

## Corn Fertility in Medium- to High-Yield Environments

Over the past 10 years, growers have seen the average corn yield increase by nearly 2.8 bushels per acre per year.<sup>1</sup> With advancements in crop production, it makes sense to think that corn may require more fertilizer. Growers should account for nutrient removal and realistic yield goals when making fertilizer plans. Additionally, soil testing is a good starting point when trying to quantify nutrient levels and determine fertilizer rates.

**Nutrient Removal by the Crop.** Some fertilizer is applied one or two seasons ahead of time, so it is important to account for nutrients that previous crops have taken from the soil. Corn and soybean differ in their nutrient removal rates (Table 1). Each bushel of corn harvested per acre removes approximately 0.9 pounds of N, 0.38 pounds of P<sub>2</sub>O<sub>5</sub>, and 0.27 pounds of K<sub>2</sub>O (Table 1). Additionally, yield levels illustrate how fertilizer rates can be affected (Table 2). As expected, higher levels of corn production often require higher levels of fertilizer to achieve yield goals.

**Importance of Soil Test.** A soil test can indicate whether a field or area of a field requires additional fertilizer to reach a critical value. When soil test values are below a critical value, a crop often responds to additional fertilizer. The farther below the critical value the soil test is, the more likely you will see a yield response.

When fertilizing in medium- to high-yield environments, it is important to keep the soil test values for each nutrient within the “maintenance” zone. There is little chance of achieving a yield response when soil test values are above the maintenance range. Soil test values within the maintenance range still require fertilizing for crop removal. The frequency of this maintenance fertilizer application is often every two years. As a result, two seasons of crop removals must be calculated.

Crop	N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O
Corn grain	0.9	0.38	0.27
Soybean grain	3.8*	0.84	1.3

\*N from nitrogen fixation and soil removal. Source: International Plant Nutrition Institute. Online at <http://nanc.ipni.net>

Corn Yield	N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O
150 bu/A	135	57	40.5
200 bu/A	180	76	54
250 bu/A	225	95	67.5
300 bu/A	270	114	81

Source: Calculations made using International Plant Nutrition Institute data.

For P, the rate needed to maintain soil test P levels (maintenance rate) is equal to the P<sub>2</sub>O<sub>5</sub> removed by each crop. For K, the maintenance rate is equal to crop K<sub>2</sub>O removal plus 20 pounds of K<sub>2</sub>O that may be leached or fixed by soils in a form not measured by traditional soil tests.

**Minor Nutrients.** While other nutrients, such as sulfur (S), zinc (Zn), and manganese (Mn) are needed in much smaller quantities than N, P, and K, it is important to acknowledge their contribution to corn development. Higher corn yields mean more minor nutrients are removed from the soil; thus, minor nutrient deficiencies may occur. Additionally, sandy soils that are low in organic matter may not supply adequate S, while Mn and Zn availability may be reduced in soils with high pH. Tissue testing can confirm deficiencies. Foliar fertilizers to correct deficiencies may be an option.

**Soil pH.** At soil pH levels between 5.5 and 7.0, nutrients such as nitrogen and phosphorus are most available to the plant. Acidic residuals from nitrogen fertilizers can reduce soil pH. Lime can be applied to raise pH levels to the appropriate range. A soil pH of 6.5 should be targeted.

**In summary:** In the past 10 years we have seen considerable changes in crop production such as increased yield potentials, partially due to biotech traits and advancements in germplasm. Therefore, it is important to fertilize accordingly. Soil tests, crop removal, and yield goals can be used to determine how much fertilizer is needed.

**Sources:** <sup>1</sup>United States Department of Agriculture-National Agricultural Statistics Service. 2000-2009 U.S. Corn and Soybean production. Online at <http://www.nass.usda.gov>  
International Plant Nutrition Institute. Average Nutrient Removal Rates for Crops in the Northcentral Region. Online at <http://nanc.ipni.net>  
Tri-State Fertilizer Recommendations for Corn, Soybeans, Wheat, and Alfalfa. Michigan State University, The Ohio State University, and Purdue University. Extension Bulletin E-2567, July 1995.

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