NEWS & VIEWS

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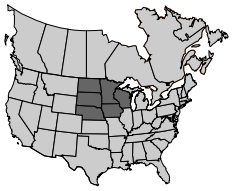

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Northcentral Director

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Target Phosphorus this Fall

THE MOST RECENT SURVEY of soil tests conducted by the Potash & Phosphate Institute demonstrated, at a state and province scale, the varying phosphorus (P) needs across North America (**Figure 1**). Phosphorus levels also vary among and within fields, making more intensive soil sampling necessary in many situations.

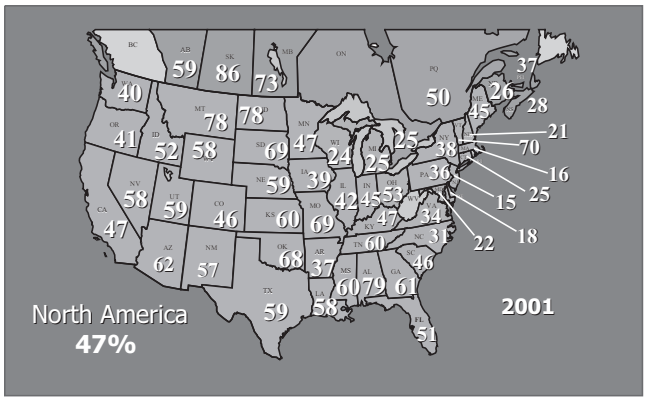
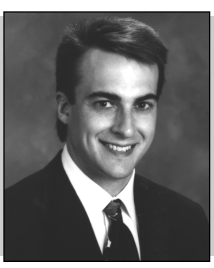


Figure 1. Percent of soil samples testing at or below "medium" in P for states and provinces in North America (Fixen, 2002).

Does a field area have enough P already or is more needed? The only way to tell is to take a good soil sample and have it tested by a reputable laboratory. Each state's Cooperative Extension Service, as well as many laboratories, provide guidance on how to take and submit a soil sample and interpret lab results.

At lower soil test levels, crops generally yield at a reduced percentage of what is possible when levels are higher. **Figure 2** shows an example of how relative yield of wheat (percent of yield attainable when P is sufficient) increases with higher soil test levels. An important part of this figure is the critical soil test P level. This is the level (or range of levels) beyond which crops are not likely to respond to P additions in the year of application.



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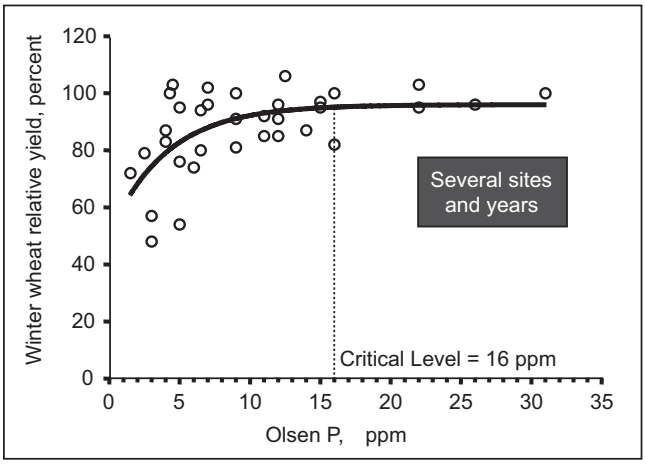

Figure 2. Phosphorus soil test calibration data for winter wheat (Gelderman et al., 1996).

An example of the probability of crop response expected at various soil test levels is provided in **Table 1**. The relationship of relative yield to soil test P level can vary for different crops, growing conditions, management practices, and P placement.

What are appropriate target soil test P levels? Target levels can differ widely depending on local conditions, management practices, cropping systems, land tenure, and cash flow. There are generally two approaches to setting target soil test P levels: 1) **the buildup and maintenance approach**, and 2) **the sufficiency approach**.

Table 1. Example of probabilities of crop response to broadcast fertilizer (Gerwing and Gelderman, 1998).

P soil test category	Range in soil test levels, ppm*		Probability of crop response to a broadcast P application, %
	Bray P-1	Olsen P	
Very low	0-5	0-3	more than 80
Medium	11-15	8-11	40-60
Very high	21+	16+	less than 20

*ppm = parts per million

The objective of the buildup and maintenance approach is to build soil test P levels to at least the critical soil test level (or range) over the course of a few years, then maintain them with smaller, regular P additions (Black, 1993). **Figure 3a** shows the general area of a soil test calibration curve where soil test levels are usually managed.

The buildup and maintenance approach attempts to minimize the risk of P limiting yields. However, because of the higher fertilizer rates required during the buildup phase, there is an initially higher risk that positive returns to fertilization will not be gained in the year of application. Adequate cash flow, available capital, and a longer-term financial strategy fit well with this approach.

