RESEARCH PPI EDUCATION

BETTER CROPS

with plant food

FALL 1983

Phosphorus Response | No Phosphorus

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BETTER CROPS with plant food

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Our cover: Yuchi arrowleaf clover plots were photographed on May 10, 1983 at the O.S.U. Eastern Research Station, Haskell, OK. It illustrates the dramatic response to fertilization so characteristic of soils in the area. Related story on page 14. Photo by Dr. Bob C. Darst.

Fall-Winter Fertilization: Here's What the Experts Say

RESEARCH shows that potash and phosphate application in fall and winter is a sound and profitable agronomic practice. We asked the experts — agronomists from various agricultural areas — to share their ideas and observations. Here's what they say.

Iowa

"Fall application of phosphorus (P) and potassium (K) is a sound agronomic practice in most field situations. Where fall tillage is planned, application should be before tillage to get incorporation and increase the fertility level of the tillage zone. Where fall tillage is not performed, studies have shown that field losses of P and K are less because the surface crop residue has reduced soil erosion losses. So in either case of fall tillage or no tillage, fall broadcast P and K can be an agronomically and environmentally sound practice on land with slopes up to 7%.

"Grower advantages for this practice are timeliness and reduction of soil compaction (traffic patterns). A wet spring such as we have experienced the past season, and its effect on timeliness of spring work, planting and effects on soil compaction are still fresh in our mind. Let's not forget.

"The tax advantage (to growers) of crop production expenses this year may be forgotten or confused with drought, low yields and the PIK program. Each grower will need to evaluate his/her situation. This is far from a normal year and a re-evaluation of economic and agronomic factors will be worthwhile.

"Advantages to fertilizer dealers are more than efficient utilization of people and equipment. Better service to the grower will be possible. There will be more time in the spring to service growers and to get new business. And the same cash flow and interest problems that plague dealers and growers are eased."

— Dr. Regis Voss
Iowa State University

Indiana

"In Indiana, **one of the keys to producing maximum economic yields is to be timely with planting but yet avoid soil compaction.** With Indiana weather, any way we can minimize spring work will improve our overall timeliness and in many cases avoid soil compaction from traffic on wet soils. Fall fertilizer applications fit this program to a 'T'.

"Research has shown that on all but our light colored sandy soils, fall application of N, P and K can be done safely and effectively. With the improvements in harvesting and drying equipment being used today many farmers have more time available in the fall for field work than was available a few years ago. When coupled with normally good soil conditions in October in Indiana, fall fertilization is definitely a tool which can be used to improve overall timeliness of an efficient farm operation. By applying fertilizers in the fall, we also are minimizing some of our compaction risks by moving one more operation off wet soils in the spring and substituting drier conditions most falls.

(continued on page 4)

"All together, fall fertilization is an important tool available to our farmers, and is a good way to help minimize compaction problems and improve the overall timeliness of our crop production programs."

— Dr. D.B. Mengel
Purdue University

Virginia

"We have been falling behind in lime and fertilizer applications for 2 or 3 years. Because of the drought, 1980 was a disaster financially for the majority of Virginia's farmers. This forced cutbacks in production inputs for the 1981 crop, including lime and fertilizers. In an attempt to recoup financially, this reduced level of input was maintained for the 1982 and 1983 crops. We have been drawing on reserve fertility for three years. Obviously this cannot continue.

"In addition, we have a large acreage of land in the PIK program that received no lime or fertilizer in 1983. This will also need to be limed and fertilized for the next round of crop production.

"The time for soil testing and application of lime and fertilizer extends well into November. Farmers will not be falling all over each other trying to get lime and fertilizer applied this fall. Yet, it needs to be done. It will be up to those of us who recognize the need to play the role of catalysts in bringing it about."

— Dr. George Hawkins
Virginia Tech

Kansas

"Fall is an excellent time to apply phosphorus and potassium for spring planted crops on most Kansas soils. Nitrogen can also be fall applied with the exception of sandy soils or a few areas subject to flooding. With our limited precipitation during November through March, little loss of fertilizer by erosion or leaching occurs. Fall application allows for better incorporation of P and K on land fall-tilled, plus it alleviates the rush in the spring if a wet spring occurs."

— Dr. David A. Whitney
Kansas State University

Alberta, Canada

"Some of the negative attitudes towards fall fertilization are based on out-dated information. New research indicates fall fertilization can be very effective. As well, surveys of above average barley and canola producers in Alberta indicate that the top yields were usually associated with those farmers who deep banded (3-5 inches deep) most of their fertilizer in the fall while lower yields were associated with those farmers who broadcast the bulk of their fertilizer in spring of the year."

—Mr. J.T. Harapiak
Western Cooperative Fertilizers Limited
Calgary, Alberta, Canada

Minnesota

"In Minnesota, **fall application of fertilizer has been a suggested practice for most soils for several years.** This emphasis on fall fertilization is based largely on the consideration of seasonal weather patterns. Soils are often wet in early spring and when they become dry enough for tillage, it's usually time to plant. So, in many years, spring application of fertilizer can result in delayed planting.

"Fall is particularly appropriate for the application of nitrogen in much of southern and southwestern Minnesota. Growers are, of course, urged to delay application until the soil temperature drops to at least 50 °F. Urea and anhydrous ammonia fit nicely into the fall application picture and should perform equally if the urea is not allowed to remain on the soil surface.

"Some exceptions are made for the sandy soils. Although the fall application of P and K is a recommended practice for these soils, fall application of N and S to these coarse textured soils must be avoided. These nutrients are mobile and subject to leaching."

—Dr. George Rehm
Dr. Bill Fenster
University of Minnesota

Arkansas

"With phosphorus, the issue revolves around soil pH which affects phosphorus fixation. At pH 6.0 to 7.0, phosphorus fixation in most mid-south soils is sufficiently minimized to permit fall applications of phosphorus for row crops.

"With potassium, leaching loss and erosion are considerations. Soil application of potash is permissible on level-to-gently sloping land except with sandy subsoils. Where soybeans or grain sorghum are double cropped with small grain, fall application of phosphorus and potash for both crops saves a trip in the spring.

"Growers who fall-apply phosphorus and potash for next year's crop feel secure with this preplant operation behind them. During limited breaks in wet, spring weather, they can then concentrate on other rushing jobs. As extra bonuses, more even distribution and less soil compaction often result from fertilizer application in the fall when soils are dry than in the spring when soils are wet.

"One reason that fall application helps growers is that it greatly relieves spring pressure for dealers. This can result in better dealer service to growers in both fall and spring. In the fall, dealers may have access to higher quality materials than in the spring rush. Dealers may be able to give better price breaks in the fall. Another side benefit is the opportunity to charge cost to the 1983 crop for income tax purposes.

"In short, growers and dealers can contribute to their agricultural community through a concentrated and agronomically sound effort on fall fertilization."

— Dr. Woody Miley
University of Arkansas

Oklahoma

"We in Oklahoma should be well aware of the importance of fall and winter fertilization. Heavy spring rains prevent the application of fertilizer.

"When fertilizer is applied in the fall or winter, Oklahoma growers have a better opportunity for higher yields and profits.

"Another point to remember about fertilizing during fall and winter months is that the farmer can do a better job of spreading his labor costs, thus reducing overall production expenses."

— Dr. Billy Tucker
Oklahoma State University

Texas

"We in Texas encourage producers to sample their soils at this time of year for next spring's crop.

"This allows them to plan their fertilizer program, get fertilizer applied and land rebedded to take advantage of winter moisture.

"Delay until spring can result in the loss of moisture that may be critical to the producer's getting a stand in dryland areas."

— Dr. Lanny Ashlock
Texas A&M

Fall-Winter Fertilization Information

THE Potash & Phosphate Institute offers folders, slide sets, and other information materials with helpful, practical facts on the benefits of fall-winter fertilization. To learn more about opportunities and reasons for this important practice in 1983-84, contact: **Potash & Phosphate Institute, 2801 Buford Hwy., Atlanta, GA 30329. Phone: (404) 634-4274.**

Dr. E.T. York to Head Food and Agriculture Board

DR. E.T. YORK, JR., former Chancellor of the State University System of Florida, has been appointed by President Reagan as Chairman of the Board for International Food and Agricultural Development (BIFAD).

The seven-member board works to strengthen agricultural programs and combat hunger and malnutrition in developing countries. It does this by mobilizing resources of U.S. universities to be used in Agency for International Development (AID) programs to make developing countries more self-sufficient in food production.

Dr. E.T. York

Dr. York formerly headed the University of Florida's Institute of Food and Agricultural Sciences and was Interim President of the University. He has long expressed an interest in programs to combat world hunger and has led several presidential missions abroad to develop such programs.

Earlier this year, Dr. York was appointed by the Consultative Group on International Agricultural Research to the body which provides technical and program guidance to 13 International Agricultural Research centers throughout the world.

In recognition of Dr. York's lifelong record and accomplishment, the *Gainesville Sun* recently honored him with the newspaper's annual Community Service Award.

Nominating letters for the award cited Dr. York as "the epitome of community service in its broadest sense, having served his city, state, country and indeed the world in an outstanding and unselfish way."

