indiana Agricultural Experiment Station, Departments of Agronomy and Animal Sciences, Lafayette, Indiana. Journal Paper No. 2824. Acknowledgment is made to International Minerals and Chemical Corporation and the American Potash Institute, Inc. for support of this project.

itoring of environmental conditions greatly increase the possibility of understanding and interpreting events behind this type of experiment.

ENVIRONMENT & POTASSIUM

An experiment conducted in July, 1964, with Ranger alfalfa (*Medicago sativa* L.) indicated an apparent interaction between environment and potassium fertilization. **Bloat occurred in animals consuming low potassium forage.**

On the morning of July 6, seven of eight dairy heifers fed green chop alfalfa from plots receiving no potassium fertilizer showed moderate to severe bloat after consuming about 15 pounds of green material. The bloat required immediate veterinary attention. **Only one mild case of bloat occurred in 16 heifers fed green forage from plots fertilized with potassium.**

Bloat did not occur at any other time during the 20-day experiment. Two days before bloat, the animals were changed from alfalfa at bud stage to that in the vegetative stage on the same plots. Changes in plant composition before and following bloat were of less magnitude than those occurring at bloat time.

The bloat occurred in an experiment where Ranger alfalfa (*Medicago sativa* L.) was fertilized with combinations of nitrogen (N), phosphorus (P), and potassium (K) at 200, 150, and 400 pounds per acre, respectively. In this paper, the N and NP plots are designated as "low K" while the NK, PK, NPK and NPK plus trace elements plots are called "high K".

Alfalfa was harvested each morning at 5:30 a.m. and fed to dairy heifers. Samples of forage were frozen in liquid nitrogen, lyophilized and stored at —20°F. until analyzed. Radiation, temperature, and rain-fall measurements were made in the field.

Temperature and radiation data in Tables 1 and 2 were taken on one of the experimental plots with a simple multiple point recording instrument utilizing thermistors as sensors. The net radiation estimates were obtained by imbedding thermistors in identical neoprene black bodies mounted 30 inches high and exposed to the earth or sky.

Differences between readings from sky and earth-exposed black bodies constitute a measure of net radiation. No standard net radiometer or pyroheliometer was operating in the area, so it was impossible to calibrate the instrument in standard units. The trends are clearly shown, however, in arbitrary units taken from the baseline of the recorder chart.

HIGH RADIATION LEVEL

The major environmental trend observed during this five-day period was the high level of incoming radiation during the light period of July 5 and the high level of back radiation (indicated by a large negative num-

TABLE 1. RAINFALL AND TEMPERATURE DATA FOR JULY 3 THROUGH JULY 8, 1964

Environmental Factor	July					
	3	4	5	6	7	8
Rainfall (Inches):	0.00	0.06	0.00	0.19	0.53	0.88
Temperature (°F.):						
Maximum	90	79	87	66	78	89
Minimum	61	47	46	59	64	62

TABLE 2. SUMMARY OF RADIATION DATA FOR PERIOD FROM JULY 4 TO JULY 8, 1964, MEASURED AT EXPERIMENTAL SITE*

	July								
Periods	4	4 & 5	5	5 & 6	6	6 & 7	7	7 & 8	8
Day	1033		1194		139†		302		806
Night		−116		−131		−81†		−39	

* Values are in arbitrary units from recorder chart baseline. A reading was obtained hourly, and positive and negative values summed for each day and night. Each sum represents approximately a 12-hour period.

† These values are somewhat influenced by the cooling effect of rain on the sky exposed black body. The periods represented were very cloudy with a trace of rain.

ber) against the cold, clear sky of the ensuing night. The maximum and minimum temperatures for this period, at 87°F. and 46°F., respectively, bear witness to the unusual magnitude of radiant flux during this period.

By comparison, this day and night period represented the widest variation in daily maximum and minimum temperatures and daily incoming and outgoing radiation for the entire one-month period during which measurements were made.

Tests of plant material sampled during the five-day period strongly suggest that environmental extremes encountered on July 5 did induce unusual compositional changes in the plants, presumably through changes in metabolic and/or translocative processes. The most extreme changes were evident in the forage grown under "low K" conditions, shown in Table 3.

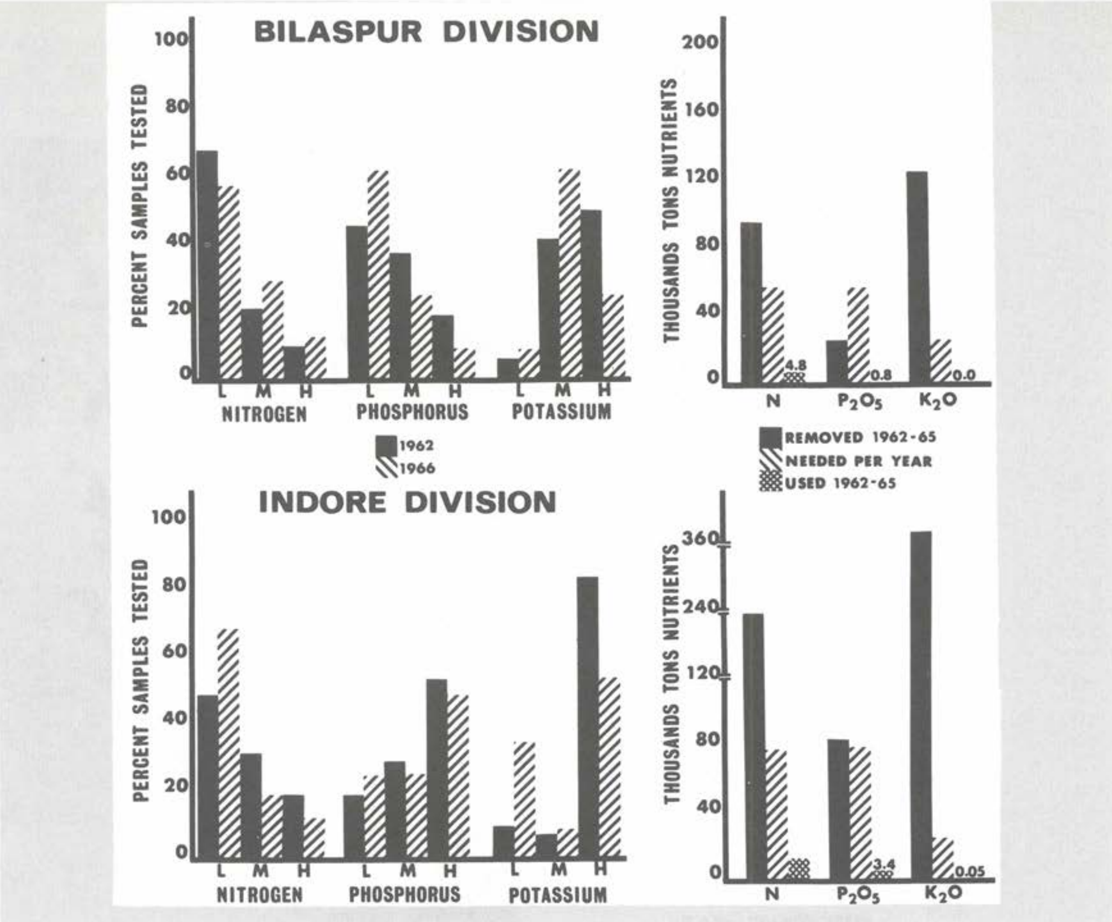
In the present investigation, potassium fertilization and environment appeared to perform a decisive role in determining biochemical characteristics of the forage plant. Changes in composition of the plant corresponded with occurrence of bloat in the animals. In their dairy cattle studies, J. B. Swan and N. D. Jamieson also noted an increased incidence in animal disturbances associated with inclement weather, particularly a combination of rain, cold, and wind.

These facts indicate environment and potassium fertilization may team up to alter the organic and mineral components of forage. It also appears that alteration in plant composition may be associated with incidences of animal disturbances.

