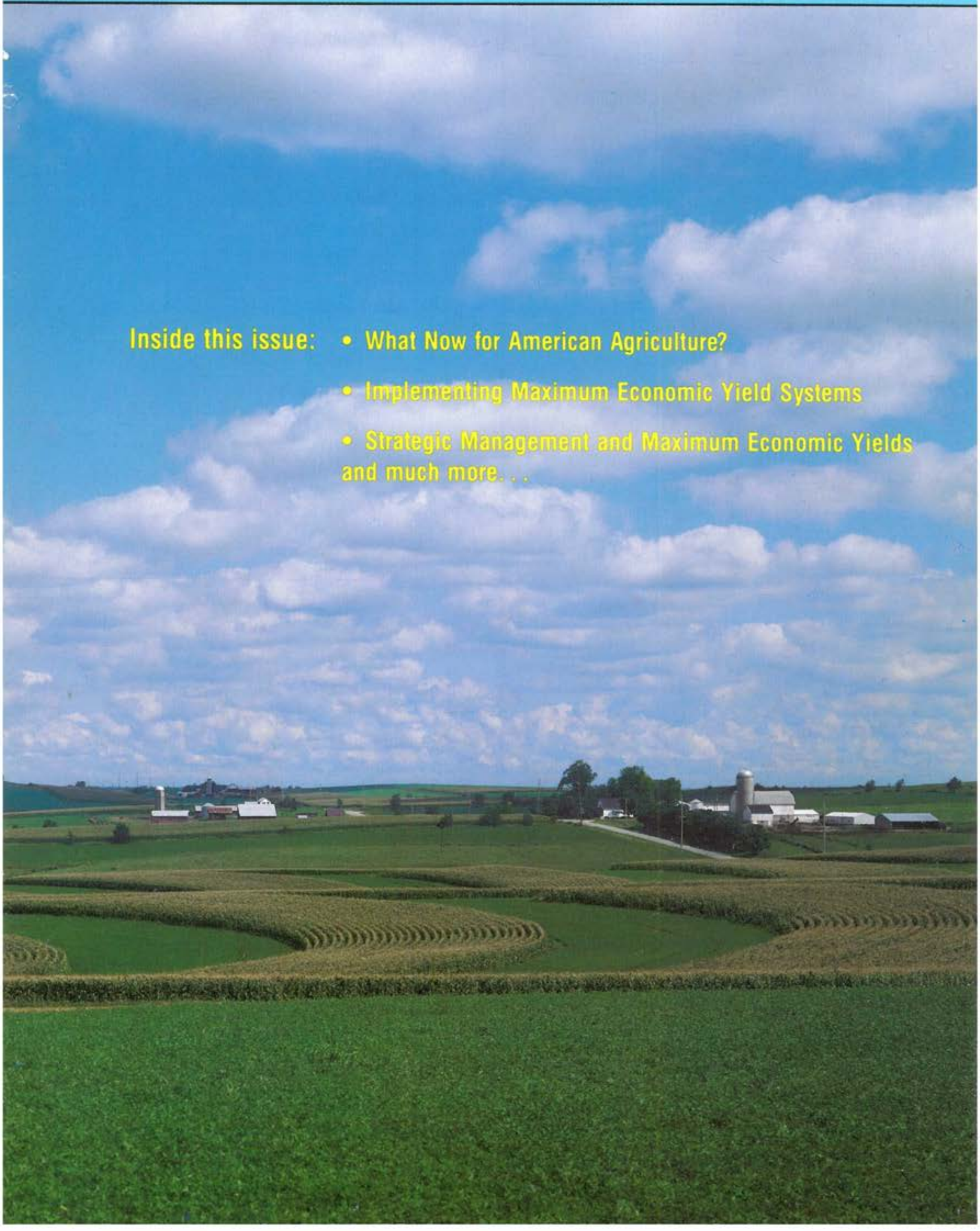
BETTER CROPS

with plant food

Winter 1985-86

RESEARCH EDUCATION



Inside this issue:

- What Now for American Agriculture?
- Implementing Maximum Economic Yield Systems
- Strategic Management and Maximum Economic Yields

and much more. . .

BETTER CROPS with plant food

Editors: Don Armstrong, Bill Agerton, and Santford Martin
Assistant Editor: Selma Bushman
Circulation Mgr.: Barbara Martin

Vol. LXX (70) Winter 1985-86

BETTER CROPS WITH PLANT FOOD (ISSN: 0006-0089, USPS: 396850) is published quarterly by Potash & Phosphate Institute. Subscription price $5.00 per year or $1.25 per issue. Second Class postage paid at Atlanta, GA. **Postmaster:** Send address changes to Potash & Phosphate Institute, 2801 Buford Hwy., N.E., Suite 401, Atlanta, GA 30329. Phone (404) 634-4274.

Contents

Our cover: The beautiful farm scene on our cover is near Mineral Point, Wisconsin. The photo is by J.C. Allen & Son.

THE DISTINGUISHED SERVICE AWARD in Agriculture was presented by Dr. Duane Acker (left) President of Kansas State University, to Dr. R.E. Wagner, President of PPI and FAR.

The award recognizes individuals who have made outstanding contributions to a professional field or in public service related to agriculture.

The article which follows is adapted from Dr. Wagner's statement at the time of the Kansas State University awards luncheon.

What Now for American Agriculture?

By R.E. Wagner

Maximum economic yield (MEY) management holds opportunity for farmers who intend to stay in business.

MEETING THE FOOD NEEDS of an increasing global population has been and remains a challenging and noble goal. For much of the world, the problem is the inability to pay for food or to distribute it to those who need it most.

The great need is for lower unit costs of production so farmers can make money at market-clearing levels, which even developing countries can afford as they work to feed their people better.

There is likelihood of long-term global pressures on farm commodity prices. If so, U.S. farmers will have to learn to compete in a sustained low price economy. . .where there will be a high premium on sound management practices.

More Exports an Imperative

An imperative in American agriculture is that we regain a greater share of the export market. Nearly two out of five crop acres in the United States depend on it. We need a firm commitment to exports through national policy and practice.

Repeated and ill-advised embargoes, the high value of the U.S. dollar, high interest rates, and high loan and target prices have been devastating to U.S. agricultural exports. . .dropping from $43.8 billion in 1981 to a projected $33.5 billion in 1985. Net farm income during that same period dropped from $31 billion in 1981 to a projected $20 billion in 1985. In the past decade total U.S. farm debt rose by 193%.

Market-Clearing Prices Needed

Competitive "market-clearing" pricing of U.S. farm products would be the biggest help to our export dilemma. For example, August 1985 international commodity prices showed U.S. rice price was 105% above that of competitors; wheat price was 30% higher; cotton 19%; corn 17%; and soybeans 7%.

Improvement in the U.S. price-competitive position will not happen with acreage restrictions nor with high loan and target prices. There is the argument that the U.S. would be better advised to use subsidies or credits to build its markets rather than to control production. **(continued on next page)**

Dr. Wagner is President of the Potash & Phosphate Institute (PPI) and the Foundation for Agronomic Research (FAR), Atlanta, GA.

In a fiercely competitive market, high price won't sell. Neither is it good for economically depressed economies where food needs are greatest.

MEY. . . Its Low Unit Costs

What options do farmers have? Yes, they can become more efficient even at current yield levels. But that won't be enough, given the coming keen competition among all components of global agriculture. American farmers need the kind of giant step that high yields can give to cost effectiveness in agriculture.

The one option that is most logical and perhaps the only one for much of the world is to move to maximum economic yield (MEY) agriculture. . .with its **low unit cost** hallmark. The ability to yield economic highs in crop production will be crucial.

What Is MEY?

What do we really mean by MEY? It is simply that yield which gives the highest possible net return per acre or per hectare. It is a specific point on the yield curve. . . not just any high yield which might or might not maximize returns. It happens that MEY is usually very close to maximum. . .within 5 or 10%. . . but never maximum. Maximum is for research. Economic maximum is for farmers.

High yield levels drop unit costs so farmers can produce a bushel or a ton of corn or wheat or soybeans at least cost.

High Yields, Low Unit Costs Go Hand in Hand

An important point to be made is that MEY does not mean **low input cost per acre.** In fact it usually means **higher** per acre costs because high yields to the maximum economic level can require more fertilizer and other inputs than most farmers now use.

The Magic of Biotechnology

The research component of American agriculture has had the attention of the world's scientific community for years. Recently the strength of that research was brought into question as public funding declined and with it, perhaps, some fuzzing of the focus on problems and opportunities in production agriculture that are of economic significance to farmers.

The magic of biotechnology has caught agriculture's attention. Because it focuses on the single cell, whether plant, animal or microorganism, it has exciting potential. In-place commitment by agribusiness already is a multibillion dollar investment.

Many argue that agricultural research has been in the business of biotechnology since its inception. . .admittedly, with less sophistication of methods and techniques. Scientists caution that much of the payoff from the "new" biotechnology will be long term, particularly in the engineering of the genetics of higher plants.

The MYR Opportunity

Meantime, though, farmers are hurting. Research other than that in the modern biotechnology sense has the potential to make a positive difference in a relatively short time with little or no input from the "new" biotechnology. I speak of the **maximum yield research** (MYR) opportunity. The goal is to establish yield potential of agricultural areas of the world and to get the kind of data from which full response curves can be drawn. The curves can be used to identify the point of maximum **economic** yield or other points below MEY that might be useful for one with limited resources but who wants to take the first step on his way to MEY.

In just 5 years, maximum yield researchers have compiled an impressive record reaching 338 bu/A of corn, 118 bu/A of soybeans, and 182 bu/A of wheat. These levels are three times the U.S. averages. . . more than that in the case of wheat.

Such yields are neither accidents nor freaks. They can be put back to back. New Jersey researcher Dr. Roy Flannery. . .a real pioneer in MYR. . .achieved a 5-year average of 307 bu/A of corn. Truly, these are super yields.

The U.S. no longer has a monopoly on MYR/MEY. In fact, the most exciting part of the MEY movement in many ways is the acceptance it is getting in developing nations. PPI and FAR are funding MYR or are otherwise involved with MEY in China, Brazil, India, Philippines, Peru, Ecuador, Bangladesh, Indonesia, and Malaysia. Brazil, for example, is making real progress. Researchers report yields of corn and wheat that are five times the average.

Positive Interactions Among Components of the MYR Package

A fundamental objective of maximum yield research is to build systems in which components of an integrated package of management practices interact positively. Key components of these multidisciplinary systems go far beyond plant nutrients (major, secondary, and micronutrients) to include such things as genetics or varieties, pesticides and other chemicals, lime, tillage and residue management, plant spacing and population, timeliness of operations, fertilizer placement and water management. Indeed, much more than in the days of lesser yields, failure to use the "total package" approach at favorable input levels in research opens to question the validity of the results.

Positive interactions occur when the response to two or more inputs used together is greater than the sum of their individual responses.

Dr. G.W. Cooke, recently retired chief scientific officer of Britain's Agricultural Research Council, says in his book *Fertilizing for Maximum Yields:* "In a highly developed agriculture large increases in yield potential will mostly come from interaction effects. Farmers must be ready to test all new advances that may raise yield potentials of their crops and be prepared to try combinations of two or more practices."