Early in his career, Dr. York served as Northeast Director of the American Potash Institute, Inc., forerunner of the Potash & Phosphate Institute (PPI). He has maintained a close working relationship with the Institute and more recently with the Foundation for Agronomic Research (FAR). Dr. York has served on the FAR Board of Directors since the inception of the Foundation in 1980. ■

The Same Old Story

This is the story about four people named Somebody — Everybody — Anybody — Nobody. There was an important job to be done. Everybody was sure that Somebody would do it. Anybody could have done it, but Nobody did it. Somebody got angry about that because it was Everybody's job.

Everybody thought that Anybody could do it, but Nobody realized that Everybody wouldn't do it. It ended up that Everybody blamed Somebody and Nobody did what Anybody could have done.

Study Says More U.S. Soybeans Needed by 2002

U.S. FARMERS could be called on to plant nearly 100 million acres of soybeans by the year 2002, according to the results of a recent study. The resulting 4.2 billion bushels from this planted acreage, based on a projected average yield of 46 bu/A, would be the U.S. contribution to a projected 7 billion bushel world demand for that year. This compares to the highest U.S. soybean production to date of slightly more than 2.2 billion bushels in 1982.

The study, "2002: A Blueprint for Soybeans," was an unprecedented 18-month joint project of Elanco Products Company and the American Soybean Association (ASA). ASA is a farmer-funded, farmer-controlled single commodity organization dedicated to improving the profitability of U.S. soybean farmers. Project 2002 involved more than 200 experts including farmers, economists, molecular biologists, barge company executives, seed and chemical company specialists, government officials, processors and trade officials.

According to Elanco President Vaughn Bryson, "2002" was undertaken to provide a forum for industry-wide dialogue on the critical, long-term issues that will impact soybeans; define the alternative futures for U.S. soybean production and acreage; and develop strategic guidelines to help soybean farmers shape their future.

"In addition to the projected need for increased U.S. acreage and average yields, 'Project 2002' also defined other key factors which will impact our soybean industry," said Project Manager Dennis Sharpe. "These factors were world economic growth, other oilseed competition, soil conservation policies and biotechnology. In fact, the 'wild card' in charting the soybean's future is biogenetics.

"Farmers should resist government efforts to impose trade restrictions or sanctions, acreage controls, soybean reserve policies or even guaranteed prices," cautioned Sharpe. "The U.S. farmer must be positioned to take advantage of sudden market opportunities, as well as adopt strategy to maintain or increase his share of the world market."

Expand Markets

He said efforts must be made to expand exports into Eastern Europe, the Middle East, Southeast Asia and China, as well as exploring new export opportunities with established customers such as the Common Market countries and Japan. Capital investments from industrialized countries in developing nations, research into customer preferences, technical support and continuing consumer education are suggested tactics for increasing export demand.

Sharpe warned farmers to pare down production costs and increase productivity. Conservation policies, new production systems and products should be adopted where they prove cost effective. He also said "Project 2002" recommended a recommitment to basic research with care to fund the most soybean-intensive and yield-enhancing proposals.

"Finally, 'Project 2002' recommends farmers, processors and others in the soybean industry take an active interest in biotechnology developments," stated Sharpe. "A special industry task force is recommended to monitor this vital area and facilitate research specific to soybeans."

ASA representatives indicated the results of "Project 2002" would be presented to Secretary of Agriculture John Block and other USDA and government officials, as well as to the European oilseed processing industry. ■

Sixteen Years

Ahead of Their Time

By Ray Lockman

THE 1967 Fayette County, Ohio, Corn Club's average yield and fertilizer rates look very much like those of the "average Ohio farmer" in 1982 (see **Table 1**). The Fayette County Corn Club has now accumulated 16 years of yield, fertilizer rate, soil test, plant analysis, cost and profit records to show their progress.

Table 1. 1967 club vs 1982 state average yields & fertilizer use.

	Yield	Fertilizer Rates N	P_2O_5	K_2O
	bu/A	--------- lb/A		---------
1967 Club Avg.	116	113	79	95
1982 Ohio Avg.	117	159	69	100

Yields were all checked by the club's Agronomy Committee and records were collected by the county agents. Measured yield came from at least one contiguous machine-harvested acre which had to be pre-selected in midsummer.

Yields and Fertilizers

The club's yield-fertilizer data are compared with state data in **Table 2.** Both the club's and state's values generally increased with time but the club's yields always remained well ahead of the state's yields. This advantage also occurred in 1970 (when Southern Corn Leaf Blight occurred) and in 1981 (with wet spring and late planting) when all yields were down.

The club farmers used 52% more N, 13% more P_2O_5, and 44% more K_2O to produce 51% more grain than the average Ohio farmer over the 16 years. Furthermore, the club used their extra nutrients equally or more efficiently (see **Table 3**).

Table 2. Club vs state comparisons of average yields and fertilizer rates (1967-1982).

Period Averaged	Yields Club	Yields State	Yields Percent[1]	N Club	N State	N Percent[1]	P_2O_5 Club	P_2O_5 State	P_2O_5 Percent[1]	K_2O Club	K_2O State	K_2O Percent[1]
	--- bu/A	---	%	--- lb/A	---	%	--- lb/A	---	%	--- lb/A	---	%
1967-70	126	82	154	135	94	144	88	76	116	111	76	146
1971-74	135	84	161	168	96	175	87	75	116	107	80	134
1975-78	154	101	152	178	118	151	92	80	115	134	86	156
1979-82	153	110	139	223	154	145	81	76	107	146	104	140
16-year avg.	142	94	151	176	116	152	87	77	113	124	86	144

[1]Club average as percent of state average.

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Table 3. Fertilizer use efficiency — club vs state.

Nutrient	Bushels of corn per pound of nutrient		
	Club	State	Percent[1]
N	0.81	0.81	100
P_2O_5	1.63	1.22	134
K_2O	1.14	1.09	105

[1]Club average as percent of state average.

Soil Tests

The club farmers who used more than average fertilizer rates did so on soils usually already testing "good" or "high" by today's standards. Some soil buildup occurred (see **Table 4**). Note the steady increase in soil K tests along with increased yields and K_2O rates. The increasing trend is less definitive for P tests.

Table 4. Club average soil P K tests.

Period Averaged	Soil P Test		Soil K Test	
	P	FPI[1]	K	FKI[2]
	lb/A		lb/A	
1967-70	64	152	290	399
1971-74	72	159	309	416
1975-78	84	176	332	466
1979-82	78	159	360	505
16-year avg.	74	162	323	446

[1]Field P Index = lb/A soil P + P_2O_5 applied
[2]Field K Index = lb/A soil K + K_2O applied

Economics

Production cost records, as calculated by the club's Agronomy Committee and county agents, show that the cost of raising a bushel of corn increased rapidly from 1967 to 1982. The data in **Table 5** are from club records, calculated by using actual costs and returns for each year. This was compensated for by their increasing yields which produced at first a rapid increase in profits and then maintenance of profit.

Table 5. Club average actual costs, profits, and yields.

Period Averaged	Cost	Yield	Profit
	$/bu	bu/A	$/A
1967-70	0.62	126	63
1971-74	0.82	135	148
1975-78	1.22	154	147
1979-82[1]	1.65	153	142
16-year avg.	$1.07	142 bu	$125

[1]Cost/bu high due to exceptionally low yields in 1981 caused by wet spring and planting delay; profit reduced for same reason. Profit remained relatively high because of good yield and corn price in 1980.

The club's records also show that higher yields were helped by increasing populations and planting earlier. Additional non-recorded factors were also probably involved. These unrecorded "motivation factors" were helped by the club members' sharing of results and ideas with each other at their annual banquets.

But let's not quit! High yield data collected in recent years indicate that even this successful group can improve their yields and profits. ■

Acknowledgements

1. To the many farmers who participated in completing their club requirements;
2. To the many club Agronomy Committee members for regulating and collecting club data;
3. To the various county agents (Phil Grover, John Gruber, Ken Romain, and Larry Lotz) for their many tabulations and their organization;
4. To Agrico Chemical Company for providing the soil and plant analyses during the 16-year period.

Aiming for 6-Bale/A Cotton in Arizona

By Dean Pennington

COTTON YIELDS in central Arizona under drip irrigation have frequently exceeded 4 bales per acre (480 lb of lint per bale) using less than 3 acre-feet of water. A high of 5.41 bales per acre was obtained in 1982. This area of Arizona generally averages about 2.4 bales per acre with traditional furrow irrigation, typically using 5 acre-feet or more of water.

Such high cotton yields grown with drip irrigation raise many questions about the application of conventional fertility management. Some questions arise from the high yields and resultant high nutrient demands, others from strengths and weaknesses of the irrigation system (uniform but limited wetting zone). There are also questions about the changes that may occur in the way a cotton plant develops and sets bolls with frequent irrigations.

Despite these unanswered questions, it is clear that drip irrigation has the potential to increase farm profits by producing higher yields with less water, and by increasing the number of acres that can be planted and uniformly watered using a limited water supply. Before considering fertilizer management, let's explore the question of water management more closely.

Typical furrow irrigation systems do not apply less than 6 acre-inches/acre of water per application. Depending on the water holding capacity of the soil and depth of plant rooting, from 40 to 90% of the applied water may be used by the crop with 60 to 70% being typical. In contrast, drip irrigation systems are capable of applying less than 0.05 acre-inch/acre per application with rates of a few tenths of an inch common. Small frequent applications planned to approximately equal water use by the crop can result in very little deep percolation (below rooting zone) and give correspondingly high irrigation efficiencies.