Although environment is hard to alter under field conditions, proper fertilization may help prevent unfavorable effects. **THE END**

TABLE 3. THE INFLUENCE OF POTASSIUM FERTILIZATION ON SOME MINERAL AND ORGANIC COMPONENTS OF ALFALFA, JULY, 1964

Plant Components (Dry Basis)	Potassium Applied (lbs/A)	July 5	July 6	July 7	July 8
Total Nitrogen	0	4.07	4.15	4.19	4.57
(%)	400	3.80	4.01	4.22	4.21
Water Soluble Nitrogen	0	1.77	1.86	1.90	1.83
(%)	400	1.64	1.73	2.11	1.74
Soluble Carbohydrates	0	8.45	5.71	6.35	5.10
(%)	400	5.52	6.39	5.81	5.17
Malic Acid	0	87.6	100.7	63.0	68.4
(uM/gm)	400	52.1	70.5	41.0	64.2
Succinic Acid	0	10.3	7.9	13.7	10.3
(uM/gm)	400	10.2	11.6	9.7	9.4
Malonic Acid	0	74.0	57.3	50.9	67.1
(uM/gm)	400	100.6	96.3	70.1	75.6
Potassium	0	1.65	1.38	1.58	2.21
(%)	400	2.90	2.79	2.65	2.70



SOIL TEST LEVELS | UTILIZATION

Largest Indian State Draining Soil Nutrients

Better Crops Adaptation Of Report By Dr. P. M. Tamboli and Shri. S. M. Gorantiwar, Jawaharlal Nehru Agriculture University, Jabalpur, India

Soil test summaries are a vital tool for letting people know what shape their soils are in, what should be done to build up soil nutrition.

Madhya Pradesh, largest state of the Indian Union, covers, 1,170,271 square miles, nearly 15% of the land area. It has seven major soil groups: alluvial soils, deep black soils of valleys, medium black soils on trap, shallow black soils, mixed red and black soils, red and yellow soils, and skeletal soils.

Cropping pattern follows certain soil groups: generally paddy on red, yellow, and mixed red-black soils; wheat and gram (leguminous crop) on deep and medium black soils; cotton, Indian millet, and groundnut on medium black soils; millet on shallow, medium, and alluvial soils.

FERTILITY DECLINING

The fertility status of these soils

is deteriorating, as soil test summaries show. Several important changes are showing up. In Bhopal Division, low nitrogen soils increased 85% in just 4 years—from 31% in 1962 to 85% in 1966 testing low N.

In the Raipur, Rewa, and Bhopal Divisions, soils testing low phosphorus increased 18%, 26%, and 26% respectively between 1962 and 1966. And the nutrient index value of potassium has fallen from 2.43 to 1.91 in the Bilaspur Division, from 2.73 to 2.12 in the Indore Division.

Such fertility depletion demands an intensive fertilizer program. The two Divisions on page 13—Bilaspur and Indore—show estimated removal and reported use of fertilizers from 1962 to 1965. They also show nutrients needed per year to maintain fertility for better crops.

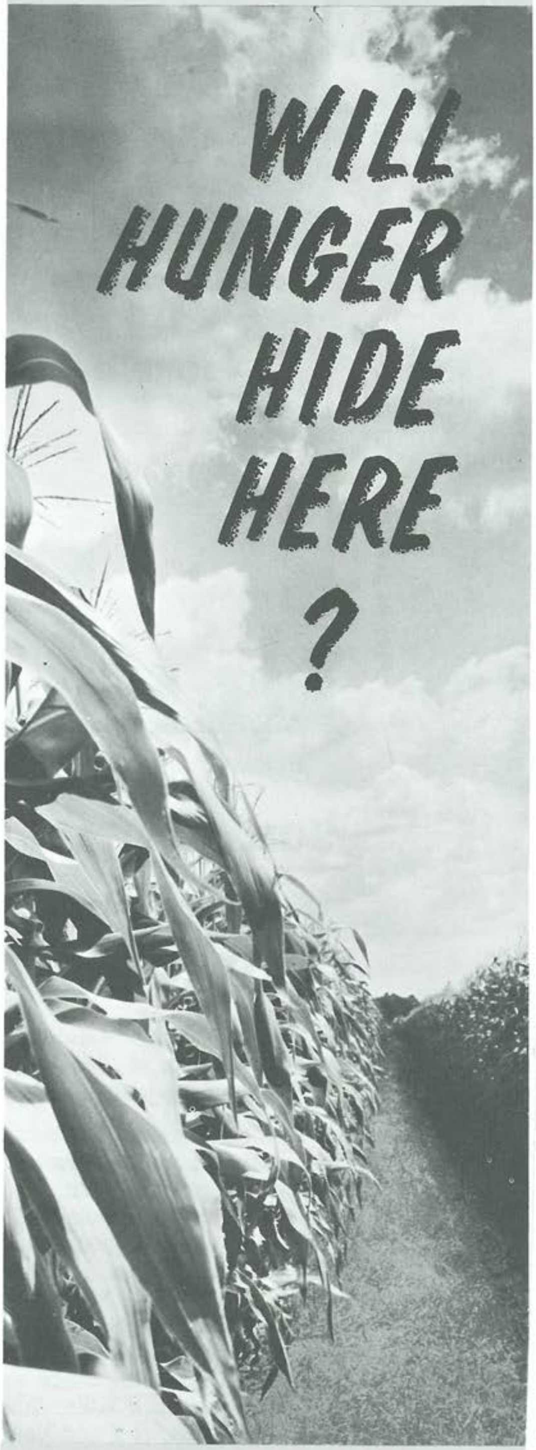
The drain on soil nutrients is great. Soil fertility status depends on removal and use of nutrients and the cropping pattern followed on a given soil.

DIFFERENT GAPS

The gap between potassium removal by crops and use of potassium fertilizers is much wider than the removal-usage gaps with phosphorus and nitrogen. But the decline in nitrogen and potassium status of all Divisions is less than the decline of phosphorus. With nitrogen, this may be due to use of organic manures, green manures, and cultivation of leguminous crops. With potassium, it may be due to most of Madhya Pradesh being medium to rich in potassium.

When removed nutrients are not returned to the soil, fertility status can go down and average crop yields can ultimately decline every year. The fertilization must be in right proportion to soil needs. Soil tests help insure proper use and economy in fertilization.

THE END



EXPERIENCE MAKES EVERY YOUNG SCIENTIST MORE PRACTICAL

HERBERT L. GARRARD
GARRARD AG PHOTOS

NOBLESVILLE, INDIANA

HIDDEN HUNGER is the kind of nutrient deficiency that keeps the crop from producing its maximum yield, although no external abnormalities can be seen in the plants or in the quality of products.

The critical nutrition period of most crops comes 1, 2, or 3 months after planting.

For example, corn absorbs its greatest amounts of nutrients about two or three months after planting —at least one month after it could be sidedressed practically—so the plant foods must be stored in the self-feeder soil where the roots of the growing plant can reach them.

Different diagnostic tools are available to guard against hunger:

1—Field trials come first, to show possibilities and trends, or to test theories.

2—Soil tests indicate immediate needs.

3—Chemical tests on plants—including tissue tests, leaf analyses, and total plant food contents—all help to show deficiencies and guide to adequacy.

4—Plant physiology studies show effects of below-adequate nutrient supplies.

5—Economic studies prove practicality of short-time and long-time investment in fertilizers, lime, and related soil fertility management practices.

Interpreting all the related facts revealed by these various methods is a challenging job. Every young scientist hopes to develop accurate methods. But experience soon teaches him that the most accurate data must be interpreted back into relative terms before being most useful.

He soon learns that crops vary in their ability to grow at different pH levels, that crops vary in their total requirements for different elements, and that varieties of specific crops differ in their total requirements and their abilities to get adequate nutrients from the same root environment.

He soon learns the size, rate of growth, and especially numbers of plants per acre may determine whether a certain rate of nitrogen release from soil may be adequate or deficient. He learns, also, that the rate of nitrogen release from soil may vary according to "weather."