More Basic Research

As MYR progresses, it becomes more apparent that basic studies will be needed to unravel some of the mysteries to yield barriers. Biotech will help. Physiological studies of metabolism and nutrient and food transport in the dynamic system of rapidly growing plants have moved to high priority as those plants are pressured to grow and produce at levels unheard of only a decade ago, or even five years ago.

With the vast changes taking place above ground in the physiology of plants in high yield environments, much needs to be learned about what is going on underground.

Technology Transfer at Work

Another deterrent to still more rapid farmer adoption of MEY is that too many feel it can be done by academics on small research plots, but not practically and economically by farmers. In some ways this is the greatest barrier of all. It will take a lot of working with farmers to show them how much better off they can be and to help them understand what is involved in the system and to get them convinced and comfortable with it.

In 1980, North Carolina State University (with encouragement and some financial assistance from PPI and FAR) launched a maximum yield research study with corn, later including soybeans and wheat. Results have been so exciting that they are anxious to transfer them directly to the farm, and have just started to do that.

The unique feature of this program is that recommendations in the delivery system will be based on **maximum yield research** results. They will not be burdened with an over-infusion of results from average-yield studies, which can be of questionable value or even highly misleading. Recommendations will be in constant update and fine tuning as the ongoing research phase generates new and better findings.

The one thing that does stand out and seems clear is that agriculture of the future must embrace MEY. Whether there are crop surpluses, or whether food is in short supply; whether we will get export markets re-opened to the U.S., or whether we let our position erode further; whether agriculture is controlled and subsidized, or whether it returns to the private enterprise system; or whether it all ends up somewhere in between. . . I submit that MEY is the essential ingredient for farmers who intend to stay in business. ■

Implementing Maximum Economic Yield (MEY) Systems

This unique workshop served as a forum to bring together information and ideas to implement maximum economic yield systems.

MORE THAN 200 crop consultants, industry and university agronomists, professional farm managers, agricultural economists and others recently participated in a special workshop on "Implementing Maximum Economic Yield (MEY) Systems." The program in St. Louis, Missouri, attracted individuals from 26 states, Canada, and Mexico.

The three-day meeting (November 12-14) was designed as a working session in which participants analyzed actual farm situations, considered management alternatives that might increase profits, and developed hypothetical, composite plans. Computer programs aided in projecting the outcome of various plans.

The workshop was sponsored by the Potash & Phosphate Institute (PPI) and the Foundation for Agronomic Research (FAR). Dr. Harold F. Reetz, Jr., PPI Southcentral Director, served as coordinator.

"This workshop represents a major milestone in moving the maximum economic yield philosophy into action," emphasized Dr. R.E. Wagner, President of PPI and FAR. "We've gathered research information and experience with maximum yield research for more than five years. Now we're beginning to implement management systems that will help farmers make a profit by keeping **unit cost of production low."**

Format for the meeting included general sessions with presentations by specialists in various subject areas. Smaller group sessions allowed more time for discussion and strategy planning. Following are some key comments from speakers during the program.

- **Dr. Steve Sonka, University of Illinois agricultural economist:**
"International economic trends and forecasts of future conditions mandate that farmers adapt their management systems to be profitable. The maximum economic yield approach is an appropriate part of the strategic management philosophy. It offers an important opportunity for producers to more effectively manage for the future." (See related article on page 8 of this issue.)

- **Dr. Robert G. Hoeft, University of Illinois agronomist:**
"A maximum economic yield system supplies nitrogen (N) to the corn plant in the correct form, at the time needed, and at the proper rate. Higher yields are possible only when good N management is combined with improvements in all phases of the production system."

- **Dr. Dave Mengel, Purdue University agronomist:**
"Potassium (K) management in maximum economic yield systems requires some work. Soil testing is still the key, but we may want to look at more than the exchangeable K level of the plow layer. Cation exchange capacity (CEC) will provide insight into the mobility of K. Sampling deeper in the profile in low CEC soils will tell if K may be accumulating in areas other than the tillage zone."

SMALL GROUP sessions such as this one during the workshop gave participants the opportunity to consider alternative management plans.

- **Mr. Don Griffith, Purdue University agronomist:**

"The tillage system can have a major effect on maximum economic yield. Both output (yield) and input (cost) factors in the net profit equation often change when farmers switch from conventional to very reduced tillage systems such as no-till or ridge plant."

- **Mr. Marty Thornton, Vice President and Senior Farm Manager, Peoples Bank of Bloomington, Bloomington, Illinois:**

"While the 'cutback' approach to farm management has received much attention, lenders and farm managers must look closely at cash flow and return on investment. Managing for maximum economic yield encourages the positive interaction of inputs which can increase the cash generated from a farm."

- **Dr. Fred Welch, University of Illinois agronomist:**

"There will always be risks in crop production, but the grower can reduce some risks through management. The immobile nature of P and K allows them to be built-up in soils by addition of fertilizer. The risk of these nutrients limiting crop yields (and profits) can be reduced to a low level."

- **Mr. Waddy Garrett, Alliance Agronomics, Mechanicsville, Virginia:**

"A fertilizer/chemical dealer faces three major challenges in putting intensive farm management into practice. First, he must identify the requirements for a successful program. Second, he must have the proper resources to implement the program. Third, the value of the program must be established with farmer-customers."

- **Mr. Ron Olson, Top-Soil Testing Service, Frankfort, Illinois:**

"Integration is the key to making maximum economic yield systems work. That means following a definite plan to bring together the many components of crop production. This process is as unique as each individual farm is unique. It takes desire and effort on the part of the farmer and those working with him to implement maximum economic yield management." ■

Strategic Management and Maximum Economic Yield (MEY)

By Steven T. Sonka and Steven L. Hofing

Tomorrow's farmer, even more than today's, will need an adaptable management system for profitability. The maximum economic yield (MEY) approach has growing importance in that environment.

TODAY'S AGRICULTURAL ECONOMY is undergoing a period of severe financial stress. There are many causal factors that have contributed to these problems, including the rapidly changing economic conditions facing agricultural producers. Indeed analysis of our agricultural conditions over the last 50 years shows a relatively steadily increasing level of uncertainty and volatility within the agricultural economy.

Although these rapid changes have been identified as contributors to our farm problems, there has been much less recognition of the relationship between changing economic conditions and the appropriate management style that individual farmers need to adopt. This article has two objectives:

- To explore the concept of strategic management as it relates to agricultural management in turbulent times and
- To consider the Maximum Economic Yield (MEY) concept as a specific response consistent with the need for more effective management styles in farming.

What is Strategic Management?

Strategic management is the process of managing a firm's relationship with its environment. Instead of focusing solely on the firm's internal practices, strategic management requires that the manager consider the firm's internal practices relative to the external conditions within which the firm is operating. Those external conditions are often referred to as the firm's environment. In this context the firm's environment includes all those forces—physical, social, legal, and economic—that can impact on the firm's performance.

A major benefit of the strategic management concept is its orientation to external events and their impact on the firm. But this concept must not be interpreted as implying that internal practices are unimportant. The overriding theme of strategic management is consistency, especially consistency of the firm's environment and its planning, control and implementation processes.

The concept of "environmental turbulence" is closely related to that of strategic management. Turbulence refers to the changeability of a firm's operating environment. Environmental turbulence is characterized in two dimensions:

1. By the speed at which changes occur;
2. By the degree of novelty associated with the changing conditions.

The phenomena of an increasingly turbulent environment is occurring thoughout the economy. Indeed some scholars have successfully documented similar increases in turbulence throughout the nations of the Western World.

Dr. Sonka is Professor of Agriculture Economics, University of Illinois at Urbana-Champaign. Mr. Hofing is Managing Partner, Agricultural Education and Consulting, Champaign, IL.

How Does MEY Fit?

The maximum economic yield (MEY) concept involves primarily operating decisions. Yet adoption of MEY is a strategic decision and one of potentially major significance. Implicitly a commitment to use of the MEY concept is a decision to pursue an intensive management philosophy.

Agriculture in the last 40 years has been rapidly proceeding through an industrialization phase. Adoption of inputs based on science and engineering was a key element of successful management. In that environment, information could be delivered in the form of recommendations that were appropriate for many producers over several years. Given the financial environment, producers chose the strategy of controlling larger acreages as a means to achieve a long run goal of increasing net worth. This strategy served many producers well over the 1950's, 1960's, and 1970's.

If we believe that a turbulent environment is likely to persist in the future, however, the rigid recommendation-based approach to management may *not* be desirable.

Table 1 illustrates this concept for financial management. Our goal in this example was to evaluate the effect of the leverage decision. Based on actual farm record data for central Illinois, two hypothetical farms were created. These firms were almost identical. The same production, marketing and investment decisions were assumed to have been made on each. Only the initial debt-to-asset ratio was assumed to be different.

Table 1. Results of alternative financial strategies over the periods 1972-77 and 1979-83.

Initial debt-to-asset ratio (%)	Results after 5 years of operation: Change in net worth	Results after 5 years of operation: Average annual rate of return to equity
	1972-77 Period	
25	+13%	+20%
75	+20%	+54%
	1979-83 Period	
25	+3%	+2%
75	-35%	-9%

The results of this experiment for the 1972-77 period suggest that the most appropriate strategy in that period was to be more aggressive with respect to the use of debt. If we compare those results with the data for the later period, however, we see the importance of matching strategies to the overall environment within which the firm operates. The same strategy that was successful only a few years previously had disastrous consequences in the differing environmental conditions of 1979-83.

In more turbulent environments, what types of strategies are likely to be more successful? In general terms, our rigid recommendation based approaches are likely to be replaced by flexible, adaptive strategies that can react more quickly to changes in the environment. The need to adopt innovative technologies is likely to continue to be important. Economic goals will need to be much more focused on short term profitability and feasibility as well as longer run net worth. Economic efficiency will be critically important but the producer's focus will need to consider efficient management of individual subunits of the operation as well as the firm's overall performance.

The MEY concept is well-suited to this environment. The MEY goal attempts to maximize expected profits. But in doing so recognition is given to the need for input decisions to be flexible to achieve that goal. The MEY approach requires intensive management to tailor production choices to differing soil conditions, management abilities, and economic conditions.

Conclusion

As the environment in which agricultural firms operate becomes more turbulent, management styles also must adapt. The concept of strategic management explicitly considers the need for the firm to manage its relationship with its environment. The MEY approach is an appropriate component to consider as a strategic management option. As such, it represents an important opportunity for producers to more effectively manage for the future. ■

Adequate P and K Levels Reduce Doublecrop Soybean Stand Loss

By Fred Rhoads

Doublecrop soybean yields are reduced by both weed competition and stand loss. Florida researchers encourage a combination of weed control and fertility practices that maximize yield and profit.

CONSERVATION TILLAGE reduces the time between wheat harvest and planting doublecrop soybeans. This is important in order to take advantage of available soil moisture for seed germination. Conservation tillage also offers the advantage of planting sooner after rainfall in comparison to situations where rain occurs between seedbed preparation and planting.