Efficiencies of drip systems should range from about 85 to 98% with greater than 90% being common. Of course, higher water use efficiencies result in less water used on each acre and represent a substantial dollar savings to the grower. Uniformity of applied water is excellent with drip; most systems have only a 10% difference in the amount of water applied to the wettest versus driest parts of the field.

Using less water per acre results in two fundamental advantages. In areas where irrigation is from deep wells, less energy is used to pump the water needed for each acre. The second advantage is especially important in areas where water is relatively scarce and the total number of acres planted on a farm at any one time is limited by available water, not available land. This is the case for most farms in Arizona.

Dr. Pennington was formerly Extension Soils Specialist, University of Arizona. He is presently Assistant Manager, Red River Land and Cattle Co., Stanfield, Arizona. He is overseeing the conversion of furrow to drip irrigation.

The increased irrigation efficiency means that the "extra" water can be diverted to plant additional land which would lie fallow with conventional irrigation. On some farms currently using relatively inefficient furrow systems on sandy soils a 50% increase in planted acres may be achieved. On other farms using highly efficient furrow systems the acreage increase may only be 5 to 10%.

Drip irrigation can greatly improve the uniformity of available water across the entire field. This increased uniformity results directly in increased yields. An example will demonstrate this point. Consider a field with a narrow sandy strip in the middle of that field, running across the rows and furrows. The sandy strip might represent only 15% of the total field. In most furrow irrigated fields plants grown on this strip would be allowed to burn up due to the impracticality and inefficiency of irrigating the field to meet the water needs of this small area. Because of this, 15% of the field is written off with no yield or substantially reduced yield. The total field production is substantially reduced because of the low yielding sandy area.

Drip irrigation can substantially reduce this problem with properly scheduled frequent irrigations using small individual applications of water. In other words, the variation in water holding capacity of different soil textures becomes much less significant. The result can be a dramatic yield increase on the sandy areas with a substantial increase in total field yield.

How will drip irrigation change fertilizer management? Conventional soil test interpretation and fertilizer recommendations are calibrated for average to slightly better than average yields. Will soil tests need to be completely recalibrated for these higher yields? Also, soil tests for cotton are calibrated for a deep rooted plant which extracts water and nutrients from the top 3 to 4 feet of soil.

Observation of root distribution and soil water use patterns indicate that drip irrigated cotton is shallow rooted, extracting almost all of its water and probably nutrients from the top 12 to 18 inches of soil. The reduced volume of soil explored by active roots may greatly reduce the total potential supply of nutrients available to the plant. This may be a particular problem with immobile nutrients such as phosphorus, potassium, and others.

The drip system itself will cause changes in fertilizer practices. Water soluble fertilizer can be applied with each irrigation if desired. Decisions on fertilizer application, therefore, change from how many pounds of nutrient per acre **per year** in one or two applications for furrow irrigated crops to how many pounds of nutrient per acre **per day.** Thus, drip irrigation adds tremendously to in-season fertilizer flexibility and manageability. Fertilizer formulations will change more to highly pure and highly water soluble materials. Phosphorus represents a special example because of its immobility in the soil and the hazard of precipitation with alkaline irrigation waters in the drip system. The only suitable water soluble form of phosphate is phosphoric acid. But what quality of acid?

Lower quality, relatively inexpensive green acids contain many impurities whose interactions with dissolved salts are difficult to predict and can result in system plugging. White acids have fewer impurities but are more expensive. To make these types of choices intelligently, we will need experience and a better understanding of the water chemistry involved.

In the past, drip irrigation systems have been used mostly on higher valued permanent crops or vegetables. New irrigation technology coupled with shrinking and increasingly expensive water supplies in Arizona are encouraging growers to use drip irrigation on row crops, especially cotton. Although there are many questions yet to be answered it is evident that widespread changes are taking place and the yield potential of cotton has been substantially increased. Imagine — 6-bale cotton! ■

Fertility Factors Associated With High Yield Corn

By Ray Lockman

MOST CURRENT CORN PRODUCTION programs are based on yield goals of up to 200 bu/A. Recent attempts by farmers and researchers to produce higher corn yields have been successful. Data from these high-yielding sites suggest that our old fertilizer recommendations and critical values might not hold true with corn yields over 200 bu/A.

Information from 60 treatments where corn yielded between **200 bu/A and 338 bu/A** is summarized in this paper. The data represent research plots, corn club results and farmer fields from 7 states and provinces in northeastern North America. Some of the data are from the same sites on different years. The sources of the data are acknowledged at the end of this paper.

The data were interpreted in several ways to help develop a "nutritional fingerprint" of high yield corn. While no attempt was made to apply statistical analysis to the data, some interesting trends are obvious when yields are plotted against nutritional factors.

Space did not allow presentation of all the data. The author may be contacted for further information.

NITROGEN. Figure 1 shows that corn yields tended to increase up to the highest nitrogen (N) rate of 500 lb/A. The large range in yields produced at the higher N rates indicates that N was not the only factor limiting yield. But the trend toward higher yields is apparent. Considering the large N requirements of high-yielding corn this should be expected. It is interesting that **all corn yields over 275 bu/A received at least 300 lb/A of N.**

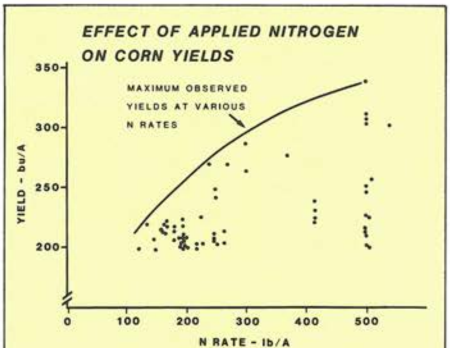

Figure 1

PHOSPHORUS. Corn yields increased with higher soil phosphorus (P) tests up to about 200 lb/A P and then tended to drop off at higher P levels. Corn yields also tended to increase with higher rates of **applied P.** Plant analysis showed that the highest yields were produced with ear-leaf levels of 0.32 to 0.40% P.

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A "Field P Index" was calculated for each yield by adding the soil test P in lb/A to the lb/A of applied P_2O_5. This index was more closely related to yield than either the soil test P or applied P_2O_5 alone. When plotted against yield in **Figure 2,** there is a trend towards higher yields up to an index value of about 500.

As with N, higher P fertility does not by itself guarantee high corn yields. But the data suggest that the chances for successfully producing high yields are better with higher P fertility levels, up to a point.

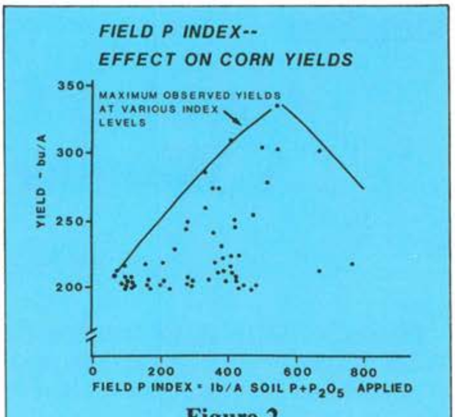


Figure 2

POTASSIUM. Corn yields tended to increase up to a K test of about 350 lb/A while a soil K saturation of 4 to 7% appeared to be optimum. Applied K_2O rates of 150 to 350 lb/A produced the highest corn yields. Increases in ear-leaf K closely paralleled higher yields up to a concentration of 2.4% K. At higher leaf K levels yields tended to decline.

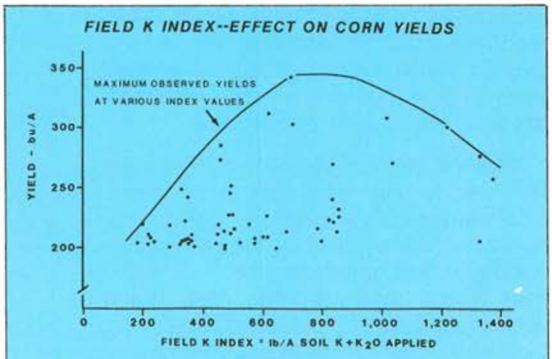


Figure 3

Figure 3 shows that a Field K Index of about 700 was associated with the highest yields. Field K Index values of up to 1,200 did not have a strong negative effect on yield.

MAGNESIUM. The high K soil tests and/or high K application rates apparently reduced the magnesium (Mg) concentration in corn leaves. All yields of 260 bu/A and above had ear-leaf Mg concentrations of 0.11 to 0.18%. Yields fell off sharply with ear-leaf Mg concentrations above 0.2% as **Figure 4** shows. ■

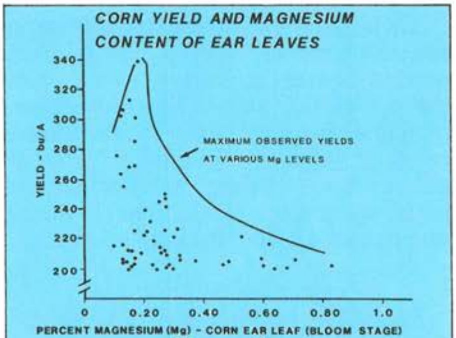


Figure 4

Acknowledgements. Data in this report came from research conducted by Dr. Roy Flannery (NJ), Dr. Ken Stevenson (Ont.), Mike Kimmerly of Agrico (Ont.), and Agrico's Agronomic Research Laboratory (OH). Thanks go to Don Bateman of Shields Soil Service (IL) for collecting the series of soil and plant samples from the Herman Warsaw farm (IL), to Roger Dumond for the Decatur County (IN) Corn Club data, to Mike Brubaker of Brubaker Ag (PA), to Dr. M.L. Vitosh (MI), and to Agrico agronomists Chuck Robinson, Ray Kolwaite, and M.G. Molloy for data collections.