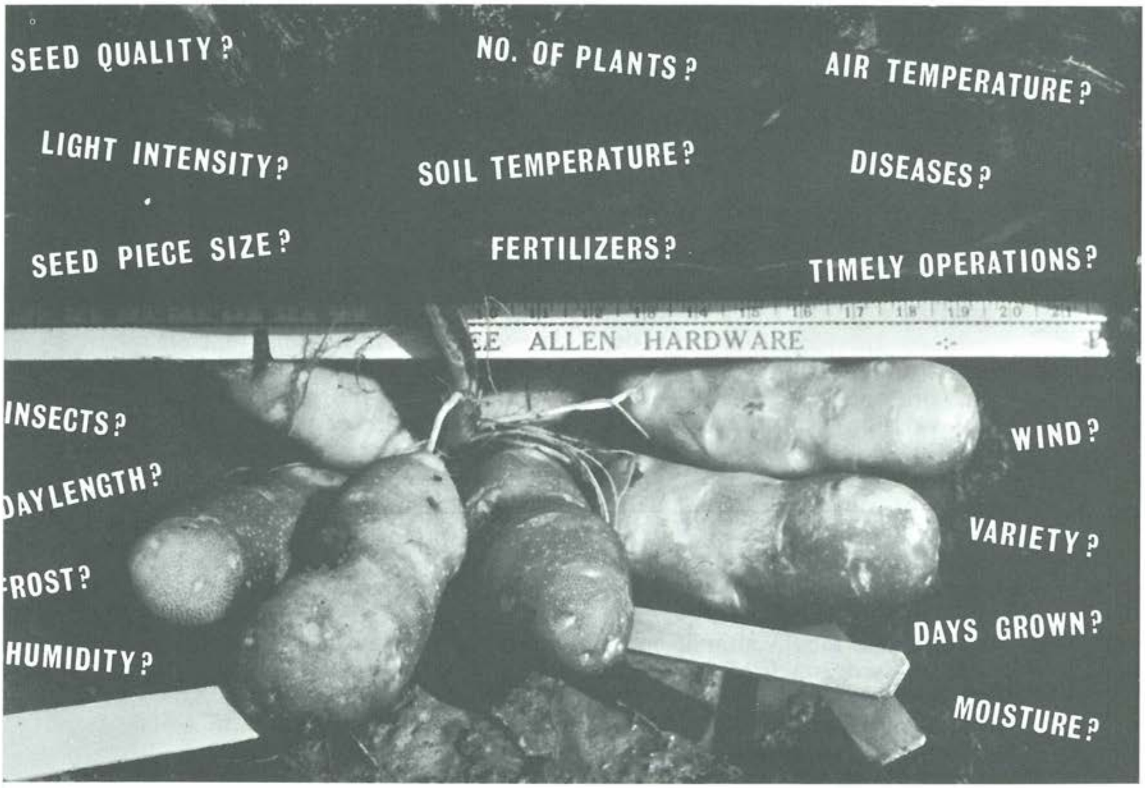
He soon learns the chemical availability of potassium may be reduced by poor aeration in the soil. Anything that restricts root growth will reduce its positional availability because potassium absorption depends largely on actual contact of root hairs and soil particles.

Because of all these variables, the exact requirements for any one year may be difficult to predict.

Why good judgment is so important for interpreting most data was best answered by Prof. Emil Truog of Wisconsin, a pioneer in soil testing: "When you go fishing, you may not catch all the fish within the range of your tackle, for various reasons."

The same truth applies to plants. No plant will get, within a short growing season, all the nutrients that might be chemically extractable from a soil. No soil test will state the exact amount of nutrients available to a crop. Both chemical availability and positional availability of nutrients in a soil and those added by fertilizers must be considered.

THE END



You Can Grow Top-Grade POTATOES

R. KUNKEL

WASHINGTON STATE UNIVERSITY

Potato acreage is climbing fast in the Columbia Basin—from 16,701 in 1959 to 40,480 acres in 1965. **Why?** High acre yields, high dry matter content of potatoes, and a harvest season extending from early July to November have attracted processors.

Many potato storage and processing plants are being built to prolong the marketing season and to provide a source of potatoes for processing when they are not available from the field.

Relative cost of producing small and large yields makes a small difference. But whether a grower has 600 or only 300 cwt. of potatoes per acre to sell makes a huge difference.

Yesterday 350 cwt. per acre was thought satisfactory. Today 600 cwt. is not uncommon. A few have produced 700 cwt. on large areas, while the Basin averages about 365 cwt.

Some potato plants produce huge yields of No. 1 grade, while neighbor hills produce mostly culls.

WHY?

THEY DON'T JUST DIE—THEY'RE KILLED!

In Columbia Basin, potassium is being depleted faster than it is being supplied by fertilizer or soil.

Top potato yields and quality come from integrating many factors. The 700 cwt. per acre yields come ONLY when all factors are present in optimum amounts. The law of the limiting factor operates here. A plant, like a man, can die from too little or too much water—from hunger or gluttony, etc.

Sometimes more than one factor limits the potato plant's response to a given treatment. Discovering which factors to change for best economic results takes years of research and application to each production area.

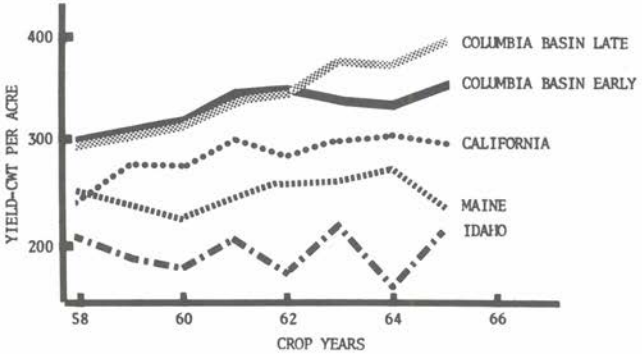
UNIQUE FACTORS FIGURE IN BASIN AREA

Washington's Columbia Basin produces the highest mean acre yields in the nation—FIGURE 1.

Briefly stated, yield is the difference between the amount produced and the amount lived up. If Washington's average yield was used for com-

Top yields come where most limiting factors are eliminated or controlled.

FIGURE 1



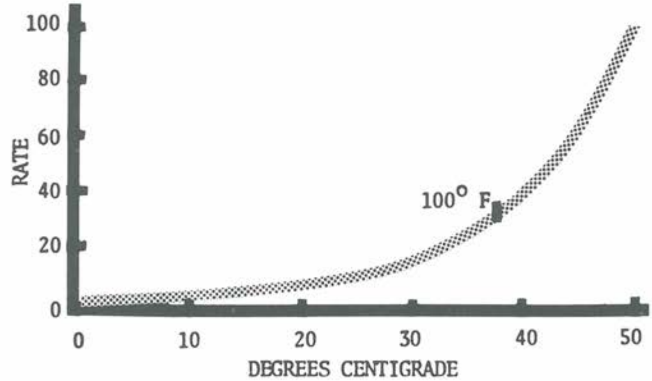


FIGURE 2

The higher the temperature the faster enzymatic action increases.

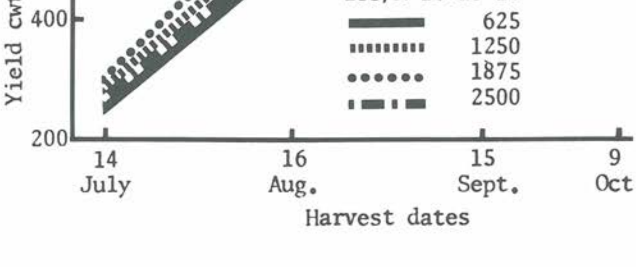
parison, the acre yields would parallel California. Both areas have hot summers. But Washington also has short, cool nights, influencing enzymatic action in plant growth, the basis of all life processes.

The rate of an enzymatic action changes with temperature—almost two and a half times for every 10°C.(18°F) change in temperature. **The higher the temperature the faster the increase—FIGURE 2.**

This factor favorably influences the maximum yields and dry matter content of potatoes grown in the Basin area. Thus, California and Washington yields are comparable, but Washington potatoes have a high dry matter content while the California potato is low. Most of the dry matter produced during day in Columbia Basin potatoes is conserved through cool nights and long daylight hours, extending from 4 a.m. to 9 p.m. during summer. These conditions contribute to high yields and high dry matter content (high specific gravity), essential for nearly all forms of potato processing.

Because of long, bright, hot growing season in the Columbia Basin, plants require more nourishment than those in short, cool season areas or where moisture is limiting. Thus, enough of the right fertilizer is needed.

