

eKonomics

*You can't prepare for a drought — or can you?
This long-term study says yes...*



NEWS & VIEWS

*A regional newsletter published by the
Potash & Phosphate Institute (PPI) and the
Potash & Phosphate Institute of Canada (PPIC)*

*Dr. H.F. Reetz,
Midwest Director
January 2003*

High Fertility— Extremely Important with Weather Extremes

AS FINAL PLANS are made for the 2003 growing season, take another look at nutrient levels. Review soil tests and fertilizer plans to be sure nutrient needs of the planned crops will be adequately met. Some areas came through the 2002 season with a shortage of soil moisture, and winter precipitation has been variable. While it is too early to predict seasonal weather patterns, dry areas are likely to occur again. Crop yields can best be protected by maintaining adequate nutrient levels.

Some areas of the country were severely affected by weather extremes last season, with corn yields well below 100 bu/A reported. Yet farmers with high soil test levels were able to produce much better yields.

Some key points to think about in reviewing plans for the 2003 season:

- Drought will have less impact on yield where nitrogen (N), phosphorus (P), and potassium (K) availability are high throughout the growing season.
- Yield increases in response to added fertilizer may actually be higher in a dry year than in a normal year.
- Good fertility stimulates earlier and deeper root growth, making more efficient use of available water and ensuring season-long nutrient uptake.
- Where drought-damaged crops were harvested for hay or silage last year, nutrient removal may have been greater than if a normal grain crop had been harvested. Be sure to adjust crop removal estimates.
- Soil compaction increases the impact of drought stress. Steps to eliminate compaction will help improve root growth and water use efficiency.

- Because root growth will be limited in a dry year, high soil tests and deep placement may be even more important to assure adequate season-long supplies of nutrients.
- High P is important to early root growth.
- Adequate K is necessary for healthy plant water relations. Opening and closing of stomata, which regulate carbon dioxide (CO₂)...photosynthesis... and water vapor exchange (transpiration) between the leaves and the atmosphere, are controlled by K level in the leaves. If K is inadequate, transpiration water loss increases and photosynthesis decreases.
- Development and maturity are speeded up by high fertility levels, allowing the crop to get through critical flowering stages earlier, perhaps before drought stress occurs.
- Selecting varieties with deeper, more vigorous root growth patterns may be beneficial, so long as their yield under normal conditions is also good.
- Other management practices such as early planting, conservation tillage, and adequate weed, disease, and insect control measures also help keep the crop growing at peak performance and enhance water use efficiency.

Long-term field studies with a range of soil test levels provide a unique opportunity to quantify the importance of soil test level in reducing the impact of drought



Agronomic market development information provided by:
Dr. Harold F. Reetz, Midwest Director
Potash & Phosphate Institute (PPI)
111 E. Washington Street, Monticello, IL 61856-1640
Phone: (217) 762-2074, E-mail: hreetz@ppi-far.org



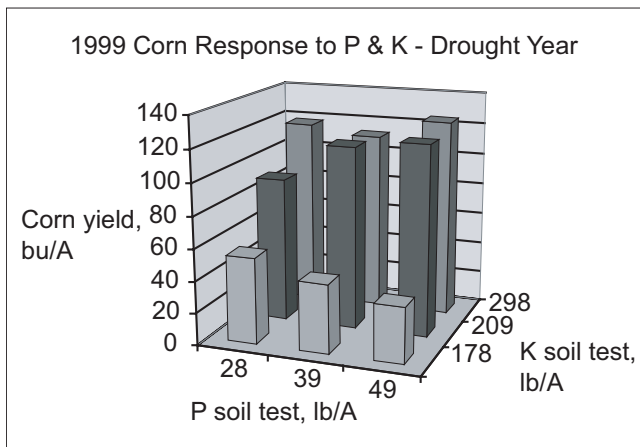


Figure 1. Corn response to different soil test levels in a corn-soybean rotation. Soil tests were taken after the 1998 soybean harvest. Source: Dr. Jay Johnson, Ohio State University, 1999.

stress. Results from a long-term P and K rate study on a corn/soybean rotation conducted by Dr. Jay Johnson in Ohio showed a dramatic response to high fertility as a means of combating drought effects on yield (**Figures 1 and 2**).