If weed control at planting is inadequate due to low rates of preplant herbicides, a post-directed herbicide application is required to prevent yield loss from weed competition. Successful post-directed weed control depends on uniform plant growth so there are no small plants to be damaged from spray drift beneath sprayer shields.

Non-uniform fertilizer application can cause non-uniformity in plant size and result in killed plants from post-directed herbicides. In fields where fertilizer nutrients are deficient, crop plants may not grow large enough for successful weed control with post-directed sprays.

In a 1985 experiment at the North Florida Research and Education Center, we studied the effect of phosphorus (P) and potassium (K) fertilization on percent-kill of two soybean varieties after post-directed Paraquat was applied to protect the crop.

Under the conditions of this study, we found that stand loss with high levels of P and K was low enough that replanting would not be justified. However, with low residual soil levels of P and K, replanting was necessary to reduce yield loss due to poor stand. Some yield loss is expected because of late planting, but it is not in the range of 60% as would be the case with a 60% stand loss **plus** weakened surviving plants. Following are more details of the experiment.

Materials and Methods

Two soybean varieties (Davis and Cobb) were planted on June 6, 1985, following wheat, using a subsoiler under the row with a row till attachment. Paraquat (1 pt/A) and Surflan (1 lb/A a.i.) were applied preplant to kill existing grass and weeds and control grasses while the crop was in the seedling stage. Grass and weeds were not controlled.

For post-emergence control, Fusilade (1 pt/A) was applied on June 24, 1985. Paraquat (2 pts/A) and Lasso (2 lb/A a.i.) were applied as a post-directed spray with shields to protect the crop on July 12, 1985. A second application of Paraquat (2 pts/A) was applied as a post directed spray on July 15, 1985.

There were four levels of P_2O_5 (0, 60, 120, and 240 lb/A), three levels of K_2O (0, 225, and 450 lb/A), and three levels of MgO (0, 100, and 200 lb/A) fertilizer treatments applied to the wheat in the fall of 1984. No fertilizer was applied directly to the soybeans.

Results

Acceptable weed control was achieved after the last application of herbicide, but

Dr. Rhoads is a Soil Scientist located at the North Florida Research and Education Center, Route 3, Box 4370, Quincy, FL 32351.

Table 1. Effect of P_2O_5 fertilization on percent of soybean plants killed with a post-directed herbicide.

Variety	P_2O_5 (lb/A) 0	60	120	240
	% killed			
Davis	63	46	33	29
Cobb	63	32	36	21

Table 2. Effect of K_2O fertilization on percent of soybean plants killed with a post-directed herbicide.

Variety	K_2O (lb/A) 0	225	450
	% killed		
Davis	62	30	33
Cobb	61	37	36

the percent of soybean plants killed was quite high in some cases. The highest percent-kill occurred with no P and K fertilizer **(Tables 1 and 2).** The lowest percent of plants killed occurred with the highest fertilizer levels of P and K. A significant (probability $\leq$ 5%) negative correlation between % killed plants and fertilizer P and K levels was found.

Percent of plants killed was higher with zero Mg than with 100 or 200 lb/A rate of MgO. However, the lowest percent killed occurred at 100 lb/A for Davis variety and at 200 lb/A Mg0 for Cobb variety.

Summary

Stand loss due to post-directed herbicides in conservation tillage soybeans can be minimized by following a fertility program that provides adequate levels of P, K, and Mg. The need for post-directed herbicides can be reduced by using the highest recommended rate of Paraquat at planting. ■

THIS SOYBEAN PLOT received no phosphate or potash.

PHOSPHATE (120 lb/A) and potash improved the stand and growth in this plot.

Here's How Herman Warsaw Produced 370 bu/A Corn Yield

This Illinois farmer continues his quest for higher corn yields, learning from intensively managed plots.

WHILE MOST FARMERS expect good yields from their crops, Herman Warsaw of Saybrook, Illinois, has topped the scale with a corn (grain) yield of 370 bu/A. On October 17, 1985, a total of 433 bushels of shelled corn (corrected to 15.5% moisture content) was harvested from a measured 1.17 acres in Mr. Warsaw's intensively managed production area. This is considered a record farm yield for non-irrigated corn.

In 1975, Mr. Warsaw produced a 338 bu/A yield on a different field, and has also achieved previous yields of 312 bu/A in 1979, 325 bu/A in 1981, and 307 bu/A in 1982.

The 1985 yield was produced with FS Hybrid 854, planted April 25 in 28-inch rows at a rate of 37,000 seeds per acre. Harvest population was nearly 36,000 plants per acre. Harvest moisture was 22.2%. High soil fertility levels and a favorable growing season were important factors in attaining the yield.

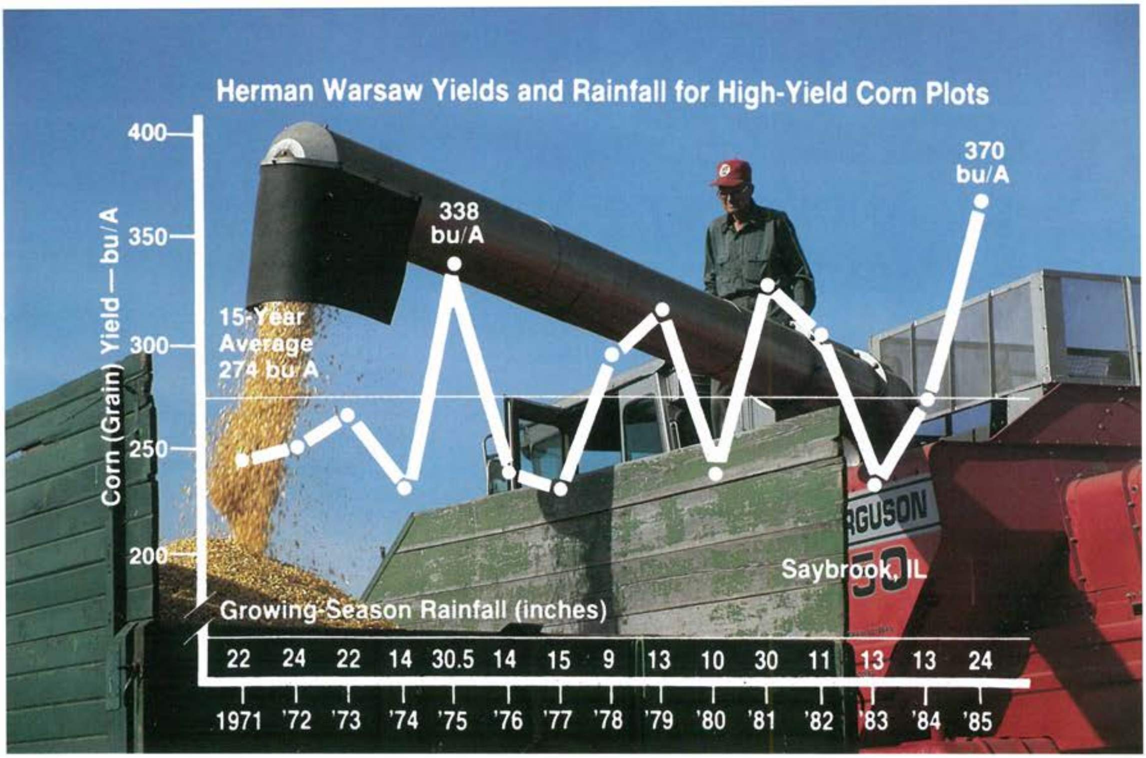
Dr. Harold F. Reetz, Jr., Potash & Phosphate Institute (PPI) Southcentral Director located at Monticello, Illinois, has cooperated with Mr. Warsaw in recent years to observe and identify key management practices in a high-yield system.

"We've helped host hundreds of visitors from around the world, including researchers and farmers who come to talk with Herman Warsaw and hear his ideas. He's worked for many years to improve his crop production methods," Dr. Reetz points out.

Following are some key elements of Mr. Warsaw's system.

- **The hybrid,** FS 854, has some unique physiological traits (identified in University of Illinois research plots). The hybrid remains active with photosynthesis longer in the season, continued nitrogen (N) uptake later in the season, and its lower leaves stay green longer than several other hybrids tested.
- **Deep chisel plowing** helps incorporate fertilizer and crop residues deeper in the profile. The rich, deep soil with well-developed structure is partly natural and partly due to management practices on the farm.
- **Addition of large amounts of crop residue** and livestock manure has contributed to soil tilth and fertility levels.
- **There was good rainfall distribution** — 24 inches during the 1985 growing season.
- **With the soil built up to high fertility levels,** nutrients were available to meet crop needs. The management system and hybrid responded well. Soil tests taken from the top 10 inches on August 6, 1985, showed the following results:

phosphorus (P_1) - 161 lb/A	pH - 6.0; lime index 6.5
potassium (K) - 800 lb/A	organic matter - 5.3%
magnesium (Mg) - 871 lb/A	zinc (Zn) - good
calcium (Ca) - 4,850 lb/A	iron (Fe) - good
cation exchange capacity (CEC) - 23	boron (B) - good
sulfate (S) - 35 ppm (parts per million)	copper (Cu) - good



The graph above shows Mr. Warsaw's top yields for the past fifteen years from intensively managed plots.

Mr. Warsaw currently has about 20 acres of continuous corn in his intensive management system.

"With current technology, it's not advisable to attempt such an intensive system on a large acreage," Dr. Reetz notes. "But by concentrating efforts on a small acreage we can learn important responses to the management system and adapt this information to increase yields and profits on larger acreages. Knowing that these super yields are possible provides incentive and confidence to set higher yield goals on other fields."

Corn yields for the entire Warsaw farm averaged about 200 bu/A for 1985. Mr. Warsaw says that higher yields per acre help to reduce the cost of each bushel produced. Following is a summary of his costs for the 370 bu/A test plot.

Costs (per acre) on high yield plot:

Fertilizer program	—$201.05
Limestone	— 10.42
Herbicide/Insecticide	— 39.10
Seed	— 26.72
Field operations, including harvesting and drying	— 186.50
Total out-of-pocket costs	$463.79

Based on the figure of $463.79 per acre, the out-of-pocket *cost per bushel* for the 370 bu/A yield averages only $1.25: ($463.79 ÷ 370 bu = $1.25 per bushel).

This figure does not include a charge for land. However, assuming a rate of $130 per acre, the production cost would total $593.79: ($463.79 + $130 = $593.79). With this total cost per acre, the production cost per bushel for the 370 bu/A yield would be $1.60: ($593.79 ÷ 370 = $1.60 per bushel). ■

In Western Oregon

Maximizing Wheat Yields Requires Integrated System

By Neil W. Christensen

A detailed management plan is essential for maximum economic yields of winter wheat without irrigation in the Pacific Northwest.

NONIRRIGATED WINTER WHEAT yields of 120 to 140 bu/A are common in the Willamette Valley of western Oregon. Yields as high as 180 bu/A have been measured in experimental plots. These yields are possible because of mild, wet winters and dry summers, but require a high level of management. Top yields require deep, well-drained soils, high levels of available nutrients, and an absence of weed and disease problems. Yields approaching 140 bu/A are most readily achieved where winter wheat follows a vegetable or clover crop since residual fertility levels are high and disease problems are minimized.