Large crops require much plant food. This was shown by a Columbia Basin experiment in 1966—FIGURE 3. If potatoes were harvested in mid-July when yield was lowest, only lowest fertilization rate was eco-

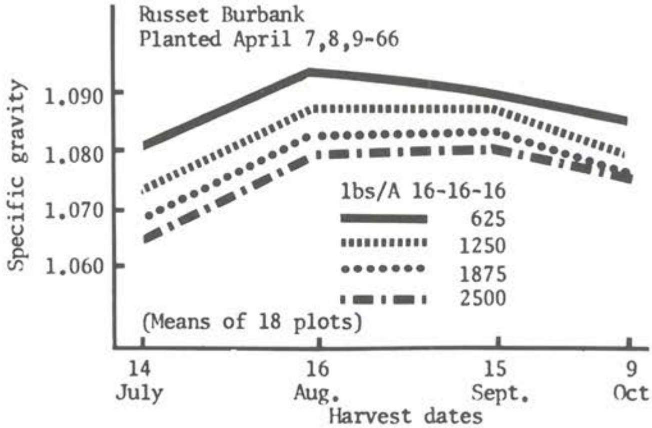


Plenty of fertilizer plus right harvest time help get top yields.

FIGURE 3

FIGURE 4

Differences in specific gravity often depend on time of comparisons.



nomical. But to keep them growing until October 9, when yield exceeded 700 cwt. per acre, highest fertilization rate was needed.

Most rapid yield increase occurred in July and August. During this period, yield increased about 8 cwt. per acre per day. **Highest specific gravity of the tubers also occurred between August 15 and September 15, while definitely declining toward the end of the growing season—FIGURE 4.** It would appear generally that the highest fertilizer rate produced tubers of the lowest specific gravity. But what would have happened with only one harvest date? The plants growing on lowest fertility level were dead before August 16, while those receiving highest fertilizer rate remained green until after the first of October. Blackspot in potatoes (No. 1 grade) examined October 12 occurred least with highest fertilizer rate, medium with medium rate, and the most with lowest rate (not market grade potatoes).

In another experiment using vast amounts of fertilizer, yield was still increasing at the highest fertilizer rate—FIGURE 5. Yield of No. 1 grade potatoes increased and then leveled off, but specific gravity was almost unaffected and chip color was actually improved at the higher fertilizer rates.

The same fertilizer application does not always produce the same yield

At very high fertilization, No. 1 yields and gravity held, chip color improved (lower values mean better chip color).

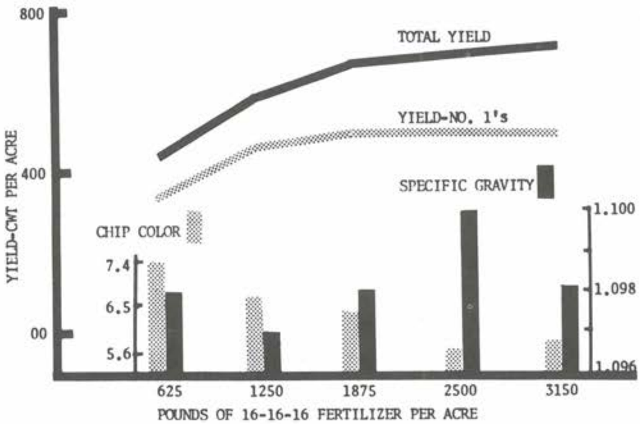


FIGURE 5

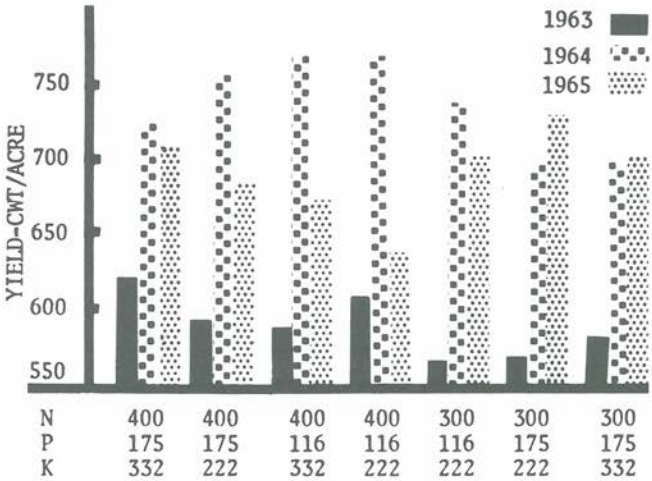


FIGURE 6

Response to same fertilizer treatment can vary—from year to year, field to field, and from practices used.

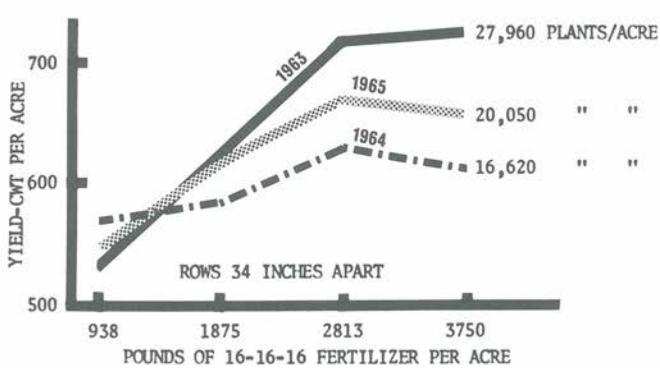
of potatoes. **Growing seasons, soil fertility level, plant populations, and past cropping histories can all influence the response to fertilizer—FIGURE 6.**

1963—BLACK BARS

The 1963 results are the means of eleven replications. Top yield—over 600 cwt. per acre—came from highest fertilizer rate. When potash was reduced, yield declined. When it was restored and phosphorus was reduced, yield remained about the same. When both phosphorus and potash were reduced, yield equalled about the highest fertilizer rate. Reducing nitrogen from 400 to 300 pounds decreased yield at all phosphorus and potash levels.

1964—CHECKERED BARS

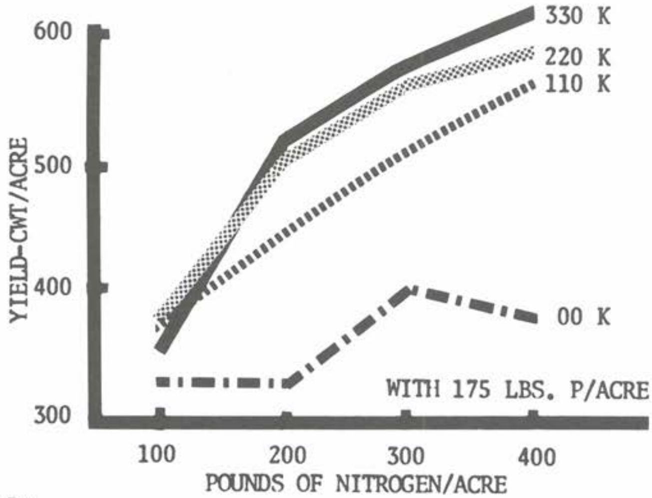
The 1964 experiment was on different land. Each point is the mean of eight replications. Note how 400 pounds per acre of each nutrient produced over 700 cwt. per acre. When nitrogen was maintained at 400 pounds per acre and both phosphorus and potash were reduced, a yield of nearly 750 cwt. per acre was produced. Reducing the nitrogen from 400 to 300 pounds decreased yield regardless of the phosphorus and potassium levels.



Why such yield gaps? The more plants to nourish the more fertilizer for top yields.

FIGURE 7

FIGURE 8



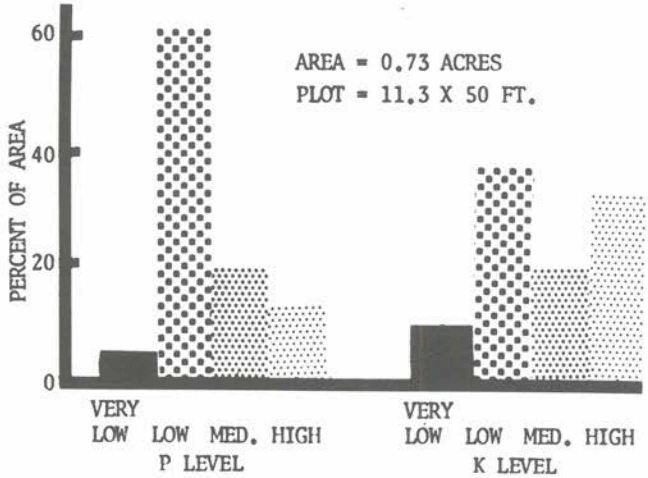
Teamwork: with no potassium (K), nitrogen (N), did little for yields. With plenty K, yield depended on N.