This is one of many examples supporting the need to maintain high soil tests to reduce the impact of drought stress. Drought makes it difficult for a plant's roots to supply adequate nutrients throughout the season. When water supplies are short, a higher soil test level supplies the plant with more nutrients in a limited root volume. Shortage of nutrients reduces physiological functions of the plant, making energy transfer and other growth processes less efficient.

Water use efficiency is perhaps the most seriously affected by moderate water stress. Stomata tend to lose their control of water loss from the leaves, further increasing the stress. Photosynthesis rate declines and respiration tends to increase, so that net accumulation of sugars is reduced. Since the main component of crop yield is converting light energy into chemical energy through the accumulation of sugars, there is a direct effect on yield potential.

All of these processes are better maintained under stress conditions if adequate supplies of nutrients are available throughout the growing season.

In the Ohio study, corn yields were severely depressed at low soil test levels, but impact of the drought was greatly reduced with high P and K soil test levels, highest yields being where P and K soil tests were highest (**Figure 1**).

The most dramatic effect was the response to higher K soil tests. There was a positive interaction between P and K soil test levels. Increasing P levels at low K levels resulted in decreased yield, possibly due to interaction with other

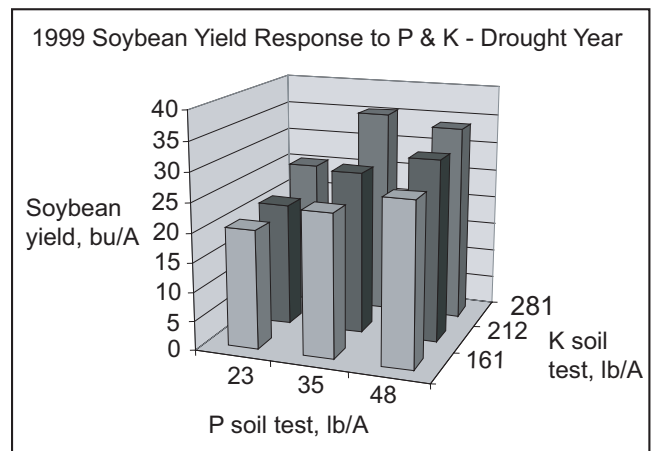


Figure 2. Soybean response to different soil test levels in a corn-soybean rotation. Soil tests were taken after the 1998 corn harvest. Source: Dr. Jay Johnson, Ohio State University, 1999.

nutrients. Increasing K soil test levels resulted in increased yield. At higher K soil test levels, there was also an increase in yield as P increased. Farmers, dealers, crop advisers, and Extension workers throughout the Midwest have frequently observed that fields with high soil test levels are able to produce near-normal yields, while fields testing medium or below can suffer major yield losses from dry weather during the growing season. The benefits of high fertility are much more evident in a stress year than in a normal year.

Soybean yields for the study in 1999 also responded to higher P and K soil test levels (**Figure 2**). Having adequate nutrients appeared to be more important in a stress year than in a normal year. There is also a positive P and K interaction, so that highest yields were obtained where both P and K soil tests were at the highest level.

Generally, it is not advisable to make decisions on the basis of one year's data, but this study has been in place for over 25 years. The data series includes several examples where this same type of response is seen in dry years. The effect is masked when years are averaged together, so it is important to look at the individual year in this case. The 1999 response was nearly double the response that occurred under similar drought conditions in the mid-1970s, probably due to the increased yield potential of modern hybrids compared to those of 25 years ago.

If dry conditions are expected, one of the best defensive strategies is to be sure soil test levels are high. If good conditions prevail, you have lost nothing, because the higher nutrient supply will help increase yields.

Fortunately, the best strategy for dealing with an expected dry year is also the best strategy for a good year...that is, *plan for a good year*. Adequate nutrition is essential to take advantage of the good growing seasons,