Not all growers have the option to rotate wheat with vegetable or clover crops, however. This complicates crop management since weed and disease control is more difficult and the requirements for fertilizer nutrients may increase.

Disease control is essential for maximum yields. Major diseases which may limit yield include cercosporella foot-rot, stripe rust, Septoria, and take-all root rot. Septoria and stripe rust diseases are controlled primarily through the use of resistant cultivars. Fungicides are used to control cercosporella and may also be used to control Septoria and stripe rust when host resistance to these diseases fails.

No fungicides are available for the control of take-all. This disease must be controlled using a combination of cultural and fertilizer management practices.

Plant nutrients which limit winter wheat yield in western Oregon include nitrogen (N), phosphorus (P), sulfur (S), and sometimes potassium (K). Nitrogen is the most limiting nutrient, and fertilizer N requirements commonly range between 80 and 220 lb N/A. This wide range in N fertilizer requirement reflects not only differences in yield potential based on soil depth and drainage, but also the impact of cropping history on mineralizable soil N.

Soil tests for inorganic N or organic matter are of little value in predicting mineralizable soil N.

Data in **Table 1** illustrate the effect that differences in available soil N and N fertilizer use efficiency have on the amount of fertilizer N required to maximize yield. Maximum yields ranged from 65 to 123 bu/A and required from 83 to 206 lb fertilizer N/A. Note, however, that the highest yield (123 bu/A) was obtained with only 85 lb fertilizer N/A. Eighty-nine percent of the variability in the quantity of fertilizer N required to maximize yield at these eight sites could be explained by differences in soil N and N fertilizer-use

THE AUTHOR is shown at left, observing wheat research plots with Dr. T.L. Jackson, Professor Emeritus of Soil Science, Oregon State University.

Dr. Christensen is Associate Professor of Soil Science, Oregon State University, Corvallis.

Table 1. Maximum N fertilizer rates and grain yield as influenced by available soil N and N fertilizer-use efficiency.

Exptl. site	Previous crop	Maximum grain yield	N rate† for max. yield	Available‡ soil N	N fertilizer use efficiency	Total N required
		bu/A	-----lb/A-----		%	lb N/bu
A	wheat	90	122	69	53	2.1
B	wheat	106	149	67	68	2.0
C	wheat	102	206	57	71	2.6
D	wheat	102	196	45	55	2.4
E	wheat	80	205	25	56	2.9
F	ryegrass	65	170	54	44	3.5
G	fallow	116	83	107	62	1.6
H	clover	123	85	116	55	1.6

†N rates for maximum yield average 12% higher than N rates for maximum economic yield.
‡Defined as N recovery in straw and grain for unfertilized check.

efficiency. The total quantity of N required to produce a bushel of soft white wheat ranged from 1.6 lb N/bu on deep, well-drained sites with little plant disease to 3.5 lb N/bu on a shallow, poorly-drained site.

When wheat follows wheat, take-all often limits yield and growers must be concerned not only with fertilizer rate, but also with the form of N (NH_4^+ or NO_3^-) applied. Summary data in **Table 2** illustrate the effect that soil pH and N form can have on take-all severity and grain yield.

Yield data regressed on take-all severity gave the following relationship: **Grain yield (bu/A) = 140 − 6.7 (infected crown roots), R^2 = 0.86.**

Our predictive equation indicates that grain yield at this site was reduced by 6.7 bu/A for each additional crown root per plant which was infected with take-all on May 30. The intercept value suggests that our yield goal for this site (140 bu/A) was right on target.

Table 2. Soil pH and N form effects on take-all root rot severity and grain yield.

Soil pH	Spring N source†	Grain yield bu/A	Take-all infected crown roots/plant on May 30
6.5	NH_4NO_3	71	10.2
	$(NH_4)_2SO_4$ or NH_4Cl	94	6.8
5.5	NH_4NO_3	94	7.1
	$(NH_4)_2SO_4$ or NH_4Cl	114	4.5

†Topdressed at 160 lb N/A on March 6.

Plant diseases and large quantities of residue from the previous crop often impose stress on plants and increase the need for P and S fertilization as well. One of the management practices to reduce take-all is to delay planting until late October. This means that winter wheat is being planted in cold, wet soils. We have found that regardless of P soil test level, 40 to 50 lb P_2O_5/A must be banded with the seed to maximize yield of winter wheat sown under these conditions. The large quantities of crop residue (5 to 6 tons/A) encountered when wheat follows wheat or grass seed crops provide the potential to immobilize significant quantities of S as well as N. Under these conditions, S fertilizer requirements increase from 10 lb S/A to 25 lb S/A with the application split between fall and spring. Where soil tests indicate a need for K, 30 to 40 lb K_2O/A as KCl is banded with the seed at planting.

Summary

Maximizing yield of winter wheat in western Oregon requires close attention to detail. It involves consideration of yield potential set by soil depth and drainage, probability of disease, disease control options, and fertilizer nutrient requirements across a wide range of soil and cropping conditions. Success depends upon development of integrated "packages" of management practices which consider not only the present crop but also other crops which may be grown in rotation. ■

R.R. Johnson Elected Chairman, C.C. Williams Vice Chairman of PPI and FAR Boards of Directors

MR. R.R. JOHNSON, Executive Vice President of Agrico Chemical Company, and Mr. C.C. Williams, Senior Vice President, Marketing, Fertilizer Group, of International Minerals & Chemical Corporation (IMC) have been elected Chairman and Vice Chairman, respectively, of the Potash & Phosphate Institute (PPI) Board of Directors. Mr. Johnson also serves as Chairman of the Foundation for Agronomic Research (FAR) Board of Directors, and Mr. Williams as Vice Chairman.

In welcoming the new leaders, Dr. R.E. Wagner, President of PPI and FAR, also expressed sincere appreciation for the dedicated service of outgoing Chairman, Mr. Douglas J. Bourne, and other Board members whose terms were recently completed.

Mr. Johnson served as Vice Chairman of the two Boards during the previous year. He has served on the PPI Board of Directors since 1977 and was Chairman of the Finance Committee. An Agrico employee since his graduation from the University

Mr. R.R. Johnson

Chairman, Board of Directors
Potash & Phosphate Institute
Foundation for Agronomic Research

Mr. C.C. Williams

Vice Chairman, Board of Directors
Potash & Phosphate Institute
Foundation for Agronomic Research

of Missouri in 1950, Mr. Johnson served in various functions in field and middle management prior to being elected a Vice President in 1972. He was promoted to Senior Vice President in 1975. In 1979, he became Executive Vice President of Agrico Chemical Company, one of the Williams Companies.

A native of Columbia, Missouri, Mr. Johnson is a member of the boards of Crop Production Services, Inc., Phosphate Rock Export Association, and Phosphate Chemical Export Association. He is also a council member of the International Fertilizer Industry Association (IFA) and Chairman of the Farm Policy Committee of the Fertilizer Institute (TFI). Mr. Johnson also serves on various other committees of the nitrogen and phosphate industry.

Mr. Williams, as Senior Vice President of Marketing for IMC's Fertilizer Group since 1982, is responsible for all fertilizer marketing areas of the corporation, including Domestic, International, and retail businesses. He joined the staff of IMC in 1964 as a District Sales Manager and earned promotions to National Account Executive, Regional Sales Manager, and Southern Sales Manager.

A native of Winfield, Kansas, Mr. Williams was graduated from Kansas State University in 1952. He served in the U.S. Army Artillery in 1952-1954 with the rank of 1st Lieutenant.

In addition to serving on the Boards of PPI and FAR, Mr. Williams is also a Director of Canpotex Limited, Phosphate Chemicals Export Association, Phosphate Rock Export Association, and International Fertilizer Industry Association (IFA) Council, 1985/86. He previously served on the Board of Directors of the National Fertilizer Solutions Association (NFSA).

Mr. Williams and his family reside in Northbrook, Illinois. ■.

New Directors Named to PPI Board

THREE NEW MEMBERS of the Board of Directors of the Potash & Phosphate Institute (PPI) have been announced. The new Directors, representing member companies of the Institute, are:

Mr. Robert B. Gwyn, President
Agrico Chemical Company
Tulsa, Oklahoma

Mr. John U. Huber
Vice President - Sales
Kalium Chemicals
Rolling Meadows, Illinois

Mr. P.L. Rushing
Marketing Manager, Fertilizer Division
Chevron Chemical Company
San Francisco, California

New Directors Announced for FAR Board

THREE NEW MEMBERS of the Board of Directors of the Foundation for Agronomic Research (FAR) have been announced. They are:

Dr. E.C.A. Runge
Professor and Head
Soil and Crop Sciences
Texas A&M University
College Station, Texas

Mr. C.C. Williams
Senior Vice President, Marketing
Fertilizer Group
International Minerals & Chemical
Corporation (IMC)

Dr. K.M. Pretty, Senior Vice President, Potash & Phosphate Institute; President, Potash & Phosphate Institute of Canada
Toronto, Ontario

Adapting DRIS for Alfalfa: What Are the Diagnostic Norms?

By K.A. Kelling, E.E. Schulte, and T. Erickson

Use of the Diagnosis and Recommendation Integrated System (DRIS) for interpreting the results of plant analysis helps reveal "hidden hunger" in addition to the most deficient element. Time of sampling is less important than with the "critical concentration" approach. This enables diagnoses of many crops to be made in time to take remedial action if necessary.

A NEW CONCEPT in plant analysis, labeled DRIS (Diagnosis and Recommendation Integrated System), uses nutrient ratios for interpreting tissue analysis data. DRIS offers an alternative to the "critical level" or "sufficiency range" approach for interpretation. With DRIS, many of the problems associated with or related to dry matter accumulation are reduced.

For example, research with several crops, including sugarcane, corn, soybeans, and wheat, has shown that the effects of plant maturity, plant part, and cultivar can be minimized using DRIS.

The objective of this work was to adapt the DRIS concept for use with alfalfa by developing diagnostic norms, creating a mechanism for using the norms, and testing their value through alfalfa-fertility field plot research.

Alfalfa DRIS Norms

Data were gathered from several high yield experiments and surveys conducted in several states including Wisconsin, Pennsylvania, Ohio, Michigan, Iowa and Minnesota. Since much of the data were from high-yield experiments, they probably represent an abnormally high yielding population when compared with a more complete sample.

The base population was divided into two subpopulations on the basis of yield with the high yielding population having single cutting yields exceeding 1.95 T/A (>1.95) of dry matter. This represents about the top 15% of the total population.

Table 1. Comparison of selected tissue parameters for high (>1.95 T/A) versus low (<1.95 T/A) yielding alfalfa populations. Yields are for single cutting.