1965—DOTTED BARS

The 1965 experiment was conducted on land which was in alfalfa two years before the trial. Each point is the mean of six replications. When nitrogen, phosphorus, and potash were each used at 400 pounds per acre, yield ran about the same as this treatment in 1964. But in 1965, yield definitely declined when phosphorus and potassium were reduced, and nitrogen was maintained at 400 pounds per acre. The 300 pound per acre nitrogen rate nearly equalled the 400 pound per acre rate, but this experiment was on land its first year out of alfalfa. This 1965 season was shorter than normal, as vines died from frost on September 17. On September 9, vines in the plots receiving 400 pound nitrogen rate were still green. The results would have been different with two more weeks of growth.

PLANTS TO FEED, NOT ACRES TO HARVEST

The large yield differences between 1963, 1964, and 1965 may be traced to different growing seasons and soil fertility levels. But a better



Getting adequate soil samples is often a hard job because of soil differences.

FIGURE 9

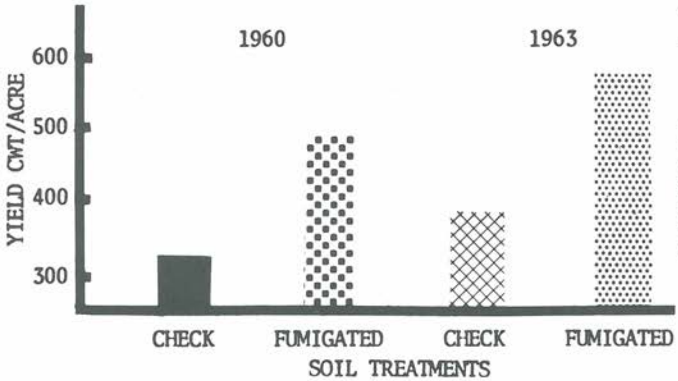


FIGURE 10

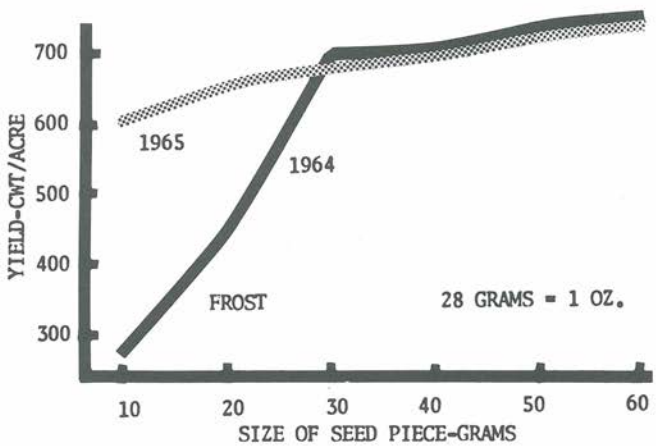
Destroying soil pathogens by fumigation boosted yields unexpectedly.

explanation is that the plants were spaced 11 inches apart in 1963 and 9.2 inches apart in 1964 and 1965. **The greater number of plants per acre needed more fertilizer for top yields—FIGURE 7.**

Plant population affected yield little when only 938 pounds per acre of triple 16 fertilizer was applied—in fact, greatest yield may have occurred with fewest plants. At 1875 pounds of the triple 16 fertilizer per acre, the order reversed, and at 2813 pounds the lines separate. At highest fertilizer rate, yield trend moved up with 27,960 plants per acre and down with lower plant populations. Thus, the farmer must consider plants to feed, not acres to fertilizer.

NOT ONE ALONE

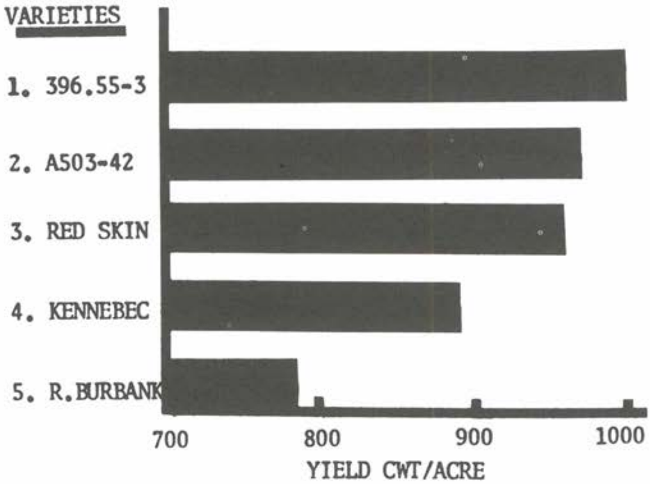
The limiting factors law was illustrated by a nitrogen, phosphorus, and potassium factorial experiment—FIGURE 8. These nutrients were each used at four levels and in all possible combinations with each other. Phosphorus was applied at a high level to remove it as a limiting factor. So, this shows only the effect of nitrogen levels on potassium levels. When nitrogen fertilizer was increased from 100 to 400 pounds per acre, yield failed to increase because potassium controlled the response. Then when high potassium rates were applied, nitrogen became the controlling factor. Only when phosphorus and potassium were adequate did yield climb with in-



The size of potato seed piece planted can affect yield very greatly.

FIGURE 11

FIGURE 12



1,000 cwt. per acre may come with good cultural practices and higher yielding genetics.

creasing nitrogen rates. In this experiment, the influence of the two limiting factors, nitrogen and potassium, depended on relative level of the other.

FERTILIZER BLACKSPOT, WEEDS

Adequate fertilization affects not only potato yield, grade, and quality, but also blackspot and weed control. Usually high potassium rates decrease blackspot severity. Tubers of plants that died prematurely from inadequate fertilization suffer more blackspot than those from vines alive at harvest. When vines die and the foliage no longer shades the soil, weeds begin to grow, often becoming a problem if harvest is delayed.

HOW MUCH FERTILIZER?

How much fertilizer to use? This depends on amount of nutrients the plant can get from the soil.

For the Columbia Basin's heterogeneous soil, no one fertilizer recommendation will serve most cases. This soil accumulates more phosphorus than the plant needs. But potassium is being depleted faster than it is being supplied by fertilizers or released by soil disintegration. Soil testing seems essential to such an area. Although laboratory procedures for soil tests are accurate, the problem lies in obtaining a soil sample representative of the area to be fertilized. Soil differences not only complicate this problem but can even lead to wrong conclusions. Intensive soil sampling studies reveal great differences in both top and second foot of soil. But current soil sampling procedures do not consider the percent of a given area which tests low, medium, or high, nor the available nutrients in the second foot of soil.

The magnitude of the problem is emphasized in FIGURE 9 where nearly three-fourths of an acre was divided into 40 small plots. Twelve cores of soil, 0-12 inches deep, were taken from each plot and composited to make a soil sample for chemical analysis. The large differences in both phosphorus and potassium content show that no single rate of either element would adequately supply the need for either nutrient.

In some parts of the experiment, a single rate would be too low, in others too high. The average phosphorus index was 13.3-12.1, and the average potassium index was 338±123.4. The standard deviations are very large, suggesting a similar index value would rarely be obtained if the field were resampled a second time. Two-thirds of the time the phosphorus index would fall between 1.2 (13.3−12.1) and 25.4 (13.3+12.1), but the recommendation would be greatly different. The other third of the time the index might even be outside the limits prescribed by the standard deviation. The same logic applied to potassium.

Too many times soil tests are used without properly considering the accuracy of the values obtained. This leads to poor yields and lack of confidence in the soil testing service.