The objective of the sufficiency level approach is to keep soil test levels in the responsive range (below the critical level) to assure a higher probability that positive economic returns to fertilization will be gained in the year of application (Black, 1993). **Figure 3b** identifies the lower soil test levels with higher probabilities of crop response in the year P applications are made.

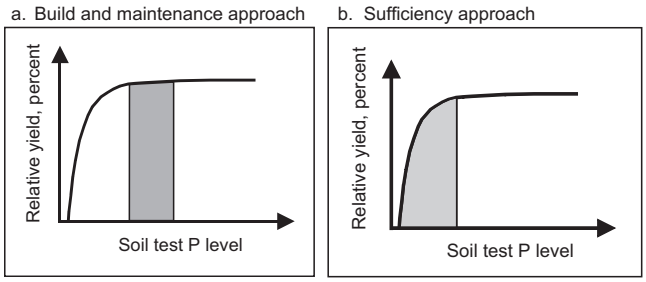

Figure 3. Conceptual target soil test P ranges for: a) the buildup and maintenance approach, and b) the sufficiency approach.

The sufficiency philosophy attempts to reduce short-term economic risks, but carries a greater risk that P may be yield-limiting. Usually, there is a long-term build component in these recommendations as well. Over several years, soil test levels are targeted to move to a range nearer the critical level. This approach is most appropriate when cash flow and available capital are limited, and/or land tenure is short-term.

Nutrient budgets examine fields or field areas to compare how much P has been added to how much has been removed. Additions include both organic and inorganic sources. Removals include harvesting of crops, erosion, runoff, and leaching. For practical purposes, farmers and advisers can use a partial budget that examines both additions and removals estimated solely from crop harvest. This will capture most of the budget on areas that, by location, management, or both, are not at a high risk for the other losses mentioned above. For information on how to perform a P budget, visit the website: >**http://www.ppi-ppic.org/northcentral**<. Click on "Training Materials", then click "PKalc: Nutrient Budget Estimator."

So what is an appropriate budget? Should a budget show that more has been applied than removed, or should it show just the opposite? To answer this, you need a recent soil test that is representative of the area you are considering. If your soil test is below the target level, then you will want your budget to have greater P and K additions than removals (quadrant IV, **Figure 4**). This positive budget is expected to increase soil test P and K levels. If your soil test is above the target level, then a negative budget (crop removal exceeding nutrient additions) is expected to decrease soil test P and K levels (quadrant II). Without a recent soil test, there is no way of evaluating the appropriateness of your budget.

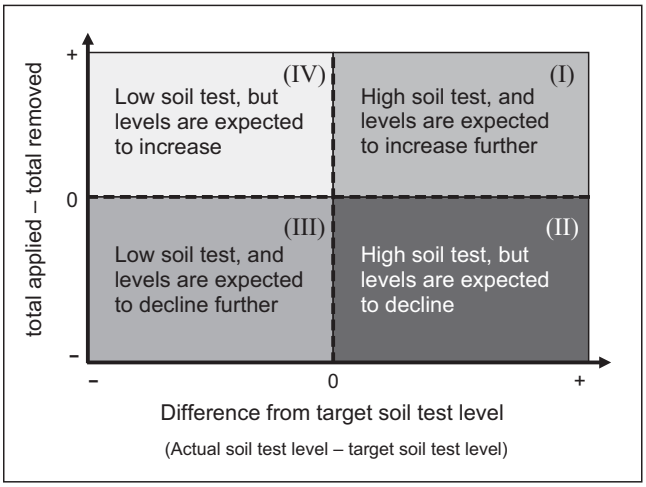

Figure 4. Evaluating historical, local P budgets with recent soil tests.

Summary

Phosphorus should be managed to meet economic, agronomic, and environmental objectives. Building soil tests to higher levels is appropriate on land that is owned or under a longer term lease and where more operating capital is available. Managing soil tests at lower levels with higher probabilities of crop response to added P is appropriate on land with a short-term lease and where cash flow is limited.

Taking the time to evaluate planned versus actual production levels is necessary for making adjustments in the P fertility program. Examining historical, local P budgets along with recent soil tests can help farmers evaluate the effectiveness of their P management practices.

By targeting appropriate P soil test levels and keeping a watchful eye on P budgets and soil test changes, farmers and their advisers can make the adjustments they need to come ever closer to optimizing their P inputs to meet their management objectives. ■

References

Black, C.A. 1993. Soil fertility evaluation and control. Lewis Publishers, Boca Raton, FL.

Fixen, P.E. 2002. Soil test levels in North America. Better Crops 86(1):12-15.

Gelderman, R., J. Gerwing, C. Stymiest, and S. Haley. 1996. Correlation of phosphorus soil tests for winter wheat. SOIL PR 96-16. Soil/Water Research. 1996 Progress Report. Agric. Exp. Sta., Plant Sci. Dept., South Dakota State Univ., Brookings.

Gerwing, J. and R. Gelderman. 1998. Fertilizer recommendation guide. EC 750. Coop. Ext. Serv., South Dakota State Univ., USDA, Brookings.

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