Cover Story

Arrowleaf Clover and P – A Winning Combination

By R.L. Westerman

FORAGE AND BEEF PRODUCTION is a major agricultural enterprise in eastern and southeastern Oklahoma. Many of the soils are hilly and rocky, unsuited for growing row crops. They are generally acid in pH and low in P and K fertility. Common bermudagrass and improved warm season perennial grasses such as Midland and Coastal bermuda are used to get best production.

One of the problems with growing legumes in the area has been stand establishment. Getting an acceptable stand is often prohibited because of dry conditions at planting time. Climatic limitations and infertile soils have discouraged many producers from trying to grow legumes and have caused failure in many cases where they were tried.

Yuchi arrowleaf clover is a cool season reseeding annual legume that is often used to extend the grazing season when overseeded into stands of warm season perennial grasses. It offers the potential for good yields of high quality forage at a time when the base grass is dormant. It is also more tolerant to soil acidity than other popular legumes such as alfalfa.

Description of the study

This study was conducted on a Taloka silt loam soil at the Eastern Research Station, Haskell, OK. It consisted of four replications of ten treatments in an incomplete factorial arrangement in a randomized block design. Rates of P_2O_5 and K_2O included a control that received no fertilizer; 40, 80 and 160 lb/A P_2O_5; 40, 80 and 160 lb/A K_2O; combinations of 40-40, 80-80 and 160-160 lb/A. Fertilizer sources were 0-46-0 and 0-0-60. Initial soil test values were: pH - 5.3; P index - 17; K index - 123.

Lime was not applied to any of the plots. The purpose in omitting lime was to determine the feasibility of growing Yuchi under very acid conditions. Most producers in the area are unwilling — or unable — to invest in a high cost input such as lime because of the moderate management levels under which they operate. Also, lime efficiency is poor when applied on perennial sod.

Seed was inoculated and planted at a rate of 10 lb/A on October 21, 1977. Stand establishment was not uniform, so plots were not harvested. Plots were reseeded in 1978 and yields taken in 1979-82. (Lime has been included in the study beginning in 1983.)

Results of the study

Table 1 shows that response to P was dramatic with a four-year average yield response of 2,641 lb/A at the 40 lb/A P_2O_5 rate. Although the highest average yield occurred at the 160-160 rate, it was not significantly higher than those yields at the 40-0 and 80-0 rates. Potash did not significantly increase yields at any rate or in combination with P_2O_5. It did depress yields at the 40 and 160 lb/A rate when no P_2O_5 was applied.

Soil indexes for both P and K at the beginning of the study were sufficient to produce approximately 50% optimum

Dr. Westerman is Professor of Agronomy, Oklahoma State University, Stillwater, OK. This study was partially funded through a grant from the Potash & Phosphate Institute.

Table 1: Dry matter yields of Yuchi arrowleaf clover as influenced by P and K fertilization.

Fertilizer rate, lb/A		Dry matter
P_2O_5	K_2O	yield, lb/A
0	0	2611
40	0	5252
0	40	1894
40	40	4914
80	0	5259
0	80	2653
80	80	5337
160	0	4907
0	160	2129
160	160	5798

Haskell, OK 1979-82

Table 2: Nutrient content of Yuchi arrowleaf clover as influenced by P and K fertilization.

Fertilizer rate, lb/A		Nutrient content, %		
P_2O_5	K_2O	N	P	K
0	0	1.78	0.11	1.17
40	0	2.08	0.18	1.09
0	40	1.58	0.10	1.14
40	40	2.08	0.16	1.36
80	0	2.25	0.18	0.96
0	80	1.73	0.11	1.23
80	80	2.02	0.17	1.30
160	0	2.11	0.25	1.01
0	160	1.51	0.10	1.23
160	160	2.23	0.24	1.64

Haskell, OK 1979-82

yield without fertilization. However, these indexes were determined only on topsoil. The soil profile at the study site obviously contains sufficient K to have kept K from being a limiting nutrient during the course of the study.

Phosphate fertilization enhanced nutrient contents of both N and P in the forage as shown in **Table 2**. At each treatment rate of P both were increased significantly. Again, K had no influence on N content nor on P content of the forage. The 160-160 combination did significantly increase forage K content over all other treatments.

Summary

This study shows that Yuchi arrowleaf clover can be grown successfully on acid, infertile soils with adequate fertilization. Although the soil at this particular site was not responsive to K, most such soils in eastern Oklahoma that have not been fertilized for row crop production are highly responsive to both P and K. ■

Dean R. Gidney — Memorial to a Leader

MR. DEAN R. GIDNEY, President of the Potash Company of America and a leader for more than 45 years in the fertilizer industry, died on August 15 in New York at the age of 67. He had served continuously on the Board of the Potash & Phosphate Institute (PPI) for 27 years, including a term as Chairman of the Board.

Considered an elder statesman of the fertilizer industry, Mr. Gidney had also served as a member of the Board and as Chairman of The Fertilizer Institute and was a member of the Board of the Canadian Fertilizer Institute.

He had been associated with the potash industry since 1937, after graduating from Dartmouth College. During his college years, he achieved membership in Phi Beta Kappa.

While with the U.S. Potash Company, Mr. Gidney earned a MBA degree from New York University. He served with the U.S. Navy in World War II, attaining the rank of Lt. Commander.

In 1960, he joined the Potash Company of America (PCA) as Vice President for Sales. He was named Executive Vice President in 1973 and President in 1975. In 1980, he was named Senior Vice President of PCA's parent company, Ideal Basic Industries. Among his many milestones was the development of the New Brunswick potash operation which came on stream only weeks before his death.

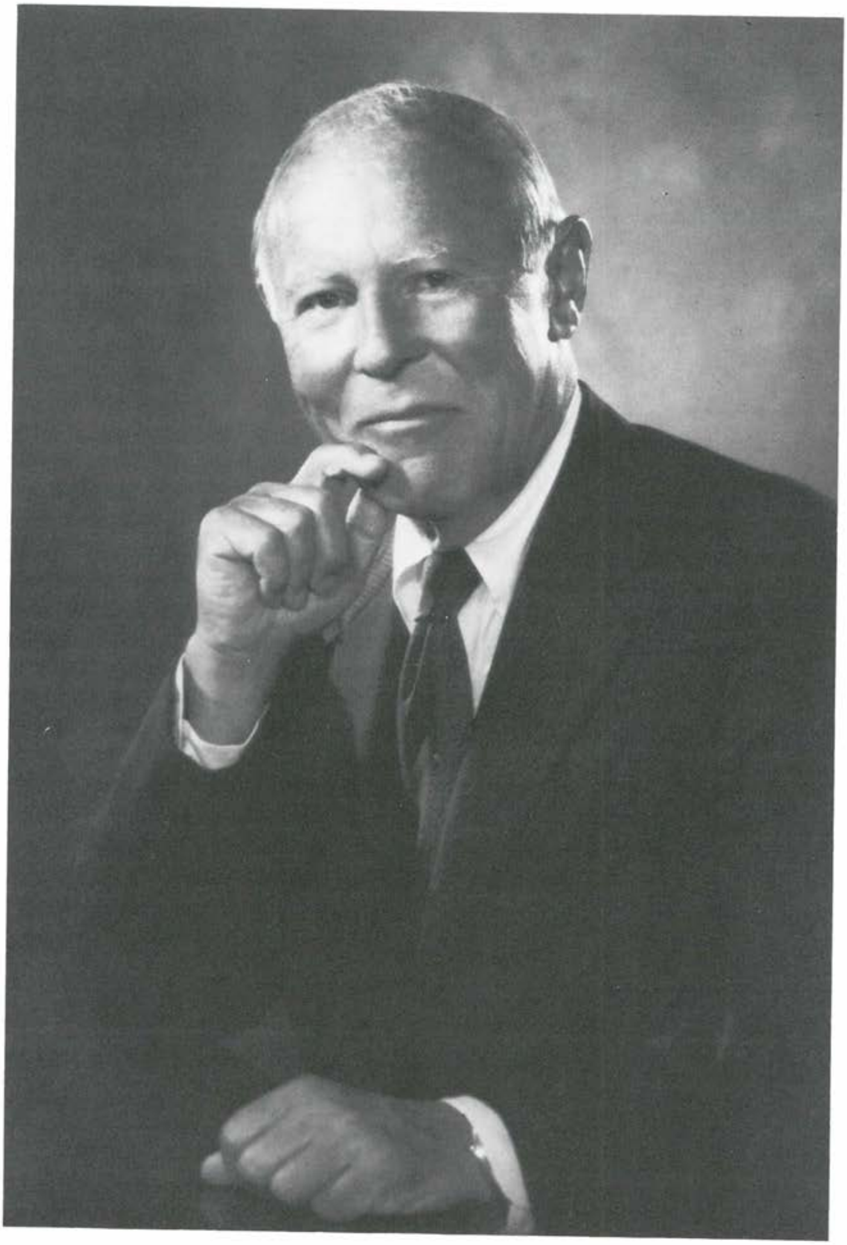
Mr. Gidney is survived by his wife, Olive, who resides in New York City. A memorial service was held August 18 at the Church of the Ascension, New York City.