Parameter	Low Yield Pop.	High Yield Pop.	F ratio for variances
%N	3.40	3.23	37.75
%P	0.32	0.32	3.55
%K	2.63	2.75	15.16
%S	0.29	0.25	1.84
N/P	10.89	9.78	9.31
P/K	0.136	0.121	57.81
N/K	1.45	1.17	43.49
N/S	12.40	12.80	1.23
S/P	0.895	0.752	20.51
S/K	0.125	0.087	73.61

The levels of N, P, K, Ca, Mg, S and B in the two populations were expressed both as concentrations and as ratios of two nutrients. As illustrated in **Table 1,** the ratio form was typically more discriminating than the concentration for separating the low and high yield populations. Because alfalfa is a multiple harvest crop, each harvest or cut is considered as an individual case, rather than averages or totals for the growing season. This was considered essential since using total yield would bias all of the high yielding population toward those climates where four or more cuttings each year are commonplace.

Norms were selected which included the nutrients N, P, K, S, B, Ca and Mg. These were considered likely to be the most important for alfalfa **(Table 2).**

Dr. Kelling and Dr. Schulte are Extension Soil Scientists; T. Erickson is former graduate student; Department of Soil Science, University of Wisconsin, Madison, WI 53706.

Table 2. Alfalfa DRIS norms for selected nutrients with the high yielding population (> 1.95 T/A, single cutting) dry matter.

Parameter	Number (total pop.)	Norm	Standard deviation
N/P +	2391	9.777	1.887
N/K	2391	1.171	0.288
N/S	2115	12.809	2.520
N/Ca	2123	2.505	0.700
Mg/N	2123	0.084	0.023
B/N	2123	0.094	0.020
P/K	2615	0.121	0.023
S/P	2226	0.752	0.170
Ca/P	2347	4.073	1.290
Mg/P	2347	0.829	0.323
B/P	2347	0.893	0.354
S/K	2226	0.087	0.023
Ca/K	2347	0.489	0.201
Mg/K	2347	0.100	0.048
B/K	2347	0.105	0.046
S/Ca	2226	0.197	0.054
Mg/S	2226	1.102	0.342
B/S	2226	1.171	0.318
Mg/Ca	2347	0.208	0.059
B/Ca	2347	0.225	0.071
B/Mg	2347	1.145	0.425

+ N, P, K, S, Ca and Mg expressed as % dry matter, B expressed as ppm $x10^{-2}$.

The other micronutrient norms can be added as more information is gained; however, when more nutrients are included the sensitivity of the expressions increase. Until experimental data are available to evaluate the effectiveness of including these additional norms, they are omitted.

Although using a ratio approach such as DRIS reduces the influence of location on interpretion levels, a separation of the total data base into the two dominant locations of origin shows that differences can arise **(Table 3)**. Note, for example, that the norms generated from Pennsylvania data showed distinctly lower levels of N, Mg and B present. This was attributed to the lower native soil Mg levels in Pennsylvania and the lower use of B for their forage. Part of the N difference may be a result of different material being analyzed from each location. The Wisconsin data are largely from specific hand samplings of pure alfalfa, whereas the Pennsylvania data are from harvested forage which may contain some grass.

Table 3. Change in selected DRIS norms for tissue identified with specific regions.

Parameter	Total (2500) +	Wis. (1100) +	Penn. (1300) +
N	3.23	3.44	3.13
P	0.32	0.31	0.33
K	2.75	2.64	2.81
Mg	0.28	0.35	0.22
B	30.8	36.8	26.2
N/P	9.78	10.61	9.51
N/K	1.17	1.22	1.16
P/K	0.122	0.116	0.124
Mg/N	0.084	0.100	0.077
Mg/P	0.829	1.132	0.671
B/Mg	1.14	1.07	1.18

+ Approximate number of samples in data base.

Field Testing of Norms

To test the developed norms, field experiments were conducted at several locations in Wisconsin from 1979-1982. These experiments used a $P^3xK^5xS^2$ factorial design with treatments applied as topdressings in split applications each year. **Table 4** shows selected nutrient values, DRIS indices, and subsequent yields for some treatments of one of the experiments.

In general, these data illustrate that as the nutrient diagnosed as most deficient (largest negative index) is supplied by fertilizer treatment, the yield increases. The more subtle increases after the initial yield gain are likely the result of one or more soil or climatic factors not considered by the system. Note that improved plant balance is being achieved (as shown by the decreasing sum of the indices).

Interestingly, diagnoses from all three cuts and an early sampling (2 weeks before first harvest) at this location resulted in similar diagnoses even though tissue composition varied considerably between these samples (data not shown). This supports the applicability of the norms and demonstrates their usefulness at varying stages of plant growth. The sufficiency

(continued on next page)

Table 4. Diagnosis of the P, K, and S requirements of alfalfa at Lancaster, Wis. for first cut hay using N, P, K, S, Ca, Mg and B tissue data. +

Treatment level			Plant comp.			DRIS indices			Sum of indices irrespective of sign*	First cut dry matter yield	Total yr. dry matter yield
P	K	S	P	K	S	P	K	S			
			——— % ———							———— T/A	————
0	0	0	0.22	1.05	0.29	−19	−59	15	156	1.67	4.51
0	1	0	0.23	1.61	0.30	−20	−25	11	91	1.86	5.29
0	2	0	0.20	1.97	0.28	−24	−10	10	69	1.79	5.30
1	2	0	0.23	1.68	0.26	−17	−21	4	75	1.89	5.35
1	3	0	0.24	2.51	0.28	−18	− 3	4	48	1.93	5.63
2	3	0	0.26	2.60	0.25	−11	− 1	− 1	35	2.03	5.73

+ All composition data and indices not shown.
* Indices were calculated using functions that used all nutrients shown in title.

ranges used in Wisconsin (%P 0.26-0.70 and %K 2.41-3.80 being sufficient) also confirmed the DRIS diagnoses for the first cut. However, for the early sampling and the second and third cuts, P was always shown to be adequate. Levels of K were quite consistent for all harvests with the unfertilized control ranging from 1.05% K in the first cut to 1.36% K in the early sampling, while those from the K^3 level of applied potash ranged from 2.60% K in the first cut to 3.19% in the second cut.

Experience with the system has shown that some nutrients such as Ca and B can be misinterpreted when early samples are taken. This is likely the result of the relative accumulation of these elements with increasing maturity.

Why Use DRIS

Plant analysis is ideally suited for guiding nutrient needs for a multiple-harvested crop such as alfalfa, since timely treatments can be topdressed for subsequent cuttings.

DRIS improves the need predication capability because:

1) varietal differences and stage of maturity are less important when interpreting the results;
2) the norms can be used over fairly broad regions, although some bias may exist toward those regions from which the data originated;
3) the nutrients are ranked in order according to their relative need. When used in combination with the sufficiency range approach and soil tests, DRIS can substantially improve diagnostic capabilities.

An advantage of the DRIS approach to interpreting the results of plant analyses is its ability to detect "hidden hunger." If alfalfa yields are strongly limited by lack of P, for example, there may be adequate K for that amount of dry matter. When P is added the plant then runs out of K, which was interpreted as "adequate" by the critical level approach. The DRIS method predicts which element(s) will become limiting after the first is corrected. It also gives the order in which elements are present in excessive amounts. ■

U.S. Postal Service

STATEMENT OF OWNERSHIP, MANAGEMENT AND CIRCULATION

1A. TITLE OF PUBLICATION: BETTER CROPS WITH PLANT FOOD
1B. PUBLICATION NO. ISSN: 0 0 0 6 0 0 8 9
2. DATE OF FILING: September 20, 1985
3. FREQUENCY OF ISSUE: Quarterly
3A. NO. OF ISSUES PUBLISHED ANNUALLY: 4
3B. ANNUAL SUBSCRIPTION PRICE: $5.00 (Compl. sub. free on request to qualified individuals)
4. COMPLETE MAILING ADDRESS OF KNOWN OFFICE OF PUBLICATION: Potash & Phosphate Institute, 2801 Buford Hwy., N.E., Suite 401, Atlanta, Georgia 30329
5. COMPLETE MAILING ADDRESS OF THE HEADQUARTERS OF GENERAL BUSINESS OFFICES OF THE PUBLISHER: Same as above
6. FULL NAMES AND COMPLETE MAILING ADDRESS OF PUBLISHER, EDITOR, AND MANAGING EDITOR
PUBLISHER: Potash & Phosphate Institute, 2801 Buford Hwy., N.E., Suite 401, Atlanta, GA 30329
EDITOR: Donald L. Armstrong/William R. Agerton, 2801 Buford Hwy., N.E., Suite 401, Atlanta, GA 30329
MANAGING EDITOR: None
7. OWNER

FULL NAME	COMPLETE MAILING ADDRESS
Potash & Phosphate Institute	2801 Buford Hwy., N.E., Suite 401, Atlanta, Georgia 30329

8. KNOWN BONDHOLDERS, MORTGAGEES, AND OTHER SECURITY HOLDERS OWNING OR HOLDING 1 PERCENT OR MORE OF TOTAL AMOUNT OF BONDS, MORTGAGES OR OTHER SECURITIES

FULL NAME	COMPLETE MAILING ADDRESS
None	

9. FOR COMPLETION BY NONPROFIT ORGANIZATIONS AUTHORIZED TO MAIL AT SPECIAL RATES
[x] (1) HAS NOT CHANGED DURING PRECEDING 12 MONTHS
[ ] (2) HAS CHANGED DURING PRECEDING 12 MONTHS

10. EXTENT AND NATURE OF CIRCULATION	AVERAGE NO. COPIES EACH ISSUE DURING PRECEDING 12 MONTHS	ACTUAL NO. COPIES OF SINGLE ISSUE PUBLISHED NEAREST TO FILING DATE
A. TOTAL NO. COPIES (Net Press Run)	30,800	29,625
B. PAID AND/OR REQUESTED CIRCULATION 1. Sales through dealers and carriers, street vendors and counter sales	100	97
2. Mail Subscription (Paid and/or requested)	12,350	12,675
C. TOTAL PAID AND/OR REQUESTED CIRCULATION	12,450	12,772
D. FREE DISTRIBUTION BY MAIL, CARRIER OR OTHER MEANS SAMPLES, COMPLIMENTARY, AND OTHER FREE COPIES	13,605	12,273
E. TOTAL DISTRIBUTION (Sum of C and D)	26,055	25,045
F. COPIES NOT DISTRIBUTED 1. Office use, left over, unaccounted, spoiled after printing	4,745	4,580
2. Return from News Agents	None	None
G. TOTAL	30,800	29,625

11. I certify that the statements made by me above are correct and complete
SIGNATURE AND TITLE OF EDITOR, PUBLISHER, BUSINESS MANAGER, OR OWNER: Donald L. Armstrong

PS Form 3526, July 1984

FFA Encourages Young People to Achieve in Agriculture

By William R. Agerton

NEARLY A HALF-MILLION (434,000) young men and women in slightly more than 8,000 chartered groups are getting to know something more about agriculture. And some are getting more out of their time than others.

Of course, the group to which I refer here is the Future Farmers of America (FFA), closely linked to the Vocational Agriculture program in many of our public schools.

Certainly those reaching the national level of competition are getting their share from this outstanding program partially sponsored by numerous national and international companies. Here are some of the winners named at the 58th National FFA Convention in Kansas City, Missouri, November 14-16, 1985.