There are some areas in the Columbia Basin (probably true in many areas of the world) where good plant nutrition and cultural practices alone do not produce high acre yields because an undetected factor limits response.

In some experiments, destroying soil pathogens by soil fumigation boosted yields greatly and unexpectedly—FIGURE 10.

FIFTY-TON YIELDS NOT IMPOSSIBLE

A few years ago fifty ton (1,000 cwt.) potato yields appeared unrealistic. Tomorrow they will go even higher when growers realize that plants don't just mature and die, but are killed by something or lack of something. To date California has produced 740 and Washington 700 cwt. per acre of potatoes on commercial sized farms.

In a study to determine individual hill production of potatoes, 34 plants growing between adjacent plants were hand harvested and weighed.

If a perfect stand of plants was obtained and each plant produced as indicated in Table 1, 1600 cwt. per acre might be produced.

TABLE 1. THE RELATIONSHIP BETWEEN YIELD PER HILL AND YIELD PER ACRE BASED ON 20,050 PLANTS PER ACRE.[1]

	Lbs. Per Plant	Cwt. Per Acre
Minimum yield per hill	1.27	255
Mean yield per hill	4.31	865
Maximum yield per hill	8.27	1,658

[1] Based on 34 individually harvested hills growing between adjacent plants.

The failure of every plant to produce at 1600 cwt. per acre rate may be partially due to differences in seed size—FIGURE 11. Seed size effect is greater in some years than in others and perhaps for different reasons. Increasing seed size from 10 to 60 grams in 1965 increased yield over 100 cwt. per acre. But large seed pieces produce more stems, demanding more nutrients than small seed pieces. Inadequate fertilizer can limit response to larger seed size. Disease is also part of the problem. In some hills, one or more stems may be dead while the rest are green. Each stem has its own root system and set of tubers.

STEPS TO 50-TON YIELDS

On an experimental basis, 50-ton yields (1000 cwt.) were achieved in a potato variety experiment—FIGURE 12.

The following steps were used:

1—Zinc M-N-S was broadcast and plowed under in Spring.

2—The plowed soil was disked once and firmed with a Cultipacker.
3—Varieties were planted on April 28, the vines were dead by September, and the tubers were dug on October 21.
4—They were fertilized with 350 pounds N, 383 pounds P_2O_5, and 312 pounds K_2O per acre.
5—Alternate furrows were irrigated as needed until July 2, when the experiment was put on a five-day irrigation rotation. On August 5, this was changed to a seven-day, and on September 10 the water was shut off for the season.
6—On June 25, July 7 and 22, plants were dusted with Thiodan and sulfur. On August 23, they were sprayed with Thiodan and Zineb.

TEAMWORK DOES IT

Climatic conditions of the Columbia Basin, high plant nutrient levels, soil pathological problems, plant populations, and seed size—all these are vital to high quality yields. Best results demand good teamwork of all factors.

THE END

POTASH PROTECTS POTATOES

"POTASSIUM is a vital suppressor of diseases and other disorders in potatoes," Dr. R. A. Struchtemeyer of the University of Maine reports in the new American Potash Institute booklet on plant nutrients and disease resistance.

The head of Maine's Plant and Soil Sciences Department cites many areas where research has shown potash reducing black spot, stem end rot, and late blight in potatoes.

California tests showed over 60% black spot infection from potato vines containing 2.4% potassium, but only 28% black spot from vines containing 10 to 12% potassium.

Long Island workers concluded potash may "profoundly affect black spot incidence through its effect on soluble nitrogenous fractions of the tubers." Another New York scientist found "the ratio of top K content and stem-end K directly proportional to the plant's susceptibility to black spot."

African work has shown potash reducing stem end rot from 10.2% on the no-potash plot to only 4% rot on tubers receiving high potash. Both soil and foliar applications of potash helped reduce spotted leaf necrosis and tuber lesions common to potatoes grown in Alaska's Matanuska Valley.

Phosphorus and potassium teamed up to reduce late blight in Maine tests, Dr. Struchtemeyer reports. When nitrogen was increased, late blight rose. When phosphorus and potassium were increased, late blight declined.

"Plant health is a matter of nutrient balance," the Maine scientist concludes.

Single copies of the booklet, FIGHT DISEASE WITH PLANT NUTRIENTS, can be secured through Dept. N, American Potash Institute, 1102 16th St., N. W., Washington, D. C. 20036.

THE 20TH CENTURY has arrived in Kharpudi, India—and not a minute too soon.

If a small American town had a problem that only an elephant could solve, and the elephant suddenly showed up on main street in all its oriental trappings, the consternation would be no greater than in this North-Indian village when the well-drilling rig rumbled into view across their drought-parched fields.

A mundane piece of practicality in its native environment, the rig was mysterious and more than a little fearsome to the idle villagers. They were idle because all activity in Kharpudi had ground to a halt under water shortage.

Water gushes—after a day of drilling, after three years of drought.

"Coconut milk and a power drill will

The village wells were shallow, hand dug. Bedrock lies close under the soil in this part of India. Shovels can reach only water above the rock. All such water sources have been exhausted in three long rainless years.

In Kharpudi, water was rationed. Each family was allowed to draw one pot a day from the only remaining well. In half an hour of painstaking dipping with a hand bucket, a woman could collect a pot of murky brown liquid—for a full day's cooking, drinking, and washing of her family.

Kharpudi's council of elders had met, listless under their bright turbans, and agreed to let the stranger try his magic. The stranger, John McLeod, a Scotch agricultural missionary, appointed a day. And on this morning the grotesque monster was inching into Kharpudi, raising a dusty trail on the sun baked ridge.

No road passes through Kharpudi, but there is an open space on the central high ground among the 200 or so clay-stone cottages of the village. Local wise men advised that a good supply of water lay under that space in a spot near the temple.

John McLeod, knowing the success of his operation depended on the good will of village leaders, went over the ground carefully and agreed to drill in the spot indicated. He would have preferred lower ground. From the rise, they might have to drill 200 feet or more to reach a good water supply.

Kharpudi was the first village in the Jalna area to receive the drill. It was important this first well be achieved smoothly to insure local cooperation of future operations. Such equipment can help overcome India's severe and prolonged drought.

The drilling team guides the rig toward Kharpudi's clustered houses across a barren slope. Dogs bark, chickens scatter before the apparition. From windows and doorways children peer timidly. They have seen bullock carts and bicycles. But this machine is so big it must squeeze carefully between their walls on its journey to the drilling site.

As the crew prepares to hoist the rig and start the drill, the elders step forward to crack a coconut on a rock, spilling its milk over dusty ground. They sprinkle colored powder on the well site and burn incense to insure abundant water.

Then compressors begin to roar and the steel bit cuts into the earth, churning up a fine dust that coats the watchers.

As the day wears on, the crowd thins to a few children and old men. The others return to the few tasks still left to do. One of them is a daily trip by bullock cart to a well three miles away for token water supply, part of a hopeless irrigation effort to produce some harvest from the withered fields.

Just before the drill enters the

A 10-year-old hesitates—amazed at water from a tap. But there it is!

get you a glass of water—and hope"

rock that locks water beyond the reach of village shovels, mud spurts briefly. It does not last long. Through the still, parched afternoon the pneumatic hammer chatters tensely over Kharpudi.

The drill reaches 100 feet, 150. Men sit in the lengthening shadows watching the drill team move around the screaming monster that has occupied their village. It is late. The crew prepares to stop work for the day. The drill reaches 170 feet down.

Suddenly water shoots out around the air hammer. A brief cheer and the drill is brought up, the hole covered. The crew leaves. Silence and doubt descend with night on the village. All day there was great magic-making. But still they have no water to drink.

Early next morning the hole is opened. The chief elder peers down the narrow black opening. Noncommittal, he steps back. Then there is more activity.

A charge of high explosive is lowered into the hole to enlarge the well chamber. A muffled thump announces detonation. The metal lining for the shaft is sunk, and a pump to force the water up. There is much assembling, tinkering, testing.

When the pumphead is installed, village women begin to gather, hopefully carrying water jars. A few strokes of the pump handle bring a fitful splutter, then a steady stream from the tap.

The water is very cold, very clear. The first woman touches the stream that is pouring into her jar. She has pulled water up from the earth in a bucket all of her life. Never until now has water flowed into her jar with such incredible ease.