A Tribute

"Dean Gidney was truly the 'Dean' of the potash industry and was so recognized by a wide circle of business associates who were also his friends. He was trusted and respected. Dean was known for a kind of wit and song that many times kept light what otherwise could become a needless crisis.

"We in PPI have an especially fond spot in our hearts for Dean. As 'Dean' of the PPI Directors he served faithfully and continuously and with steadfast support for more than a quarter of a century — 27 years — two as Chairman. Our organization owes much to Dean Gidney and the legend he leaves."

— Dr. R.E. Wagner, President
Potash & Phosphate Institute
Foundation for Agronomic Research



Dean R. Gidney
1915-1983

Considerations for Organizing Maximum Economic Yield Clubs

By Harold F. Reetz, Jr.

THE BEST WAY to get a farmer to accept a new management practice is to show him it works on his own farm. Getting a respected local farmer to adopt a new practice is the best way to "sell" it in the community. These two observations are basic to the concept of Maximum Economic Yield (MEY) Clubs.

A number of successful MEY clubs have been established in recent years and the farmers and dealers involved are excited about the results. The following discussion outlines some important characteristics of the successful programs and some of the pitfalls to be avoided.

1. A LEADER. MEY clubs, like any organization, depend on a committed leader. Someone has to "light the fire" and also keep the group together. He might be a dealer, an extension agent, a farmer, a consultant . . . the important thing is that he can get a group to work together and to share ideas.

2. COMMITTED MEMBERS. Equally important, the members of the group must believe in the goals and be willing to devote the time and effort required for group meetings and for their own plots. This is a substantial commitment, which must be clearly understood from the beginning. A commitment for at least 5 years is important so that buildup effects can be recognized.

3. MANAGEABLE SIZE. Most successful MEY groups have 15 members or less. Small groups are easier to manage and allow everyone to be an active participant. Limit membership to farmers who have proven ability as managers. Again, commitment is the key.

4. ON-FARM PLOTS. MEY plots on each member's farm are the basis for the whole effort. Plots should be small enough to not be a financial burden but large enough to evaluate field-scale management. In most cases, about 10 acres is reasonable. It is helpful to have two fields where a crop rotation is used, so that information on both crops can be obtained each year.

5. ORGANIZATION. It is best to have a formal organization with elected officers and an established set of guidelines. These might include rules for plots (records, size, harvest procedures, methods of yield calculation, etc.), duties of officers, membership requirements, etc.

6. RECOGNITION. Avoid a contest atmosphere because it can interfere with the sharing of ideas. But some means of recognition, such as certificates of accomplishment, news articles, or recognition dinners can be used successfully as long as they don't interfere with open discussion and sharing of ideas.

7. GOALS. The group as a whole and each individual member should establish realistic, yet challenging, yield goals. Don't let economics set the bounds for the yield goals, but use them as a tool to evaluate the results. Once a yield goal is reached, a new one should be set . . . keep the target moving ahead!

8. RECORDS. Central to any successful MEY group is a good record system for each farm, including detailed records of management practices, field observations, production costs, and weather information. Although

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Dr. Reetz is South Central Director of the Potash & Phosphate Institute.

MAXIMUM ECONOMIC YIELD clubs, such as this group in Indiana, encourage an atmosphere of positive thinking among members and the local agricultural community.

economics should be de-emphasized in the early stages, the real-world of economics must be recognized. The use of any yield-boosting practice should be encouraged as long as record keeping is adequate to evaluate the economics.

9. FIELD MEETINGS. What better place to discuss high yield practices than in the field. "Show and tell" sessions out in the field can be very useful. A small group of farmers sitting in a circle at the edge of a cornfield can get into some very valuable discussions. Another advantage of a small group is that all members' farms can be visited for on-site analysis by the group. In some cases, one or two days might be set aside for touring the members' fields.

10. WINTER EVALUATION AND PLANNING MEETING. It is critical to get the group together after harvest to study results, discuss production limitations for the past season, and make plans for the next season. This may be one of the most important steps in getting farmers to recognize and adopt yield-building practices from one another.

11. MEMBER INVOLVEMENT. Each member should have some responsibility for the group. Officers, planning committees, and harvest checking are ways to get involvement and maintain members' interest.

12. AGRIBUSINESS MEMBERS. The core of the group must be farmers, but it is usually desirable to have some key agribusiness representatives actively involved. They can help provide a broader perspective and leadership.

13. COSTS. The members should be willing to bear all of the expenses for the plots on their farms and most of the expenses for the club. That is part of their commitment. Some groups assess themselves an annual membership fee ($50 to $200 has been reported) to cover costs of meetings, meals, and invited speakers. Others have simply shared such costs as they come along. The dealer or other agribusinesses might help sponsor some of the costs.

A MAXIMUM ECONOMIC YIELD CLUB can be an important part of a dealer's marketing program. By identifying and working closely with a small group of the most productive, progressive, and influential farmers in your area you can help to attract and keep them as your customers. There can easily be a direct spin-off of ideas for your non-member customers. In fact, if the club is perceived as being worthwhile, others may try

(continued on page 21)

Hybrid Selection Under Maximum Yield Management

By R.J. Lambert

CORN BREEDERS have been improving the performance of corn hybrids for conventional environments and management systems since the advent of hybrid corn in the 1930's. Corn breeding progress from 1930 to 1980 has been estimated at 1.5 bu/A/year.

About 60% of the estimated increase in corn yields has been due to genetic gains and about 40% to management practices. Little corn breeding effort has been devoted to developing hybrids that will produce ultra-high grain yields (300 to 350 bu/A). Grain yields of corn over 300 bu/A are being reported more frequently in the last five years. However, these yields have been obtained by intense management practices rather than improved hybrid performance. Only a small percentage of the total corn hybrids planted in the U.S. have the genetic potential to produce grain yields over 300 bu/A.

The corn breeder should be able to establish germplasm pools with the potential for ultra-high grain yields along with other desirable agronomic traits such as disease and insect resistance. From these populations the corn breeder can develop inbreds and hybrids with the genetic potential for ultra-high agronomic yields. There is a wide array of breeding material that can be used for this type of breeding program.

It is important for the corn breeder to develop materials of this type in an environment that will allow the full expression of the genetic potential for hybrid performance. This type of program should be conducted in a high yield environment.

Eight years ago, a project was initiated on the Agronomy and Plant Pathology South Farm at Urbana, Illinois, to develop a high yield environment and find genotypes adapted to this type of environment. The purpose of this report is to describe some of the information obtained to date.

The production practices for the last eight years have been the following: (1) corn-soybean rotation; (2) tillage, fall plow corn ground, last 2 years chisel plow soybean ground; (3) late April planting date (soil temperature 50 °F); (4) fertilizer, 300 lb/A of P_2O_5 and K_2O each year, 400-500 lb nitrogen each year; (5) weed control, Sutan +, and atrazine, (no row cultivation); (6) row spacing 20 inches and plant density 32,300 ppa.; (7) irrigation, applied as needed from 10 days prior to tasseling to 40 days into grain-fill, (application based on soil tensiometer readings).

The P_1 and K_1 tests on this field have gone from 96 and 220 in 1976 to 242 and 800 in 1982, respectively. Tissue analysis of leaves indicate adequate amounts of essential plant nutrients.

The majority of new hybrids being produced today are not well adapted to high yield conditions so that a considerable effort by agronomists must be made before the "right" high yield hybrid is found.

Dr. Lambert is corn breeder at the University of Illinois.

The main agronomic problem in ultra-high yield environments is standability. Some inbreds will produce high grain yields in hybrid combinations, but lack lodging resistance. Two populations — Illinois Stiff-stalk synthetic and BS10 (Iowa 2-ear) — are being used in a breeding program to develop high yielding hybrids. For the past 4 years, we have selected in this material and completed two cycles of recurrent selection for yield and agronomic traits. After 1983, three cycles of mass selection for multiple disease resistance will be completed.

Average grain yields of the 5 highest yielding testcrosses have gone from 234 bu/A in 1978 to 288 bu/A in 1982 or about 13 bu in 4 years. A few inbreds have been developed from the original cycle of these 2 populations. This material was tested at Urbana and Saybrook, Illinois (H. Warsaw, farm) in 1982.

The experimental hybrid BS10-676 x FrB73 had an average grain yield of 264 bu/A at the two locations in 1982, with acceptable stalk quality.

From the data accumulated to date on the breeding materials being used, there is no barrier to producing corn hybrids that are able to consistently produce 300 to 350 bu/A under the proper management system. All it will take is hard work and time. ■

(Clubs . . . from page 19)

harder so they can become members.

At the outset, you as a dealer must recognize that such a club is a commitment on your part, as well, for time and services. It should not be viewed as a burden but rather as an *opportunity*. The members should be expected to bear most of the financial burden, but you still have a large time commitment.