STAR FARMER OF AMERICA—**Michael Arends,** 21, Willmar, Minnesota
STAR AGRIBUSINESSMAN OF AMERICA—**Scott Cochran,** 21, Lavonia, Georgia

PROFICIENCY AWARDS

AGRICULTURAL PROCESSING—**Jeffrey Simmons,** 18, Penn Yan, NY
CEREAL GRAIN PRODUCTION—**Bryan Hayenga,** 19, Kings, IL
DIVERSIFIED CROP PRODUCTION—**Bruce Boyum,** 20, Wanamingo, MN
FEED GRAIN PRODUCTION—**Scott Travis,** 18, Taylorsville, KY
FIBER CROP PRODUCTION—**Cindy Carmack,** 17, Gates, TN
FORAGE PRODUCTION—**Mike Pachta,** 18, Belleville, KS
FOREST MANAGEMENT—**William Schlosser,** 19, Bremerton, WA
FRUIT AND VEGETABLE PRODUCTION—**Bill Lamalie,** Fremont, OH
NURSERY OPERATIONS—**Wayne Beal, Jr.,** 19, Bridgeton, NJ
OIL CROP PRODUCTION—**Kurt Kottke,** 19, Buffalo Lake, MN
PLACEMENT IN AGRICULTURAL PRODUCTION—**Richard Keyser,** 18, Jefferson, MD
SOIL AND WATER MANAGEMENT—**Matthew Sowers,** 18, Burkittsville, MD
SPECIALTY CROP PRODUCTION—**Kelly Freeman,** 20, Bennett, NC

There were many other awards made at the convention that boasted attendance of more than 20,000, most of them FFA members wearing their blue and gold jackets ever so proudly. There were awards to chapters, to long-term sponsors, to FFA alumni, and to others. In fact, the project winners each competed with three other regional winners. Before that there were state, district, and chapter winners.

Rick Malir, 21, of Wilson, Kansas, is the 1985-86 National FFA President, succeeding **Steve Meredith** of Glendale, Kentucky. The new national secretary is **Coby Shorter, III,** 19, Eagle Lake, Texas; **Kipling Godwin,** 20, Whiteville, North Carolina, Eastern regional V.P.; **Cindy Blair,** 20, Noble, Oklahoma, Western V.P.; **Kevin Coffman,** 20, Holliday, Missouri, Central V.P.; and **Robert Weaver,** 20, Hartselle, Alabama, Southern V.P.

These young men and women are the agricultural leaders of tomorrow. . .the leaders with challenges never before facing American farmers. . .challenges that are opportunities to the achievers. These young leaders are making the most of their opportunities and educational programs as they move into these leadership roles.

Keep up the good work, FFA.■

Mr. Agerton is an Editor with the Potash & Phosphate Institute, and has assisted with judging of proficiency awards during the national FFA convention.

Potash Fertilizer Increases Yield and Reduces Hollow Heart in Potatoes

By Robin McBride and T.L. Jackson

Oregon research shows increased potato yields and improved quality due to potash fertilizer applications.

POTASH FERTILIZERS have improved yield and quality of Oregon potatoes. Poor quality is sometimes due to physiological disorders which may be minimized with proper fertilizer management and cultural practices. Hollow heart is a physiological disorder characterized by a cavity in the central region of the tuber. The cavity is usually bordered by brown necrotic cells. Browning may occur without a cavity and is referred to as brown center, the precursor to hollow heart. Hollow heart is associated with several factors; water stress, high temperatures, low temperatures, and rapid vine growth during rapid tuber enlargement. The problem is more prevalent in large tubers.

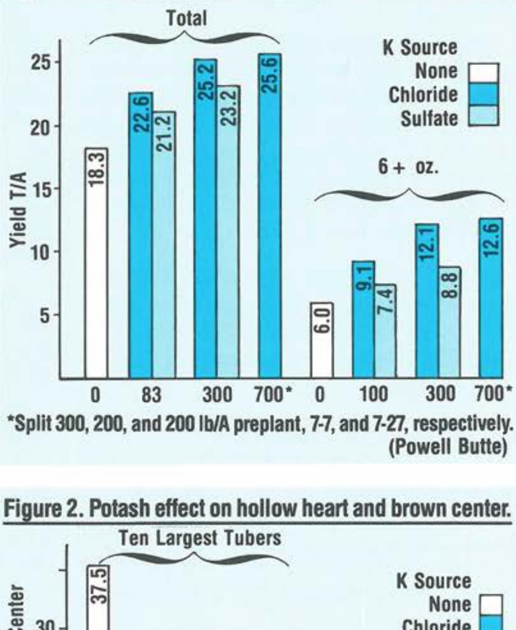
Two experiments were established in 1983 to study the effects of KCl and K_2SO_4 on yield and hollow heart in Russet Burbank potatoes. One test was located at the Central Oregon Experiment Station in Powell Butte and the other was located on a grower's field in the Columbia Basin near Hermiston. The Powell Butte experiment was on a Deschutes sandy loam with an initial soil test of 130 ppm K; the Columbia Basin experiment was on a Quincy fine sand with an initial soil test of 211 ppm K.

Treatments ranged from zero to 700 lb K_2O/A. Some treatments were applied at planting only while higher rates were applied in split applications. Potassium chloride and K_2SO_4 were compared at 100, 300, and 300 (split) lb K_2O/A rates. Base treatments of nitrogen (N), phosphorus (P), and sulfur (S) were provided (160 lb N, 150 lb P_2O_5, and 32 lb S/A at Powell Butte; 250 lb N, 130 lb P_2O_5 and 28 lb S/A at Columbia Basin).

In the Powell Butte experiment, total yield and yield of tubers weighing over 6 ounces (6 + oz.) were increased with all rates and sources of K. The yield of 6+ oz. tubers, the most marketable group, was greater with KCl than with K_2SO_4 **(Figure 1).**

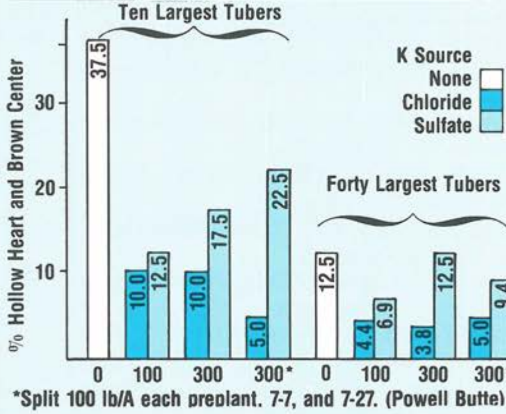
The incidence of hollow heart and brown center was highest in the larger tubers (ten largest tubers) and where no K was applied. Hollow heart and brown center were reduced

Figure 1. Potash effect on tuber yield.



*Split 300, 200, and 200 lb/A preplant, 7-7, and 7-27, respectively. (Powell Butte)

Figure 2. Potash effect on hollow heart and brown center.



*Split 100 lb/A each preplant, 7-7, and 7-27. (Powell Butte)

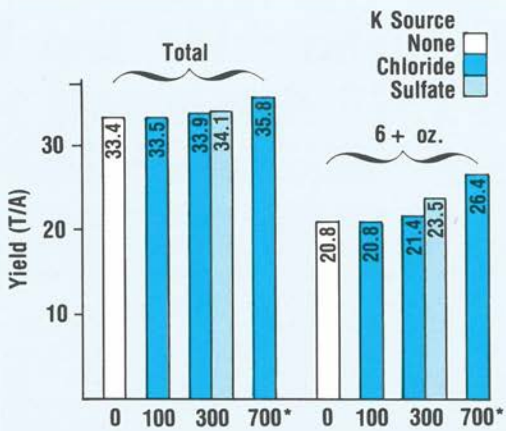
Robin McBride is former Graduate Research Assistant and Dr. Jackson is Professor Emeritus of Soil Science, Oregon State University, Corvallis.

with all rates and both sources of K, but the reduction tended to be greater with KCl. When large and medium sized tubers (forty largest tubers) were sampled, KCl treatments showed a significant reduction in hollow heart and brown center when compared to the check and K_2SO_4 treatments **(Figure 2).**

Yields were higher at the Columbia Basin site with its longer growing season but there was no response in total yield to applied K **(Figure 3).** An increase in yield of 6+ oz. tubers was found only at the highest K rate. The high initial soil K of 211 ppm was probably the reason why a yield response was not found at this site. Despite lack of total yield response to K in the Columbia Basin experiment, the incidence of hollow heart and brown center was reduced with added K **(Figure 4).** At this site, hollow heart was reduced only when KCl was applied.

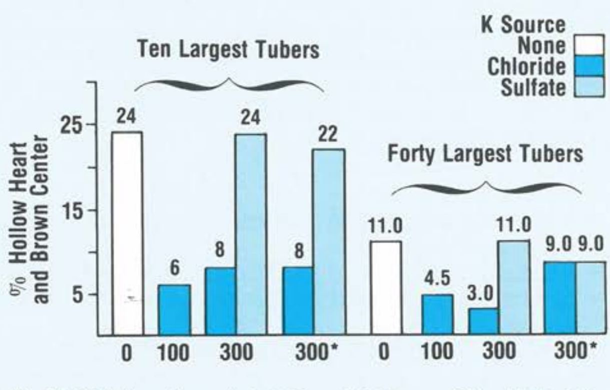
There is concern about K, and particularly KCl, causing a reduction in tuber specific gravity, indicating reduced processing quality. In our experiments, a french fry color quality test administered by quality control at J.R. Simplot, Inc., a potato processor, found no significant reduction in quality even when specific gravities were reduced with high rates of KCl **(Table 1).**

Figure 3. Potash effect on tuber yield.



*Split 100 and 600 lb/A preplant and 6-28, respectively. (Columbia Basin)

Figure 4. Potash effect on hollow heart and brown center.



*Split 100 lb/A each preplant, 6-28, and 7-29. (Columbia Basin)

Table 1. Potato tuber specific gravity and french fry color quality.

K_2O treatment			Color rating[1]				
Rate lb/A	Source of K	Specific gravity	0	1	2	3	4
			%				
0	None	1.0834	92	4	4	0	0
300	KCl	1.0776	96	4	0	0	0
300	K_2SO_4	1.0806	100	0	0	0	0
700	KCl	1.0744	94	4	2	0	0

[1]Color ratings range from 0 (light fry color) to 4 (dark or brown fry color). Ratings of 0 and 1 are desirable, 2 is intermediate, and 3 and 4 are undesirable.
From experiment site in Columbia Basin, Oregon.

Potash fertilizers increased yield and decreased the incidence of hollow heart and brown center in tubers. Greater reduction in hollow heart and brown center was found when KCl was used as compared to K_2SO_4. French fry color quality was not adversely affected by high KCl treatments. ■

For Canada

Guidelines for Top Yields with New HY320 Semidwarf Spring Wheat

Researchers summarize management suggestions for high-yielding wheat.

