Get the Edge on Fertilization Management

Fall 2004

How Important Is Fertilization When Soils Test "Medium"?

Dr. T. Scott Murrell
Northcentral Region Director, PPI

MOST university phosphorus (P) and potassium (K) recommendations adhere to one of two basic fertilization philosophies: 1) build and maintenance or 2) nutrient sufficiency.

The question of whether or not to fertilize when soils test in the "medium" range is applicable only to recommendation systems following the nutrient sufficiency approach. Both approaches are outlined below.

Approaches to Fertilization

Build and Maintenance

The objective of the build and maintenance approach is to increase soil fertility to a level that does not limit crop production, and then keep it there through maintenance fertilizer applications (Leikam et al., 2003). Raising soil tests to these higher levels is usually done over several years and reflects the long-term management associated with this approach. Soils built to target levels are capable of meeting crop P and K needs in any given year without fresh nutrient additions, with the exception of starter fertilizer applications for some crops, like corn. Higher fertility levels provide flexibility in P and K applications, periodically allowing farmers to rely solely on soil supplies when fertilization costs need to be reduced.

Nutrient Sufficiency

The second approach to P and K recommendations is nutrient sufficiency. The goal of this approach is to manage soil fertility to maximize net returns to fertilizer costs in the year of application (Leikam et al., 2003). Crop production in any given year relies on both soil fertility and fresh fertilizer additions.

Fertilization and the Nutrient Sufficiency Approach

The nutrient sufficiency approach as well as the build and maintenance approach rely on soil test calibration datasets. These datasets come from experiments examining crop response to fertilizer additions conducted across a wide range of soil test levels, environments, and years. Within each site and year, crop yield at a given soil test level without fertilizer is expressed as a percentage of the yield attained under adequate fertilization (relative yield). Left unfertilized, lower soil test levels are generally associated with lower yields and greater yield response to nutrient additions (**Figure 1**).

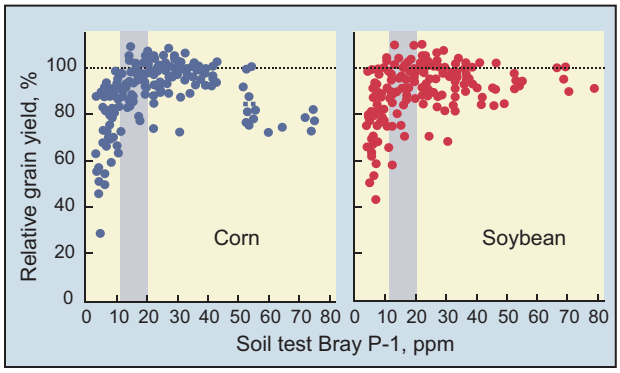

Figure 1. Comparison of the relationships between soil test P and grain yield of corn and soybean for several Iowa soils (Mallarino 1999). Optimum (medium) levels across all subsoil P levels are shown in the shaded area.

The nutrient sufficiency approach relies on crop response in each year. When fertilizer is applied to a nutrient deficient soil, crops generally exhibit an increase in yield. For fertilization to be profitable in the short term, the yield response of a single crop must be great enough to more than pay for the fertilizer applied. To generate a response of this magnitude requires that soil fertility be kept at lower levels, where there is a reasonable chance of getting the needed yield increase (**Figure 2**).

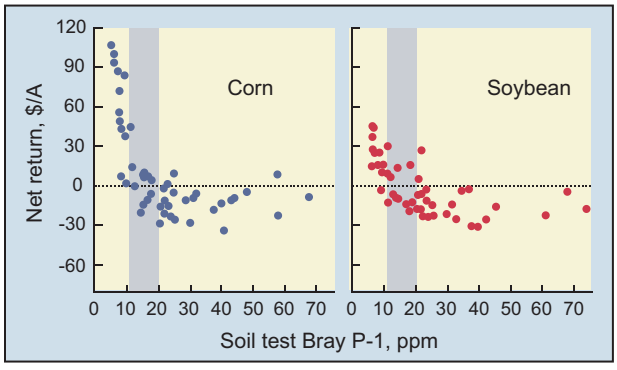

Figure 2. Single season net returns to 46 lb P_2O_5/A (Sawyer and Mallarino 1999). Optimum (medium) levels across all subsoil P levels are shown in the shaded area.

The range of soil test levels classified as "medium" or "optimum" in nutrient sufficiency recommendation systems represents the highest soil test levels

that still provide reasonable chances that fertilization will be profitable in the year it is performed. Most nutrient sufficiency recommendations strive to move soil test levels into this range and keep them there through maintenance applications.

So how important is fertilization when soils test "medium"? The answer is "very important." **Crops grown on soils with this level of fertility rely on both soil supplies and fresh P and K applications.** Applying fertilizer to "medium" testing soils provides good chances that positive returns will be seen in the year of application. ■

References

Leikam, D.F., R.E. Lamond, and D.B. Mengel. 2003. Providing flexibility in phosphorus and potassium fertilizer recommendations. Better Crops 87(3):6-10. (Available online with updates at http://www.ppi-ppic.org/ppiweb/bcrops.nsf) (Verified 21 Jun. 2004).

Mallarino, A.P. 1999. Alternatives for P and K management: A role for deep banding and starter? p. 247-253. *In* Proc. Integrated Crop Management Conf. 1-2 Dec. 1999. Iowa State University Coop. Ext. Serv., Ames. (Available online with updates at http://extension.agron.iastate.edu/faculty/mallarino/mallarinopubs/Icmpkpaper.pdf) (Verified 21 Jun. 2004).

Sawyer, J.E. and A.P. Mallarino. 1999. Interpreting P and K soil test results. *In* The Integrated Crop Management Newsletter IC-482. Iowa State University Coop. Ext. Serv., Ames. (Available online with updates at http://www.ipm.iastate.edu/ipm/icm/1999/1-18-1999/interpretpk.html) (Verified 21 Jun. 2004).

Further Reading

Better Crops 2004 #1:

Mallarino, A.P. and T.S. Murrell. 2004. Detecting phosphorus with plasma emission spectroscopy may require unique field calibration data. Better Crops 88(2):12-15. (Available online with updates at http://www.ppi-ppic.org/ppiweb/bcrops.nsf) (Verified 21 Jun. 2004).

Better Crops 2003 #4:

Mallarino, A.P., D.J. Wittry, and P.A. Barbagelata. 2003. New soil test interpretation classes for potassium. Better Crops 87(4):12-14. (Available online with updates at http://www.ppi-ppic.org/ppiweb/bcrops.nsf) (Verified 21 Jun. 2004).

For more information, contact:

Dr. T.S. (Scott) Murrell
Northcentral Region Director
Potash & Phosphate Institute (PPI)
3579 Commonwealth Road
Woodbury, MN 55125
Phone: (651) 264-1936
E-mail: smurrell@ppi-far.org

Ref. # 04090