Good planning is essential for the successful establishment of a MEY club. The most important job of the organizer is to create the environment that will make things happen. Get the right people involved and keep them interested.

A MEY club should be considered a learning activity by the organizer and the members. Each should strive to make the experience as beneficial as possible. The members are professionals in crop production and must be treated as such.

As a dealer-organizer, you can be the contact through whom speakers, support information, answers to questions, etc., are obtained. Know where to go for help and don't hesitate to do so. Agribusiness representatives, extension staff, and other farmers are important resources. The Potash & Phosphate Institute has a wide range of resource materials (slide sets, handbooks, films, and numerous publications) that may be useful. The PPI staff are also good resource people for program ideas and technical information. Make use of them.

Compiling record summaries for the group is another important step. Preparing an annual report to be distributed to all members will help encourage better records. It also provides a means of recognizing accomplishments. Over a period of years these records can become a valuable data base for making recommendations for local farmers . . . another important market development tool for the dealer who organizes the club.

The ideas listed above are by no means a complete "How to . . ." guide for establishing a MEY club. They are points to consider. Look for successful groups in your area and copy ideas from them. Much of the "design" for a successful group depends upon the interest of the members. Tailoring it to the members' needs and interests will help ensure success. Try some of your own ideas to make your group unique.

One important fact is on your side. Farmers, dealers, and lenders now realize that improving profit potential depends upon improving production efficiency . . . and that **maximum economic yield** is the goal that will result in maximum net profit over the long run.

A Maximum Economic Yield Club can encourage positive attitudes needed at the local level to maintain a progressive agricultural industry. ■

No-Tillage for Corn – Effects of Fertilizer Practices and Time

By V. Allan Bandel

NO-TILLAGE CORN PRODUCTION continues to increase in Maryland. For several years, it has been estimated that more than 50% of Maryland's corn is grown by no-tillage or by some form of reduced tillage. In some Piedmont counties, as much as 80 to 90% of the corn acreage is now no-tillage or reduced tillage.

Why is no-tillage interest increasing? No-tillage offers the farmer many advantages. Some of the more important ones include soil and water conservation, and the need for less energy, time and labor. It has long been suspected that crops grown by the no-tillage technique were not as susceptible to drought stress as crops grown conventionally. Recent data supports this observation with no-tillage corn substantially out-yielding conventional tillage corn in a drought year. In one case, no-tillage grain yields exceeded comparably fertilized conventional tillage yields by 40 to 50 bu/A. Soil moisture data taken from these plots at the end of the relatively dry 1980 growing season indicated that more than 2 inches more of available soil water remained in the top 2 feet of soil under no-tillage than under conventional tillage plots.

No-tillage over time

We have compared no-tillage and conventional tillage on several soil types in Maryland. On sites with poor soil conditions and low available soil nitrogen, no-tillage corn grain yields were inferior to conventional tillage the first few years. In the worst case, on an intensively tilled Bertie silt loam, no-tillage yields were inferior to conventional tillage for approximately the first 6 years; since that time no-tillage yields have been greater. **Figure 1** shows results obtained on a more productive Mattapex silt loam where only approximately 3 years were required for no-tillage to equal and become superior.

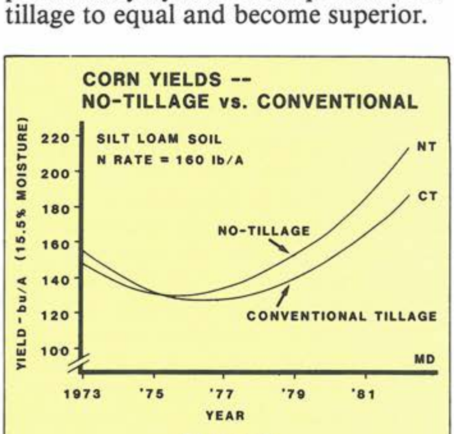

Figure 1

With any new crop production system there will usually be problems. But as experience is gained, many of these problems are resolved. Poor weed control, insect damage, and lime or fertilizer practices are examples of practices which needed refinement. Another factor is that soil tilth is apparently improved as continued no-tillage results in organic matter being returned to the soil. This results in improved soil structure, aeration,

Dr. Bandel is Professor of Soils, Department of Agronomy, University of Maryland, College Park, MD.

N treatment	Location 1 120 lb/A N	Location 2 120 lb/A N	Location 3 120 lb/A N	Location 4 160 lb/A N
	bu/A			
Ammonium nitrate	112.4	155.1	141.9	163.6
UAN broadcast	99.0	119.9	136.3	159.0
UAN dribble	119.9	156.6	148.9	176.0
UAN injected	124.2	167.2	156.2	178.4

Table 1. Influence of N source and placement on no-tillage corn grain yields (1982).

moisture holding capacity, etc. and ultimately, higher crop yields. But, realization of these benefits frequently does require time.

No-tillage and nitrogen (N) fertilization

It has long been suspected that, for maximum yield, no-till corn management required more fertilizer N than conventional tilled corn. This additional N, though, is justified because of higher yield potential with no-till.

Tests designed to measure the influence of N rate and tillage on corn grain yields have continued at 2 locations established in 1973 and at a third location since 1974. If results from all three locations are combined (which represent a wide range of soil tilth characteristics) the 29 location-years of data indicate that on the average, no-tillage corn required approximately 35 lb/A more N for maximum yields than did conventionally tilled corn (**Figure 2**).

This reflected an apparent higher soil N mineralization rate under conventional tillage than no-tillage. It was also apparent that although the average difference in N requirements between the two tillage systems was only 35 lb/A, the range from one set of soil conditions to another was rather wide. At one location, characterized by an intensively tilled soil of relatively poor tilth and low organic matter, N requirements differed by approximately 65 lb/A between the two tillage systems. At the other extreme, on a soil characterized by relatively high fertility and good tilth, there was essentially no difference in N requirement between the two-tillage systems. This would seem to indicate that an equilibrium is possible eventually between N immobilization and N mineralization under no-tillage conditions. But the attainment of equilibrium may take more time for some soils than for others.

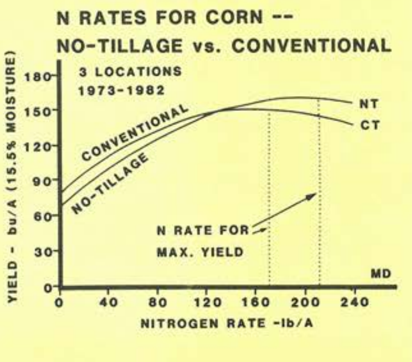

Figure 2

It has long been recognized that some risk is involved when urea or urea-based fertilizers, such as 30% N solutions (UAN), are surface broadcast. When urea N has been incorporated, ammonia losses are minimized but weeds in the injection slot have been a problem, as well as a certain potential for erosion and the extra energy required for incorporation. In 1982, we compared these two systems with a dribble application where a length of hose was placed over the sprayer nozzle. Results in **Table 1** indicate that dribble applications are superior to broadcast and warrant further research as an alternative system to injected nitrogen.

No-tillage and phosphorus fertilization

Concern has been expressed that surface applied P and K may not be as favorable in a continuous no-tillage system as through soil incorporation. We have been growing continuous no-tillage

(continued on page 25)

Sunbelt Exposition Includes Maximum Yield Soybean Test

By Bill Agerton

HOW DOES THE FARMER keep up with what's new and how to produce higher yields? The answer is simple: he reads farm magazines, attends field days, stays in touch with his farm advisers including dealers (farm equipment, fertilizer, seed, etc.), participates in numerous conferences and workshops . . . and, oh yes, he attends farm shows, expositions and the like.

The Sunbelt Agricultural Exposition at Moultrie, Georgia, features numerous attractions and learning experiences for the farmer who finds himself among more than 200,000 other farmers, farmer advisers, agricultural workers and enthusiasts. As with other expositions and farm shows, people come from far and wide . . . from throughout the U.S. and North America, Holland, New Zealand, China and many other places.

The farmer attends such events to gain new knowledge, to share ideas with others, and to enjoy a brief time away from the farm. He views acres of exhibits where companies display their products and explain their services. He tours acres of crops grown under controlled conditions . . . crops with documented test or demonstration results he can take home for in-depth study and use.

He will look at crops he may not grow, but you can bet he will concentrate on crops he grows. Most farm shows feature crops grown in the area or region. For example, at the Sunbelt Ag Expo, crops include corn, cotton, soybeans, sorghum, peanuts, bermudagrass, vegetables and more. Tests and demonstrations include management practices, varieties, fertility studies, timing of planting and harvesting, and a maximum yield soybean test-demonstration.

While most of the projects are designed to show the farmer ways to increase yields and profits, the maximum yield soybean project goals aim to maximum yields with the objective of defining **maximum economic yields**. Dr. John Woodruff and Dr. Bill Segars, both Extension Agronomists with the University of Georgia, are project leaders. The University of Georgia staff provides much of the leadership for projects at Sunbelt.

Why set goals for maximum economic yields? To make more profit on higher yields is the answer, but it isn't quite that simple. It is more a matter of maximizing profits in economic times when average yields are often simply not profitable.

Maximum Economic Yields offer hope to the farmer in his effort to survive as a producer of food and fiber for world consumption. Researchers are trying to find the combination of practices and management techniques to help the farmer produce higher yields consistently . . . to keep his farm profitable. Maximum economic yields appear to be the best alternative.