A HIGH YIELDING SEMIDWARF spring wheat, HY320, has been licensed and is eligible for Canada Prairie Spring grades. HY320 wheat has been launched into a class of its own with "triple M" quality: medium kernal hardness, medium protein content, and medium gluten strength.

In 120 tests over 9 years, HY320 yielded an average of 29% more than Neepawa and 13% more than Glenlea. HY320 yielded an average of 29% more than Neepawa in farmers' fields in 1983 (174 farms) and 27% more than Neepawa in 1984 (835 farms). Under irrigation, HY320 yielded 38% more than Neepawa and 2% more than Fielder soft white spring wheat. When HY320 is grown on summerfallow or on stubble, it gives a similar yield advantage over hard red spring varieties grown under similar conditions.

HY320 is about 6 inches (15 cm) shorter than Neepawa. It is later maturing than Neepawa, averaging about 4 days later. Maturity of HY320 relative to Neepawa varies with weather conditions, being almost the same under dry conditions, but HY320 has been up to 14 days later than Neepawa under cool, moist conditions.

HY320 is moderately resistant to leaf and stem rust, moderately susceptible to common root rot and susceptible to bunt and loose smut.

This semidwarf wheat is sensitive to management. It benefits from higher rates of fertilizer. Good weed control is important because the variety is not a strong competitor with weeds.

Seeding

- Treat seed with a fungicide containing carbithiin (e.g., Vitavax) to control loose smut and bunt
- Seed early because of the late maturity of HY320
- Seed at a higher rate than Neepawa, that is ¼ to ½ bu/acre higher than normal rate for Neepawa

The higher seeding rate will compensate for the larger seeds of HY320 (20% bigger than Neepawa), will promote earlier maturity and will improve competition with weeds.

- Seed no deeper than 2 to 2.5 inches (5 to 6.5 cm); seeding deeper may delay emergence and reduce the stand, particularly in cold or crusted soils.

There may be a risk from seeding either too deep, which could hinder emergence and/or increase the incidence of root rot, or too shallow, which could result in the seed being placed in a layer of soil treated with triallate (Avadex) or trifluralin (Treflan).

Fertility

HY320 is possibly more responsive to fertilizer than traditional varieties. Limited data indicate that HY320 responds to higher nitrogen and phosphorus fertilizer levels than traditional wheat varieties.

This article was prepared in cooperation with the following:

J.M Clarke, R.M. DePauw, T.F. Townley-Smith, C.A. Campbell, F. Selles, H. Steppuhn, and J.E. Knipfel, Research Branch, Agriculture Canada, Swift Current, Saskatchewan; J. Hunter, Research Branch, Agriculture Canada, Regina, Saskatchewan; K. Kirkland, Research Branch, Agriculture Canada, Scott, Saskatchewan.

Weed Control

HY320 is less competitive with weeds than the regular spring wheat varieties are. Wild oats (100 plants/m^2) reduced the grain yield of HY320 by as much as 63%. Good weed control is essential.

In general, herbicides registered for use on hard red spring wheats have not seriously affected the grain yield of HY320.

Avoid deep incorporation of soil applied herbicides such as triallate (Avadex BW) or trifluralin. For optimum crop tolerance, place the seed 2 to 2.5 inches (5 to 6.5 cm) deep.

Harvesting

- Swath at the same kernel development stage as Neepawa, at 30 to 40% moisture
- HY320 is also well-suited to direct combining
- HY320 is easier to thresh than Neepawa, but is also quite resistant to shattering

HY320 has an awned (bearded) head, which helps to overcome the disadvantage of short straw in forming swaths. However, late swathing when the crop is over-dry will result in a fluffy swath that is susceptible to scattering by wind. Direct combining will allow leaving taller stubble for snow trapping. HY320 sometimes produces less straw than other hard red spring wheats (80 to 110% of Neepawa, and 90 to 120% of Sinton and Leader, depending on conditions).

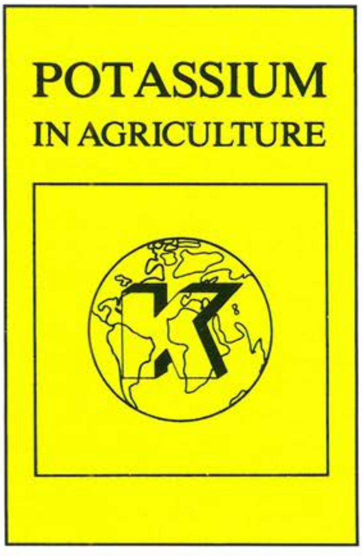
Feeding Quality of Straw

The feeding quality of straw from HY320 is superior to that of Neepawa as shown by both laboratory and feeding studies. In 1981, straw was collected from field-scale plots of HY320 and Neepawa. The protein content of HY320 straw was 4.3%, while that of Neepawa straw was 1.5%. Organic matter digestibility of HY320 was 46.6% (equivalent to high quality barley or oat straw) in comparison to only 33.2% for Neepawa straw. Following ammoniation, HY320 straw increased in protein content to 7.1% while Neepawa straw increased to 5.9%, but the organic matter digestibility of HY320 increased to 54.0% (about the same as medium to good quality grass hay), while that of Neepawa increased to 40.2% which was less than that of the untreated HY320. Animal acceptance of HY320 straw has been excellent in comparison to Neepawa straw. Further work is underway to assess the effects of beards on chaff quality.

These data suggest that the crop residue from HY320 will be of considerable use as a feed for ruminants. ■

Potassium in Agriculture: How to Order New Book

A 1,223 PAGE hardcover book, *Potassium in Agriculture,* includes 51 chapters written by more than 80 recognized international authorities. The book, edited by Dr. R.D. Munson, is published by the American Society of Agronomy (ASA), Crop Science Society of America (CSSA), and Soil Science Society of America (SSSA).



Price of the book is $58.00. All payments must be in U.S. funds. Advance payment and 75¢ per book required on all orders outside the United States. To order, or for more information, contact: ASA, CSSA, SSSA Headquarters Office, Attn: Book Order Department, 677 South Segoe Road, Madison, Wisconsin 53711 USA. ■

Variable Rate Fertilization: A Part of Maximum Economic Yield Systems?

By J. Larry Sanders

Variable rate fertilization (VRF) is not a new idea, but new technology will help make it practical for more farms.

WHETHER TOPOGRAPHY is level or rolling, there is significant soil test variation within many farmers' fields. This variation arises from many sources. Inherent soil differences due to soil type and texture occur naturally within most fields.

Other differences can be induced from past cropping and fertility practices. Incorporation of small fields into larger fields, the use of manure in selected areas, tillage practices, erosion and past crop rotation within a field may have all added to soil test variability in that field.

This variation in soil test values within a field leads to serious problems in fertilizer recommendations. One problem is that in many fields fertilizer needs may vary greatly from one area to another with soil test values. Another problem arises when the yield potential and resultant fertilizer recommendations for one soil type or texture is significantly different from another in the same field. Generally, without regard to these factors, fertilizer recommendations have been made for average field condition, which leads to either over-fertilizing one area and under-fertilizing the other.

Given this variability in soils, it is pertinent to consider variable rate fertilization and its implication to higher and more profitable yields. Normally, soil samples are taken at a rate of one or two composite samples per field, which may represent 20 to 200 acres or more. This pattern of soil sampling leads to the common misconception that an average soil test value will be determined. However, composite sampling across different soil types and textures with varying chemical characteristics and buffering capacities will not result in an average soil test value in most cases.

The idea of variable rate fertilization (VRF) is not a new concept. In variable rate fertilization, soil samples are taken and the locations and values of the samples are mapped using a pre-determined grid system or soil type map at a rate of one sample per five or ten acres. Instead of one sample representing a 100-acre field, there may be as many as 20 samples representing a field. The result is a family of values for that field which can provide a basis for increased accuracy and precision in fertilizer recommendations.

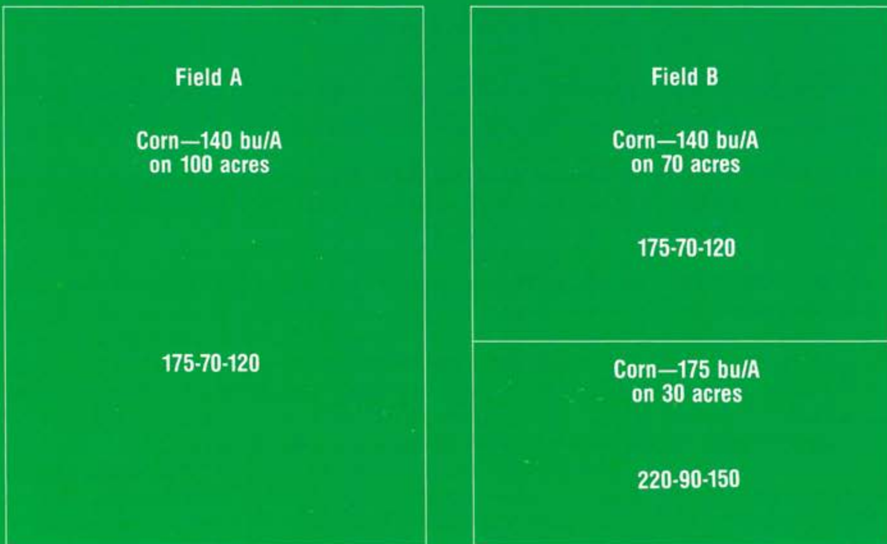
Based on this family of soil test values and realistic estimates of yield potentials within a field, fertilizer needs can be specified for different areas. **Figure 1** shows how fertility recommendations may vary within a field using VRF and normal practices.

In this example, using VRF increased fertilizer cost by an average of \$5.00, but increased corn yield by almost 11 bu/A and gross returns by \$25.20/A. On an average farm size of 500 acres, that would equal an extra gross return of \$12,600 per year, ($N = 20¢/lb$, $P_2O_5 = 22¢/lb$, $K_2O = 11¢/lb$, and corn = \$2.40/bu.)

Variable rate fertilization does have certain advantages and disadvantages for the farmer. The advantages may mean significantly higher yields and profits in certain

Dr. Sanders is Eastern Canada Director and Coordinator, Asia, for the Potash & Phosphate Institute, in the Toronto, Ontario, office.

Figure 1. Example of how normal and variable rate fertilization programs may differ dramatically in recommendations within a field.



high yield areas of the field. High yields will be achieved by tailoring fertilizer recommendations for specific soil chemical and physical conditions for the highest realistic yield goal. In other areas, yield potential may be less and fertilizer recommendations can be modified to achieve an appropriate yield. In either case, higher profits can be produced by using the right amount of fertilizer in the right place to achieve the maximum economic yield. Often the disadvantage to VRF has been dealer and farmer opposition to detailed fertilizer spreading patterns. These can usually be resolved by predetermining with the farmer a minimum size area that he would consider spreading within a field. Under certain situations another disadvantage would be the increased cost of spreading several fertilizer materials within one field. The cost of increased soil sampling and analysis would also be another consideration.

Although there are disadvantages, many of these are now being overcome through modern technology. Spreaders are now being developed that can blend fertilizers as they move across the field and spread the exact amount of fertilizer needed in each section.