Children crowd around for a turn at the pump handle, for a sip of the water. Parents look on in a joy tinged with disbelief.

But John McLeod has gone to the next village in this thirsty valley. Another council of elders is about to meet the 20th century. Coconut milk and a power drill will get you a glass of water—and hope.

From Kerygma Features

VAAC

AT WORK WINNING VITAL "SECOND WAR"

LYMAN J. NOORDHOFF
OFFICE OF
INTERNATIONAL EXTENSION
FEDERAL EXTENSION SERVICE
USDA

"THIS JOB is going to push every man for every ability he has—and some he didn't know he had. It's no picnic, 17 hours a day, 7 days a weeks—almost. The men who can stick it out and help mountain-move rural projects to some success will contribute a valuable talent to winning the vital 'second war'."

Warner Smith, just back from six weeks in Vietnam, was describing the tough assignments taken on by the first 13 volunteers in the Vietnam Agricultural Advisory Corps (VAAC). These men are the first step toward President Johnson's goal of "at least one American agricultural adviser available in each of Vietnam's 44 provinces, as these areas are made secure." Their job—to help rebuild Vietnam's war-torn family farms into full and even greater output.

FROM AN IDEA TO 81

"County agents for Vietnam" has grown from only an idea in early 1966 to 81 men now, only 1½ years later. The first 13 started work in Vietnam in mid-March, another 23 began their duty in mid-July, while the remaining 45 should go on the job in early 1968. These 45, incidentally, were requested even before the first 13 began work. *All are volunteers.*

Among the first 42 men, 36 are former Extension county agents or others with such experience from 25 States. The other six are direct-hire employees of AID (Agency for International Development).

Secretary of Agriculture Freeman had recommended the "county agent" plan after his fact-gathering tour with 10 advisers to Vietnam in February 1966. Efficient, productive agriculture, he urged, was just as necessary to achieve stability as military success. Our U.S. Extension system could be one answer, among others, to rebuilding disrupted farms and national food supply. Why not

Human history becomes more and more a race between education and catastrophe.—H. G. Wells.

share our Extension experience more widely, especially where urgently needed? Adapt it to fit needs and conditions in Vietnam. "Help people to help themselves" there, hopefully with similar success as in U.S. for the past 53 years.

As the old Chinese proverb says, "Give a man a fish and he will eat for a day. Teach him to fish and he will eat for the rest of his days."

Quickly full responsibility to make VAAC "go" was assigned to Federal Extension Service, U.S. Department of Agriculture (FES, USDA), cooperating with State Extension Services. Hundreds of details immediately fell onto Dr. Joseph L. Matthews, then just promoted to the newly-created position of Assistant Administrator, International Extension Programs, FES. Later in August, Matthews named Warner Smith, with 10 years of agricultural development experience in the Philippines, as FES coordinator of VAAC.

VAAC is one of five USDA teams going to Vietnam. All are requested and funded by AID. Others staffed by other agencies are irrigation/ag engineering, plant/seed multiplication, credit/coops and forestry. At full strength, USDA manpower will total some 125 men.

BREAKING LANGUAGE BARRIER

Thus, with 36 men now and 81 total, VAAC is (1) the largest USDA team, (2) the only one required to learn Vietnamese language and (3) according to "Time" magazine, the best prepared. After living with the first 13 trainees several days, a "Time" reporter wrote: "Yet it is their language capability, plus their specialized knowledge of tropical agriculture, that will distinguish the county agents as the best prepared workers the U.S. has sent to Vietnam."

As for language, unlike other USDA teams, VAAC'ers work directly with Vietnamese counterparts; they work with these province and district government farm officials, and village leaders and farmers to some extent, to eventually handle the total rural rebuilding task "on their own."

Direct contact is a "must." Present U.S. workers in Vietnam say invariably you lose part of what you want to say when you filter it thru an interpreter, especially your feelings. You get very little understanding, if any, if you can't speak Vietnamese.

So VAAC men spend some 450 hours, half of their 6-months training, struggling to learn Vietnamese. It's one of the five hardest languages in the world. Vietnamese, former tough army men, are brought in as instructors.

In fact, MLAT—Modern Language Aptitude Test—"has been one of the big separators" between applicants and actual trainees. Smith says more than 270 applicants who met minimum qualifications had to be processed to finally find the first 36 volunteers.

Applicants must meet some high qualifications: B.S. degree in agriculture, 5 years of Extension *or similar* experience (SCS, Vo-Ag, FHA, PCA, co-op, agribusiness, etc.), superior references, excellent health, emotionally stable, passing score on language aptitude test, clearance on full field security investigation—and above all, proven ability to work as team members.

FACING TOUGH DUTIES

VAAC standards are tough because the men are assigned some tough duties.

One of Al Bjergo's great challenges is to help unkink the credit system for thousands of small rice growers in **KIEN GIANG PROVINCE.** Also help farmer marketing associations get to working smoothly. Both are part of a total, integrated province agricultural program. Potentially rice-rich, Kien Giang rates top priority among all 44 provinces. Rice, vegetables and fish offer great possibilities for larger output. Too little credit, too late, or none at all have hampered all growers, since they all depend on credit. It's one of Al's jobs, working with province officials, to change that.

TUYEN DUC PROVINCE, top commercial fresh vegetable area, gives Charles Brown, Rutland, Vermont, considerable work in insect and plant disease control. (Also marketing). Concentrated production areas always invite insect and disease build-ups and large crop losses. Brown's 1½ years of experience in Lebanon-Iran-Afghanistan, plus some 5 years in U.S., fit him well to gain the upper hand against vegetable pests and help save more for Vietnamese to eat.

In **PHUOC LONG PROVINCE,** Carmelo Sanchez from Puerto Rico needs to change farming methods of displaced Montagnards from a slash-and-burn system into stable, long-term methods. That is, increase food supplies from strictly family needs to much larger production-for-sale. Especially rice and vegetables. Helping people make changes like these is never simple.

QUANG DUC rates high priority for VAAC support because of rich, undeveloped forests. They contain seven of the most valuable woods in all Vietnam. There are plenty of trees, they're badly needed, yet lumber is scarce. Trouble is most forests are controlled by Vietcong. So Noble Dean, the only forestry-trained VAAC'er, drew the job of helping South Vietnamese make best use of forests they have. It's up to him and Vietnamese co-workers to correct the lumber shortage. (Moreover, in his immediate area there are 6,500 displaced persons).

But Noble, like all VAAC'ers, doesn't stop there. Less than seven weeks after reaching Quang Duc, he writes, "I'm involved in designing dams, irrigation and drainage, gardening, sawmill operations, poultry, swine and fruit production." Some start isn't it?

Bobby Dodd, New York Stater assigned to **GIA DINH PROVINCE** surrounding Saigon, writes, "One of my main projects . . . is working with (Vietnamese) Agricultural Service Chief to increase vegetable production. The main problem is supplying enough water during the 6-month dry season now ending (April). We're looking into possibilities of deep-well drilling and irrigation now and hope to get a 15-hectare (37½-acre) pilot project started soon."

TOP QUALITY TRAINING

For assignments like these, training must be top quality. Besides language training, VAAC'ers learn tropical agriculture and human relations at the University of Florida and Vietnamese cultural-economic-political conditions, present food-increase work abroad—and even home economics—in Washington, D.C. Then for the climax, they literally "get their feet muddy" during a month of intensive field training in rice production in the Philippines and Taiwan.

Teamwork is stressed heavily during training. Each of the three VAAC groups trains as a team Stateside and enroute to Vietnam; when assigned to a province there, each man joins the total U.S. Civilian reconstruction team. He's also part of the five USDA teams, with full USDA resources at his call for backstop technical aid—and he's still a VAAC team member working alongside Vietnamese partners. There's no place for a "loner" in

VAAC.

Concerning training, Noble Dean writes, "I want to declare . . . the training as most worthwhile . . . My library is the authoritative guide here in agriculture already. I can handle almost all problems that come up, even to the incubation period of ducks."