Researchers in the South have been less successful in producing super-high soybean yields consistently. That's why the push is on in the Sunbelt Project . . . to find ways to do it. Southern soybean varieties usually grow taller than Northern varieties, and by harvest time lodging reduces harvested yields. The Maximum Yield Soybean study at Sunbelt is designed to find the answer. Researchers are using growth regulators to get a dwarfing effect on plants in hopes of increasing yields.

The plots are fertilized and seeded at high rates. Fertilization includes 750 lb/A

OBSERVING PLANT HEIGHT DIFFERENCES in the maximum yield soybean test-demonstration are Dr. David Dibb, (left) PPI Southeast Director and Dr. John Woodruff, Extension Agronomist for the University of Georgia. In the left photo, no growth regulator was used. At right, a growth regulator reduced plant height. Project leaders believe that reduced plant height may be a key in reducing lodging and producing maximum economic yields for the farmer. Top yield in the project in 1983 was 84 bu/A.

of 4-8-12 turned under followed by another 750 lb/A application after turning; $MnSO_4$ broadcast and turned under; molybdenum applied as a seed treatment; and some additional N, P and K (14-6-4) applied 1.5 gal/A 4 times on selected strips with micronutrients boron, copper, and zinc. Lime was applied at 3,000 lb/A and turned under.

The goal is to consistently produce yields over 80 bu/A. This is not the only maximum yield study being conducted in the South, but it does get its share of watchful eyes at harvest to see the results. The Potash & Phosphate Institute is devoted to helping the farmer and industry through its strong emphasis on Maximum Yield Research that paves the way to Maximum Economic Yields for the farmer. ■

(No-Tillage . . . from page 23)
and conventional-tillage corn for five years under variable P and K rates. **Table 2** gives the fifth year (1982) data for the variable P rates. A significant response to P was obtained. It would appear that top yields were achieved in both systems when soil test P levels were above the 200 lb/A level. This level was achieved in the 0 to 2 inch soil layer under no-tillage with 80 lb/A P_2O_5 and at the 160 lb/A P_2O_5 rate in the 0 to 8 inch layer with conventional tillage. It appears on this productive Coastal Plain soil that fertilizer P may be more efficiently utilized under no-tillage where it is surface applied than under conventional tillage where it is incorporated. ■

Table 2. Corn grain yields of no-tillage and conventional tillage at variable phosphorus rates (1982).

P_2O_5 treatment	No-tillage			Conventional	
	Soil test — lb/A(1)		Yield	Soil test	Yield
lb/A	0-2 in.	0-8 in.	bu/A	lb/A	bu/A
0	39(L)	45(L)	161	46(L)	161
40	120(L)	62(M)	173	64(M)	177
80	253(VH)	128(H)	194	100(M)	185
120	458(VH)	158(H)	182	162(H)	183
160	578(VH)	211(VH)	183	214(VH)	194

(1) L = Low M = Medium H = High VH = Very High (Mehlich double-acid extractant)

Next Big Step

Improving Communicative Skills of Agronomists

By Dr. Charles F. Eno

OVER THE YEARS, I have made observations regarding the manner in which we train students in agronomy. Also, I have received many letters on this subject from fellow agronomists.

In soil science, in the era of the 40's, much emphasis was placed on soil science subjects, languages, and courses in practical agriculture. In the 50's traditional language requirements were often reduced from two to one, and sometimes none. During this time, calculus, differential equations, physical chemistry, and statistics were emphasized. Truly, it was a strong move into the basic sciences. Now languages are "back in style," but this time it is BASIC, FORTRAN, COBOL and SAS. Today, the combination of skills and instrumentation our scientists possess make it possible for agronomists to solve complex problems and rapidly place them in print.

Despite this sophistication, at least one well-defined area of training deficiency often causes our present graduates – and others of us – to compete unfavorably with graduates in agricultural economics, other agricultural production areas, and perhaps even some oriented toward business. This deficiency, scholarly and practically, could be labelled "Training in Communications."

Recently, I surveyed the faculty assignments in Agronomy Departments in Land Grant Institutions in regard to their involvement in teaching, research and extension. Some 73% of them were involved in teaching and extension. The point is, here is a large segment of institutional agronomists who make a living largely through the use of communication skills. In fact, all agronomists in universities – those in teaching, extension and research – use these skills, for research workers constantly present their data, theories, and methodology in written, spoken, pictorial, and graphical forms . . .

Emphasis on the need for these skills is just as great in two-year technical colleges. An associate professor recently said that regardless of career goals, graduates need to be well versed in communication skills. They may not teach or give seminars, but certainly they need this expertise to obtain bank loans, to talk dad into changing old farming habits, to give directions to hired help, and for a variety of other needs. This training should be required, regardless of professional goals.

Let me hasten to say that the industrial agronomist is not being overlooked. Data are more difficult to obtain in this area. However, I believe that close to 100% of them are heavily involved in the use of communicative skills. The majority probably fit most closely the role of an extension agronomist . . .

Training Programs

Now, let me turn to training programs. In most cases it has been sadly neglected. Not many have had more than a few hours of English, writing, or speech courses in their baccalaureate degree program.

The Board of Directors of the American Registry of Certified Professionals in Agronomy, Crops, and Soils (ARCPACS) recently developed a set of course re-

Dr. Eno is Past President of the American Society of Agronomy and former Chairman of the Department of Soil Science, University of Florida. This article is condensed from Dr. Eno's Presidential Address given at the Summer, 1983 meeting of the American Society of Agronomy in Washington, D.C.

quirements for each area of certification; in all cases, they recommended six semester hours of communication courses. This is a very minimal requirement, but it is beyond freshman English and is with emphasis on technical writing and speech . . .

Some of us believe that an examination for communicative skills should be given before graduate degrees are awarded. The Graduate Record Examination measures verbal proficiency. If students enter with low scores, at least a technical writing course should be required . . .

There are similarities in research; we are judged for promotion and tenure by the number and quality of papers published. This means that the future agronomist must have a sound technical background, a practical business view, and the ability to transmit information and insights to others. To pack all this into 120 to 130 semester hours of credit presents quite a challenge.

As one professor said, the pressure for specialization is greater than ever; this makes it more difficult to work in courses such as speech and writing.

Here are just a few of the traditional, and perhaps somewhat less traditional, ways that we may improve this skill:

1. **Enrolling in formal courses** in Agriculture Education, Journalism, Radio, or Television. For example, the University of Massachusetts, at Amherst, offers a graduate course dedicated to writing of research proposals aimed at federal and private granting agencies.

   Other suggested courses include subjects such as the thesis, proposals, articles, slides, audio-visual media, use of word processing and other new technology, verbal presentation, group and conference techniques, and other topics likely to be encountered.
2. **Informal experiences** in extension, teaching, seminars, and the writing and presentation of scientific data beginning as an undergraduate student should be planned. Seminars should be video-taped, reviewed, and then constructively criticized by professors specifically trained or otherwise skilled in educational techniques.
3. **Our professionals should join clubs,** such as Toastmasters, at an early opportunity.
4. **Teachers in all areas** should not accept inferior written and oral presentations. Editors in all agencies must maintain high standards for publication. All can insist on good communication. Practice in improving these skills must continue through a lifetime.

A real problem exists in that documentation of the training and experience of students in communications is often difficult. If possible, transcripts should record these events whether they are in formal courses, seminars, or supervised teaching credit. In some universities transcripts may include the specific titles of seminars and special problems. Personal resumes should not only list publications and scientific presentations, but also radio talks, TV programs, slide-tape shows, and experience in teaching and extension. In some colleges, each student is required to develop a complete resume prior to graduation. Above all, those who write letters of recommendation should evaluate a candidate's ability to communicate . . .

Can communications training be accommodated in agronomic curricula? I believe that we have a responsibility to insure that our students have these skills in addition to mathematics, statistics, advanced chemistry and other tools-of-the-trade.

High standards, starting at the administrative level, provide the basis for student attitudes and their eventual proficiency after they complete their educational programs. Simply then, the responsibility for excellence in communication rests with each member of our profession.

Yes, I believe that most of us, even "born teachers or communicators," can be made better by positive formal and informal experiences in the areas I have mentioned throughout the educational process and, in fact, one's entire career. ■

Communication Still Our Weakest Skill

AT THE 10th ANNIVERSARY gathering of the Council of Agricultural Science and Technology (CAST), Dr. Norman Borlaug shared a wealth of knowledge about the world food problem. The comments of this renowned international agricultural scientist slammed home a more basic message — that progress on any problem begins with communication.

He explained how American agriculture might look today if 65% of the U.S. population still lived on farms, as in India, instead of the 2.5% that currently farm. According to his calculations, the average-size farm would be 9 to 10 acres if the average-size family were 3 persons. If the average family size were 6 persons, farms would average only 18 acres, he said.

More dramatic numbers emerged when he compared U.S. food-production capacity of 40 years ago with the present. If we still used the agricultural technology of the 1940s to produce the amount of food we enjoy in the 1980s, we'd need to use considerably more acres. We'd have to plow up 75% of our pastures and rangeland or chop down 65% of our woodlands and timber, he said.

"We would have had to cultivate an additional area equivalent to that east of the Mississippi, excluding Illinois," Borlaug said.