Tracking devices indicate the location of the spreader in the field and relay its position to an onboard computer. The computer can then give a prescribed fertilizer application to that area of the field.

Will VRF be widely accepted? The timing of new technology will certainly help increase the use of VRF although it can be accomplished with regular fertilizer equipment. Support for VRF will also come from environmental groups who are interested in the protection of ground water and lakes from fertilizer runoff and leaching.

Ultimately, the farmer will benefit from VRF by tailoring fertilizer needs to soil test recommendations under varying yield goal conditions to produce maximum economic yield on as many acres as possible.

In the future, VRF will certainly have a place in farming along with variable rate seeding, insect control, weed control, irrigation and other practices. As technology develops, the impossible only takes a little longer. ■

Gardening for Food, Fun and Fitness

By Bert Krantz

A California gardener shares some productive ideas for year-round fruit and vegetable gardening. The techniques can be adapted to many soil and climate conditions.

IN CALIFORNIA AND MANY OTHER AREAS, year-round vegetable and fruit production is possible. With careful planning a family can produce most of its vegetable and fruit needs in a backyard garden area.

Soil and Water Management

I use a permanent broadbed and furrow system with beds 4 ft. from center to center. This system provides for crop drainage during our winter rainy season and the soil dries out sufficiently for early spring planting (about March 1) of summer crops such as corn, beans, cabbage, tomatoes, etc. This is usually several weeks ahead of spring planting time for local gardeners who rototill or spade their garden areas each spring. By planting at the edges of each bed, efficient furrow irrigation can be practiced (drip irrigation along each crop row can also be used if so desired).

In this system no tillage is used except that required to apply the fertilizer and plant the seeds or transplants in hills or rows. To maintain good soil tilth (friable soil) and avoid soil crusting, I apply a liberal quantity of year-old composted organic materials consisting of lawn clippings and leaves to the whole bed surface soon after the crops emerge in both spring and fall. This is the sixth year of the permanent bed and furrow system without tillage and the soil tilth is continuing to improve and crop growth is excellent.

Another advantage of this no-till system is the greatly reduced weed problem. Most of the weed seeds in the surface inch of soil germinate within the first and second years after the establishment of the permanent bed and furrow system. If no subsurface soil containing weed seeds is brought to the surface by tillage, the weed problem diminishes. The occasional weed that does emerge should be eliminated when young and not allowed to go to seed.

Garden Residue Utilization and Crop Fertilization

Stalks of sweet corn, asparagus, broccoli, cauliflower and cabbage are cut off at ground level and placed in the permanent furrows. This provides a place to walk while planting and harvesting the crops grown on the beds, even when the soil is slightly wet. By cutting all stalks at ground level the roots are left to decompose in place, which contributes to the maintenance of good soil structure and tilth. As the stalks decompose in the furrow, this organic matter helps to maintain optimum infiltration of water in the crop root zone. **The stalks in the furrow and the mulch on the beds also provide some plant nutrients, but to achieve optimum growth I use adequate chemical fertilizers containing nitrogen, phosphorus, potassium and zinc below or beside the seeds or transplants at planting time.**

Greenhouse – A Useful Addition

I have an unheated, homemade "greenhouse" where I grow all my vegetable and flower plants from seeds.

In addition to the usual transplants such as tomatoes, cabbage, broccoli, cauliflower and flowers, I grow crops such as melons, squash, and sometimes even snap beans and Fordhook limas for transplanting. This reduces the turnover time between winter and summer crops by two to three weeks. Also, sturdy transplants are less vulnerable to birds, slugs and insects than newly-emerging seedlings from direct seeding.

After a lifetime profession of agricultural research and education, Dr. Krantz has become an avid gardener since retiring six years ago. By experimenting in his garden and greenhouse, he has developed soil and crop management practices for optimum production with minimal care. After observing the garden during a visit to California, Dr. W.L. Nelson of PPI asked Dr. Krantz to prepare this article.

Winter garden shown in early April. Note: Greenhouse in rear on the right side; apricot and pear trees on the right; boysenberries and sugar snap peas along north fence; composting frame and bins under orange tree on the left; broccoli, cauliflower, cabbage, Swiss chard and leaf lettuce growing on the permanent broadbeds. The early plantings of sweet corn are up but not yet visible behind the broccoli.

Maximizing Interception of Solar Radiation

In city backyards with many shade trees, fruit trees and ornamentals, availability of sunny spaces for growing vegetable crops is often a limiting factor. However, by careful planning in the placement of trees and vegetables one can maximize the interception of sunlight.

- **Where possible place fruit trees,** brambles and asparagus beds along the north or west fences of the garden area.
- **Plant tall vegetables** such as pole-type beans and tomatoes and sweet corn toward the north side to avoid shading low-growing crops. For successive plantings of sweet corn, start at the north side and continue toward the south. Also, each corn planting should be in small blocks rather than in a single row to achieve better pollination.
- **"Highrise cropping"** maximizes sunlight utilization. Pole-type crops such as snap beans, limas, sugar snap peas and sweet peas are ideal for highrise cropping, which also provides easy access for picking. My method is the use of one strand of galvanized wire at about five inches and one at six feet above ground level stretched between permanent posts. I wind kite string over the upper and lower wires at about six inch spacing for the plants to climb to the top wire.
- **"Tier cropping"** maximizes space and light utilization. By growing annual crops under deciduous fruit trees, two-tier cropping is feasible. Since these trees shed their leaves, there is ample sunlight for winter crops like lettuce, radishes, bush-type green peas and even early bush snap beans. During the summer, melons and squash, which require a large amount of space, can be successfully grown under deciduous fruit trees.

An Adaptation to a Hot, Dry Climate

In areas such as the Central Valley of California with summers of high temperature and low humidity, it is normally not feasible to grow crops such as Swiss chard and cabbage in summer. However, it is possible to grow them in the cooler shady areas under deciduous fruit trees. By shading newly-transplanted seedlings with wooden shingles, the first planting of broccoli and cauliflower can be started during the hot, early August period.

Summary

The permanent broadbed and furrow system with the semi-annual application of partially-composted mulch practically eliminates the jobs of tillage and weeding, which are the most arduous tasks of gardening. Thus, the remaining activities involve mainly planting, picking and processing which provide healthy exercise and year-round food, fun and fitness. ■

THE PROBLEM: Lodged Corn.

Plant Problem Insights

for Maximum Economic Yields (MEY)

LODGED CORN is a serious problem that can cut farmers' profits in many ways:

- **Lower harvestable yields**
- **Slower and delayed harvest**
- **More wear and tear on equipment**
- **Delayed fall fertilization and tillage**

Good standability and good yieldability are characteristics that are especially important in a corn hybrid. Scientists have demonstrated that adequate potash (K_2O) is important in improving both standability **and** yieldability. The picture shows lodged corn in a field where K was too low. The inset shows the deteriorated stalks.

Potassium is required in large amounts by the growing corn crop and is involved in many of the important chemical reactions in the plant. High N rates are also important in today's high yield corn production, but high N if not balanced with adequate K can cause lodging. Stronger and thicker stalks with greater resistance to lodging result from adequate K. Also, stalk health and nutrient and water movement through the stalk as the grain develops are enhanced with adequate K.

Other conditions can also contribute to increased lodging. Insect damage, excessive population for the selected hybrid, inadequate light, moisture stress, or herbicide damage are other possibilities... especially when potassium is also too low.

As you plan your corn fertility program, take a look at potassium and make sure it is at adequate levels. Remember... soil testing and plant analysis are important diagnostic tools. Also, as you check your fields during the year, keep an eye out for those lodged areas that may be a sign of inadequate K.

With adequate K, you can look for better standing corn and higher yields and profits. ■

*This message is available on a 3½ × 7½-inch information card. Other topics also currently available in the "Plant Problem Insights" series are: **Poor Early Wheat Growth and Soybean Cyst Nematode.** For more information, contact: Potash & Phosphate Institute (PPI), 2801 Buford Hwy., NE, Atlanta, GA 30329. See order form on next page.*

Publications Available from PPI

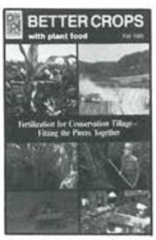
HERE'S HOW to order publications from the Potash & Phosphate Institute (PPI). A complete catalog of information materials from PPI will be returned with your request.

Quantity Cost

Plant Problem Insights for Maximum Economic Yields See previous page. This is a colorful series of photo-cards, each with a concise discussion of a specific field problem, along with positive tips for increasing yields and profits. Specify your choices: **Lodged Corn ____; Poor Early Wheat Growth ____; Soybean Cyst Nematode ____. Cost per card: 10¢ each (5¢ MC*)** ________ $ ________

For 1986 Profit – Increase Yield to Lower Unit Cost A helpful folder with ideas on how to manage for greater profits in 1986 with a changing economic environment. **Cost: 25¢ each (15¢ MC*)** ________ $ ________

Agro-Knowledge 18/What Affects Crop Response to Phosphate? This technical folder discusses factors other than P soil test which affect crop response to phosphate fertilization. **Cost: 25¢ each (15¢ MC*)** ________ $ ________



Fertilization for Conservation Tillage – Fitting the Pieces Together Additional copies of the Fall 1985 issue of *Better Crops with Plant Food* are available. Focus of the entire 40-page issue is on conservation tillage and related fertilization practices. **Cost: $1.25 each ($1.00 MC*)** ________ $ ________

***The MC* symbol indicates Member Cost: For members of PPI, contributors to FAR, to university and government agencies.**

Total cost $ ________________

20% discount on orders of 1,000 or more copies of a single item

☐ **Payment enclosed**
☐ **Bill me, add shipping to invoice**

Name ____

Address ____

City ____________________ **State** __________ **Zip Code** __________

Organization or Firm ____

Send to Potash & Phosphate Institute, 2801 Buford Hwy., NE, Suite 401, Atlanta, GA 30329 (404) 634-4274

Be Proud of Agriculture

Twilight and evening bell
And after that the dark!
And may there be no sadness of farewell
When I embark.

Tennyson

WE ENVIED this classmate. His annual income exceeded a half million dollars. He lived in an elegant home with pool and tennis court. He had another home in Florida and travelled in his private plane.

A friend, a retired agronomy professor, and I visited him shortly before his death. We complimented him on his success. By comparison, our simple lives in education and research in the field of agriculture seemed so insignificant.

He soon put us straight: "The impact of your lives will be felt long after I am forgotten. It's not what you can get out of this world, but what you can give to it. Your former students and colleagues tell me how much you influenced their lives by what you GAVE to agriculture. I would gladly trade places with you."

As we left our friend, envy gave way to pride in our field of agriculture. It may not be a glamorous one today. Enrollment in ag colleges is dwindling. But the opportunity to serve others in that field grows . . . and grows.

And that's what it's all about. We were glad we went to see him. ■

—J. Fielding Reed

Better Crops
WITH PLANT FOOD
Potash & Phosphate Institute
2801 Buford Hwy., N.E., Suite 401, Atlanta, GA 30329

Second-Class postage
paid at Atlanta, GA