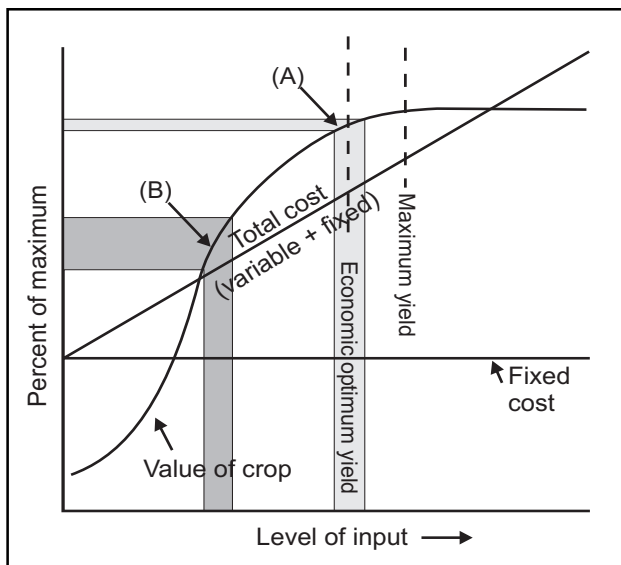


Figure 3. Typical response of crop to an input such as fertilizer and generalized relationship to costs and production.

Farmers faced with the double problem scenario of moisture shortage and low crop prices and desiring to cut input costs may be tempted to cut back on inputs such as potash. **Figure 3** illustrates why such cut-back decisions may be the wrong choice. Note the impact of reducing the application rates of a production input at different levels of management. The light gray band (A) represents the effect of reduction of input (such as potash fertilizer) when managing at a point near economic optimum...maximum economic yield (MEY). This is usually within the range where maintenance-only application rates are needed. The dark gray band (B) represents the effect of the same reduction of input when managing at a point where buildup applications are needed. Reduction of input in this zone in this example results in yield losses of several times the loss caused by the same input reduction when managing in the zone near economic optimum. Managing for high yields, near the MEY level, provides the greatest flexibility in management decisions.

but it is also the best management approach to preparing for a drought. Adequate supplies of N, P, and especially K, must be readily available to keep the crop healthy and vigorously growing all season long.

Under dry conditions, an adequate nutrient supply will ensure early root development and deeper penetration. If a good root system can be established early, the plant will be better equipped to explore deeper in the soil profile for water and nutrients later in the season.

Review recent soil tests. Areas that are medium or below should be considered for additional fertilizer application. If detailed sampling (grid- or management zone-based) has been done and variable-rate application equipment is

available, this may be an opportunity to focus limited fertilizer dollars where they will do the most good. In any case, shortcutting P and K supplies will likely lead to shortcutting yield potential and profits. If field-average management is used, it is important to move to high soil test levels to be sure no areas of the field have limited nutrient supplies. ■

**Best strategy for a poor year:
Plan for a good year.
Plan for a bad year and
you are guaranteed to get one.**

Contact PPI/PPIC/FAR on the Internet

You can reach the Potash & Phosphate Institute (PPI), Potash & Phosphate Institute of Canada (PPIC), and Foundation for Agronomic Research (FAR) on-line at www.ppi-ppic.org.

There is increasing variety and diversity of information now available in electronic form at PPI/PPIC/FAR, with more additions and changes to the website coming soon. Current and back issues of *Better Crops with Plant Food*, *Better Crops International*, *News & Views*, *Agri-Briefs*, and other publications are available as pdf files.

For further information, contact PPI headquarters by phone at (770) 447-0335 or fax (770) 448-0439.

InfoAg 2003 Set for July 29 to August 1

The sixth Information Agriculture Conference is scheduled for July 29 through August 1, in 2003. The location again will be the Adam's Mark Hotel at the Indianapolis Airport, site of InfoAg 2001.

The event will begin with an optional all-day field trip by bus to visit a fertilizer dealership using site-specific systems with customers, and a tour of the Davis-Purdue Agricultural Research Center in eastern Indiana where university staff and cooperators are conducting a wide variety of site-specific management and remote sensing projects. The field trip will have a separate registration fee from the traditional conference that begins on the morning of July 30. Program features will include hands-on workshops on data management and interpretation, exhibits and demonstrations of the latest technology, and ample opportunity to attend seminars by farmers, dealers, technology developers, and researchers.

For more details, check the website at www.ppi-far.org/infoag

RN 03032

NEWS & VIEWS

Midwest Region
January 2003



Potash & Phosphate Institute (PPI)
655 Engineering Drive, Suite 110
Norcross, GA 30092-2837

PRESORTED STANDARD
U.S. POSTAGE
PAID
Atlanta, GA 30329
Permit No. 1355