The 1970 Nobel Peace Prize winner is best known for developing the "miracle wheats" that contributed to the Green Revolution in the 1960s and 1970s. CAST presented Borlaug its first Distinguished Achievement Award in Food and Agricultural Science for "his many contributions to improving food production in the world." And his work with international agricultural groups keeps him in touch with the world situation.

On the global scope, Borlaug said that if population growth continues at the 1975 rate (when it hit four billion), the earth's inhabitants would double by 2015. Despite the fact that he believes population growth rate is now slowing, he sees a tremendous challenge to produce food.

"One problem is to produce enough food," he said. "But the second is to distribute it equitably." Borlaug explained that production must increase in an orderly way and be brought on-stream carefully. Otherwise, he cautioned, the best farmers in the world will be economically destroyed.

Yet, he calls lack of communication between scientists in developing countries one of his greatest frustrations. "In India, the rice breeders weren't in contact with wheat breeders," Borlaug pointed out. Thus, rice scientists developed varieties with longer growing seasons that reduced chances for double cropping.

Borlaug finds his fellow scientists are often the greatest barriers to progress in developing countries. In working with dozens of governments around the world, and "trying to serve as a link between the scientists and their own policymakers," he also found communications the most important factor for success.

At the farmer level, Borlaug found resistance to advanced technology in developing countries. "In Mexico, in the beginning, there was no faith whatsoever in scientists and in science and technology," he said. In fact, the young Mexican scientists who worked with him were brutally treated, especially by the better farmers. They considered the scientists social parasites living off taxes and

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producing nothing to improve agriculture.

The only way to overcome that attitude is with positive results demonstrated on farms, not on experiment stations, he said. When a package of technology provides a significant yield increase, scientists must "pound on the table, especially if there is a food crisis."

So coursing through all of Norman Borlaug's observations about world agriculture is a single, undeniable fact. It's not a lack of information that holds back agricultural progress in developing countries or in our own backyard. Actually, reams of knowledge flow from the world's agricultural scientists every year.

Instead, poor communication is the barrier to increasing food production. Communicating ideas and information between scientists, to farmers and up to the highest seats of government, must be the first step. That's something to remember the next time we talk to the hired man or to the secretary of agriculture.

It's ironic that a solution to the world's hunger may come from opening our mouths to talk, rather than to eat. Let's talk about it. ■

PPI Manuals Offer Help

PPI OFFERS help to the farmer and to the farm adviser who are concerned with keeping the farm profitable. That help can be found in the **Soil Fertility Manual** and the **Maximum Economic Yield Manual, A Guide to Profitable Crop Production.**

In its 93 pages, the **Soil Fertility Manual** covers the basic principles of soil/plant relationships and fertilizer/lime use. It includes discussions about primary, secondary, and micronutrients; soil testing; plant analysis and diagnostic techniques and more. Each chapter is followed by a chapter review. **The manual costs \$7.00 each with its attractive 3-ring binder (\$5.00 for member companies – MC*); texts only cost \$5.00 each (\$3.00 MC*) without binder.**

Slide sets for each chapter are also available. When used with the manual as a resource, they make excellent teaching materials, especially for those who provide soil fertility instruction. There are 339 slides in all nine chapters . . . the cost \$90 for the package (\$70 MC*). Each chapter set may be purchased separately at a cost of \$15 each (\$10 MC*).

The **Maximum Economic Yield Manual** has been expanded to 144 pages with the addition of three new chapters – "Wheat Production for Maximum Profit in Humid Regions of North America", "Alfalfa Production for Maximum Profit", and "Forage Production for Maximum Profit." With chapters on corn, soybeans, cotton and small grains as well as general production information, the manual is an excellent teaching tool and reference source. **The revised manual costs \$9.00 each in an attractive 3-ring binder (\$7.00 MC*). The text without binder costs \$5.00 each (\$3.00 MC*).**

Slide sets for the MEY Manual are available (except chapter 1, for which there are no slides). The remaining 11 chapters are illustrated with 386 slides at a cost of \$120 (\$90 MC*), or individual chapter sets at \$15 each (\$10 MC*).

Consult your Winter 1983-84 PPI Catalog of publications and visuals for more details. Or contact the **Potash & Phosphate Institute, 2801 Buford Hwy., N.E., Suite 401, Atlanta, Georgia 30329. Phone: (404) 634-4274.**

MC* indicates member companies of PPI, contributors to the Foundation for Agronomic Research (FAR), universities and government agencies.

Many Yield Problems Related Back to Problems at Planting

MUCH OF THE YIELD potential of a crop is determined during the planting operation. Achieving an excellent yield is not simple for either the farmer or the researcher.

Score yourself on the points on this checklist — and add your own ideas for avoiding planting problems.

1. Seed
- Variety selection
- Size
- Germination
- Vigor

2. Condition of seedbed
- Tillage equipment
- Number of tillage trips
- Physical condition
- Plow pan
- Crop residues
- Uneven
- Moisture
- Drainage
- Temperature
- Fertility level

3. Previous management
- Chemical residue hazard
- Crop residue management
- Previous crop

4. Row width
- Optimum for crop
- Optimum for management level
- Optimum for variety or hybrid

5. Spacing in row
- Number of seed dropped
- Speed of planting
- Uniform distance between seed
- Planting equipment
- Adjustment and repair of equipment

6. Evenness of emergence
- Depth of planting
- Soil-seed contact
- Pesticide or fertilizer placement
- Salinity
- Plus factors listed in 2 and 3

7. Timeliness
- Optimum planting date
- Tillage

8. Nutrient application
- Rate
- Placement
- Source
- Optimum in young root zone

9. Pest control
- Seed treatment
- Selection of pesticide
- Rate
- Placement

10. Researcher or farmer
- Priority
- Know-how
- Number of experiments or acres
- Care
- New planter

11. Technician or hired help
- Training
- Out-of-date thinking
- Does planting

Attention to or control of most of these factors costs little or nothing. Sometimes only management factors separate high yields from average or disappointing yields. Many times, correcting problems with low cost inputs allows maximum returns from the higher cost inputs.

Careful planning and careful execution of the plan are the keys. Dr. Roy Flannery, the New Jersey researcher who has pioneered maximum yield corn and soybean research, sums it up with this quote: "I leave nothing to chance."

Prepared by Potash & Phosphate Institute agronomists.

New Winter Wheat Hybrids For High-Yield Management

FOLLOWING more than 10 years of research, several new high-yielding, disease-resistant hard and soft winter wheat hybrids have been introduced by Rohm and Haas Seeds, Inc. Called HYBREX, the technology is based on a chemical hybridizing agent that inhibits pollen development in wheat without affecting the fertility of the female portion of the plant.

Recent yield tests throughout the United States followed earlier research which showed that the hybrids can produce yield increases over hard red winter wheat varieties such as Centurk 78, NK 35, and Scout 66 and over soft varieties including Hart, Arthur 71, and S-76, said Dr. Wayne O. Johnson, president of Rohm and Haas Seeds, Inc.

The company is marketing the hybrids through local seed companies, which grow the hybrid seeds and sell them under their own brand names.

Average U.S. wheat yields have increased from about 26 bu/A in 1960 to more than 33 bu/A in 1980, largely as a result of improved varieties and better management. To compete, however, wheat growers must achieve ever higher yields while holding the line on production cost per acre, notes Dr. Charles H. Baker, vice president of the seed company.

Cooperative testing with universities is planned to compare performance of new hybrids to varieties presently grown in major wheat-producing states. A goal of the seed company is to "maximize yields through improved hybrids grown under conditions of optimum crop-management practices."

Hybrid wheat production may require some adjustments in management. For example, the Hybrex seed is small, meaning that farmers can plant fewer pounds of seed per acre and still get optimum plant populations. In some conditions, seeding rates may be reduced 25 to 40%.

Soil testing is strongly encouraged when planning for hybrid wheat production. Hybrid wheat responds to higher than normal fertility in most instances, according to Rohm and Haas researchers. ■

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Change

IF EVER an industry was in need of change, it is agriculture – the world's largest and most important industry.

Changes in the farm picture are long overdue – not just operational changes such as mechanization, but major decision changes. The farmer has committed the one unpardonable political sin. His great efficiency has reduced his number to a small minority with limited political clout.

When he produces himself into a glut, these surpluses trigger temporary government programs that please neither the farmer nor the public. Surely some better system of dealing with the food problem on a global basis *must* be worked out.

The answer is complex – unclear – enmeshed with the entire world economic and political situation. Here are samples of some of the **provocative ideas one encounters:**

1. **New imaginative concepts** in marketing and distribution are the key to a healthy agriculture. Too much emphasis today on controlling production – too little on marketing.
2. **The biotechnology revolution,** in its infancy, will receive more emphasis. It will have a tremendous impact on the whole structure of experiment stations and extension services.
3. **The entire educational systems** in agriculture should be revolutionized. Ancient curricula and stale lecture and laboratory approaches will give way to new and dynamic processes of education and training.

Did I hear us say we disagree with those ideas? Well, we'd better come up with some of our own!

Change is great, and challenging, and thrilling. We in the agricultural field should be the pioneers in developing a whole new system that integrates production and utilization.

Progress generally comes through **change.** No one can deny the need for change in the entire world agricultural picture. Where are **our** ideas?

– Dr. J. Fielding Reed

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