VAAC is one effort among possibly thousands worldwide to boost food supplies. (The other side of this coin is population control). Judge how serious conditions are worldwide from these statements:

. . . One pair of hands in U.S. or Australia feeds about 34 mouths. One pair of hands in many developing countries just doesn't feed even one mouth.—George Mulgrue, FAO.

. . . "The Bihar state government (in India) today declared a state of famine (in areas) where more than 12 million persons are desperately short of food and water. . . . This was the first famine declaration by a state government since India became independent 20 years ago." Bihar has suffered worst of 16 states from drouth for two successive years.—Washington Post Foreign Service and Reuters, April 19, 1967.

. . . Commonly in developing countries, one-third to one-half of all food grown rots or is lost before hungry people can eat it.—F. P. Mehrlich, Columbia Journal of World Commerce, January-February 1967.

. . . "An estimated 300 to 500 million people are locked in desperate, hourly struggle against famine. Another 1½ billion are undernourished." USDA Secretary Freeman. (World population is right at 3.4 billion).

. . . "If the hungry of the world lined up outside your door, the line would stretch around the world 25 times!"—Catholic relief agency.

. . . "Not too long ago we were saying we had 15 or 20 years to solve the world food problem. But it now appears that we have much less time . . . a massive famine . . . conceivably might come if the world does not move quickly to mobilize the necessary resources. . . . Time is the critical new dimension. . . ."—Les Brown, USDA world food authority.

. . . "The transition from traditional to modern agriculture, which must be achieved within the next decade and a half, will require more change in human behavior, in a shorter time, than has ever before been achieved."—Les Brown, USDA world food authority.

SOME HAVE LIFTED THEMSELVES

Despite widespread crises and the worst human agony, some nations have lifted themselves by their bootstraps.

Like Mexico (with $11 million Rockefeller Foundation aid and cooperation since 1941). Since 1943 food output has doubled for wheat, corn, beans, broilers and eggs—and the end is not in sight. Mexico could stop importing wheat in 1956 for the first time in history. And she began exporting wheat in 1964. Between 1942 and 1964 average wheat yields more than tripled—from 11 bushels/acre to 39 bushels—and total output went up 6½ times.

Corn no longer is in deficit supply. Nutritionally, 20 years ago, Mexico's 21 million people averaged 1,700 calories/day. Today her 37 million people average 2,700 calories from a more varied diet with more and more animal protein.

Nor is Mexico alone. She is one of 12 fast-advancing nations found from a USDA study of 26 developing nations. The study reports, **"Between 1948 and 1963, 12 of these nations had compounded rates of increase in crop output of more than 4% per year. These rates surpassed those ever achieved by now economically advanced nations. . . ." The**

other 11 are Sudan, Costa Rica, Philippines, Tanganyika, Yugoslavia, Taiwan, Turkey, Venezuela, Thailand, Brazil and Israel.

Even in drought-plagued India, some districts **where water is available** have produced outstanding gains. One district, with more people than many nations, averaged 10% larger yields each year during 1953-65. Two others with 700,000 farms achieved growth rates of 8%, considered very high.

FERTILIZER A VITAL TOOL

Fast growing areas, of course, use best-available agricultural know-how, including fertilizer. Among less-developed countries, there's tremendous potential for larger fertilizer use. USDA estimates that current yearly fertilizer use of 7 million tons in less-developed nations must climb to 47 million tons in 1980. At $150 per ton, this prospective market could well expand from its present $1 billion per year to at least $7 billion 15 years hence. This volume would still be far from ideal.

Drab failure and buoyant success live side by side today in our world. VAAC'ers surely will do all they humanly can to help the hungry feed themselves. So will thousands of other people, groups and governments. The widening gap between haves and have-nots must be narrowed, even closed.

As a great American, John F. Kennedy, once said:

"To those people in the huts and villages of half the globe struggling to break the bonds of mass misery, we pledge our best efforts to help them help themselves, for whatever period is required—not because the communists may be doing it, not because we seek their votes, but because it is right. If a free society cannot help the many who are poor, it cannot save the few who are rich."

THE END

HIS FACE was the West: open, craggy, restless with pursuit. For nearly 40 years, he pursued the need for potash on countless crops and soils, from the sugar beet flats of Colorado through the vast valleylands of California to the soft green hills of Oregon.

The quest, at last, is over for Millard E. McCollam, former Western Director of the American Potash Institute. He slipped into a coma at San Jose, in his sleep by his mate of 46 years. He died shortly after as springtime crept softly up the Sierras.

After a 2-weeks tour of California agriculture, two plane-loads of Carolinians once exclaimed: What water-use! What variety and dedication to crop quality! What streamlined marketing! What PEOPLE! They asked one grower how he did it, such yields and quality? He replied simply, "We produce more for less, and make it better".

No pompous scientific gobbledegook here. Just the MORE plus BETTER idea expressed years ago by the type farmer who welcomed the open-collared science of Mac McCollam—searching the groves for leaves cupped in tell-tale hunger, reaching behind small green fruit for sample leaves to test nutrient needs.

Millard McCollam began searching the potash needs of the arid West in a day when some scientists said potash was not needed—"now nor 1,000 years from now." That was in 1928. He used two tools in this pursuit—leaf analysis and scientific honesty. Both paid off—for potash and for himself.

He brought professionalism to commercial science. He was a professional scientist in the fullest sense: dedicated to facts, as objective as human men-

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tality can be in accepting the facts, meticulously honest. And to seal his professionalism, he worked like a brother scientist with university specialists, encouraging his Institute to support nutrition research at major universities.

Within a short time, the skeptics had reduced the time potash would be needed—down to 100 years. And . . . then . . . they were using it because they were finding some needs, not only to insure higher yielding crops, but also to improve the quality of those crops.

McCollam not only brought professionalism to his work. He also brought personal character that radiated courage. He would bring his differences to the FACE of a person or organization with which he had a bone to pick. Millard McCollam never hid behind a paper-piled desk, squirming in cowardly inferences about personalities or theories he didn't hold to. He walked gut-first into many valley orchards and fields with official scientists to conclude, "This crop needs potash —that crop does NOT need it." And they believed him because he was that kind of man.

Of course, it took much testing and re-testing. But the point here is that Mac always called a spade a spade. Yet, he was not a contentious man. He was too busy, too happy in his work to be contentious.

He was full of creative ideas that no academic degrees or titles or positions can give a man, that only natural talent can bring. The plant food industry, the universities, and the people of the West put those talents to work in many ways:

. . . as an early scientist with the Bureaus of Plant Industry and Chemistry, with the Washington State Experiment Station before joining Potash.

. . . as long-time Chairman of the powerful California Fertilizer Association's Soil Improvement Committee and a prime mover in developing a similar group for the Pacific Northwest.

. . . as an author for farm journals and sometimes university bulletins.

. . . as a member of many state and national scientific bodies, including a national committee on fertilizer application.

. . . as a long-time member of the San Jose School Board and High School Board.

Such a man—and character—played no small role in building the $3.8 billion-a-year agricultural industry California now claims. Such a man worked right down in the rows teaching the kind of efficiency that could produce 37% of the vegetables and fruit sold in the U.S.!

Even so—such credentials, such statistics seem pale to the memory of one just departed on the Great Adventure.

But on a well-groomed street of San Jose, one credential shines brilliantly: The Millard E. McCollam Public School to which bright-faced children trip each morning to develop their minds and hopefully their characters with the same spirit Mac McCollam left the West.

Potash has lost a fine scientist. The West has lost a civic-building citizen, now gone to join the stalwarts who opened the Sierra gaps for the less rugged to follow and prosper in the valleys below. They will surely recognize their kind of man.

THE END

BE AN EARLY BIRD . . . GET THE WORM

The worm we're talking about is RESPONSE to the Year-Round Fertilization idea. Do you have the tools (educational evidence) to support Fall-Winter Fertilization. Facts favor it! The American Potash Institute is constantly developing the facts into educational tools you can use. Order samples from the list below. Look 'em over. Then order quantity supplies at least 3 weeks before you need materials. BETTER CROPS will feature a special Year-Round Section in its next issue. Be an early bird . . . start building responses NOW.

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Beat The Weather: Fertilize This Fall (Color Folder)	3¢	______	______
Facts Favor Fall-Winter Fertilization (Color Folder)	3¢	______	______
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