Fertilizing Corn in Medium-to - High Yield Environments

- Soil fertility is an important management tool to help maximize corn yield potential.
- Corn has a high demand for nutrients because of its high yield potential and the amount of dry matter produced.
- Fertilizer applications should be based on soil test values, nutrient removal, and realistic yield goals for the upcoming crop.

**Nutrient Removal by the Crops**

Soil fertility levels for phosphorus and potassium are greatly affected by the inherent availability in the soil, crop removal, and soil pH. Each bushel of corn harvested per acre, removes the approximate equivalent amounts of 0.38 pounds per acre of P₂O₅ and 0.27 pounds per acre of K₂O (Table 1). These amounts are important when calculating the amount of maintenance or build-up fertilizer to apply. Crops cut for silage remove more nutrients because the majority of the aboveground tissue is harvested. 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.

**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 will be the 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 zone. Soil test values within the maintenance zone are designed to replace the nutrients lost each year through crop removal. Because the purpose of fertilizer applications in the maintenance zone is to maintain fertility, no response to nutrients in the year of application would be expected. Therefore, growers may need to make some nutrient applications every two years. As a result, two seasons of crop removals must be calculated.

**Soil pH**

The pH of soil can greatly impact crop growth and can become a problem when high rainfall and warm temperatures occur. Soil pH should be around 6.0 to 7.0 for corn production. Corn plants may show signs of nutrient deficiencies when soil pH falls below 5.5. In soils with low pH, the primary macronutrients and important secondary macronutrients (sulfur, magnesium, and calcium) may become less available to growing plants. In contrast, when soil pH is low, certain elements (aluminum and manganese) which can stunt or kill corn, may become more available in the soil.

Lime can be applied to raise pH levels to the appropriate range. It is best to apply lime in the fall to neutralize soil acidity. If soil is in need of lime and did not receive a fall application, it is better to apply in the spring than not at all. Lime recommendations should be included in a soil test analysis.

High pH is difficult to lower, but awareness allows for management of associated risks. High soil pH can reduce the availability of iron, manganese, boron, copper, and zinc.
Nitrogen (N), Phosphorus (P), and Potassium (K) Fertilizer Recommendations

Nitrogen – Inadequate fertilization, leaching of nitrate from heavy rainfall, and flooded soil are some of the causes of N deficiency. Symptoms appear on leaves as a yellow coloration in a v-shaped pattern, starting at the tip and progressing toward the leaf collar (Figure 1A). Nitrogen should be applied according to crop need at different times during the season. A split N application reduces the likelihood of N loss due to wet weather and can improve N use efficiency. A corn plant will begin needing more N after it reaches rapid vegetative growth. Corn will extract less than 5% of N uptake before rapid vegetative growth begins, so it is best to apply N closer to these stages as N applied early may be lost due to denitrification and leaching. Universities in the Midsouth recommend applying 1/4 to 1/3 of the total N near planting and applying the remaining N (3/4 to 2/3) about 25 to 35 days after planting when corn is around the V5-V8 growth stage. A corn plant will need the most N at the V10 growth stage which occurs about 40 days after plant emergence.

Phosphorus - Phosphorus deficiencies are very common when corn is grown after rice and can be a problem after cotton or soybean since corn uses nearly twice as much P. Purple corn plants are an indicator of P deficiency (Figure 1B). It is best to apply P in the fall and till for incorporation into the soil for an upcoming crop. Treating a P deficiency may take time as P is immobile in soil. In dryland fields, if a P deficiency is detected in the fall, P may be applied in the spring or in-season. A starter fertilizer may help improve P availability especially in minimum or no-tillage systems.

Minor Nutrients

Even though the uptake of other nutrients, such as sulfur (S), zinc (Zn), and manganese (Mn) is less than one percent of 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 which can cause plant abnormalities, reduced growth, and even yield loss. 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.

In the last decade, there has been considerable increase in yield potentials due to the use of 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:


Individual results may vary, and performance may vary from location to location and from year to year. This result may not be an indicator of results you may obtain as local growing, soil and weather conditions may vary. Growers should evaluate data from multiple locations and years whenever possible. ALWAYS READ AND FOLLOW PESTICIDE LABEL DIRECTIONS. Leaf Design® is a registered trademark of Monsanto Company, Fontanella and Design® is a registered trademark of American Seeds, LLC. All other trademarks are the property of their respective owners. ©2013 Monsanto Company. 03242013CRB;08272013PLB.