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Does Maintaining Soil Test Phosphorus Require Application Based on Crop Removal?

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Early-season phosphorus deficiency on corn at the V3 growth stage in southwestern Minnesota. Photo by University of Minnesota Extension Nutrient Management.

Phosphorus fertilizer recommendations generally follow one of two approaches. In the “build and maintain” approach, farmers measure soil test phosphorous (STP), build P levels to a specific target, and then maintain it by applying P to compensate for what crops take up. Farmers taking the “sufficiency” approach, in contrast, test the soil to determine how much P the crop needs to maximize yield but don’t worry about maintaining specific soil test values.

Researchers examined the fate of applied P and changes in STP values over time for the two approaches. They established various STP levels, monitored annually STP and the amount of P removed in harvested grain, and assessed changes in various P fractions in the soil. At four of six sites, initial STP was maintained with a negative net P (less P was applied than was removed in grain). At those sites, applying removal-based P rates increased STP over time. There was also a significant correlation between changes in net P and inorganic P fractions. Most change occurred in more plant-available P fractions, accounting for 66 to 100% of the change in net P. There was little, if any, effect of surplus application of P on the organic P fractions or on less-available inorganic P fractions.

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