



# Agronomic Spotlight

## Fall Fertilizer Recommendations

- Analysis from soil samples taken after harvest or the previous spring can be used to determine fall fertilizer application rates.
- If lime is needed to neutralize soil and enhance nutrient availability, fall is the best time for application since it should be applied 3 to 6 months before planting crops.
- Guidelines for fertilizer and manure applications should be followed to facilitate timely nutrient availability to the crop and to avoid nutrient loss.

### Soil Sampling

Soil sampling should be done after harvest in the fall or before planting in the spring. Fall sampling is best for determining lime application recommendations. However, it can be a challenge to collect soil samples in the fall and have the results available in time for fall fertilizer applications. As an alternative, fall fertilizer recommendations can be made from soil samples collected the previous spring. Soil samples should be taken at least every four years following sampling techniques recommended by local university Extension services.

### Lime Application

Lime neutralizes soil acidity and adds calcium, which is a micronutrient essential to plant growth. A soil pH between 6.0 and 7.0 is the recommended range where plant nutrients are most available. Lime takes time to dissolve in the soil and neutralize acidity, so it should be applied about 3 to 6 months before planting crops. Applying lime in the fall allows time for it to break down before the next growing season. Lime should be applied and incorporated at least a month before adding fertilizers, since it can interfere with the availability of fertilizer nutrients, especially phosphorus. Particular attention should be given to the different sources of liming material. Differences among products in their neutralizing efficiency (calcium carbonate equivalent and particle size composition) do exist and can influence optimum lime application rates.

### Phosphorus and Potassium Application

Fall is typically the time for making phosphorus (P) and potassium (K) applications because of time, workload, dry soils, available fertilizers, and the need for application before fall tillage. Fall is also a good time to apply P for environmental reasons, since there is generally a lower

risk of P runoff with the typical fall weather and soil conditions. P and K fertilizer should not be applied on frozen ground, because applications made to fields with any slope can result in significant runoff and fertilizer loss.

Soil test recommendations should be followed to maintain P and K above their respective critical levels in order for the soil to supply adequate quantities of the nutrients to support optimum plant growth. Operating at low soil test levels of these nutrients may reduce yield potential, especially with K. If soil tests show these nutrients to be above the critical levels, applications are not necessary for the next crop. It is common to apply P and K fertilizer once for two years of crop production. In a corn-soybean crop rotation, all of the K can be applied after soybean harvest in the fall ahead of corn. Enough K will be returned to the soil from the corn residue for the soybean crop in the rotation. However, recommended rates of fertilizer should be applied annually to soils that are below critical levels of these nutrients. These annual applications include P and K soil build-up and crop removal needs.

### Nitrogen Application

Applying nitrogen (N) in the fall can have the advantages of reduced soil compaction, spreading out the workload, and economic incentives relative to fertilizer costs. Disadvantages can include the loss of N between application and crop use and environmental concerns of nitrates leaching into streams, lakes, and groundwater.

Fertilizers comprised predominantly of ammonium-N are preferred for fall application. N sources containing urea and/or nitrates have greater potential to be lost via leaching, volatilization, or runoff. Ammonium-N is relatively stable as it attaches to soil particles while nitrate-N is subject to loss via leaching and denitrification. Due to these concerns, anhydrous ammonia is a good source for fall-applied N.

# Fall Fertilizer Recommendations

Anhydrous ammonia should be applied in late fall after soil temperatures cool to 50° F or less and cool weather is expected to continue (Figure 1). Fall applications of N are generally feasible only in areas where low winter soil temperatures limit nitrification of ammonium. It should not be applied in those areas where soils seldom or never freeze or where there is a long period between the time soils reach 50° F and when they freeze. Nitrifying organisms (convert ammonium to nitrates) continue to function at temperatures as low as 32° F, but at a slower rate. Long periods of time at low soil temperatures above 32° F can still result in nitrification of a large percentage of the applied ammonium-N. Use of a nitrification inhibitor can slow the conversion of ammonium to nitrates and improve the effectiveness of fall-applied N. It is best to avoid fall application to sandy soils and poorly drained soils.

Splitting N requirements between fall and spring, rather than applying it all in the fall should be considered. A spring application may allow for increased N utilization, particularly when the environment is wet and cool.

## Manure Application

Manure can be an adequate nutrient source of N, P, K, and micronutrients. However, one application rate may not be optimal for multiple nutrients. Nutrient content of manure varies depending on the type of livestock, ration being fed, and manure storage/handling. An analysis of the manure should be completed prior to application in order to plan a fertilization and management program.

When applying manure for N, manure sources that have high inorganic ammonium content, such as liquid swine manure, should be applied late in the fall after soils cool. For manure that has considerable bedding, fall application can give a longer time-period for microbial mineralization to inorganic N which can increase N availability to the crop. Since manure N is subject to volatilization, injection or immediate incorporation can reduce potential losses associated with surface application. Manure P application should be managed in a way to reduce risk of P loss with runoff. Injection or incorporation into the soil, avoiding application in winter to frozen/sloping soils, and managing soil residue cover will help with reducing P loss in runoff. These practices can also help reduce N loss.

## Nutrient Removal

Nutrient uptake and removal are typically considered when determining the amount of nutrients to apply in the



Figure 1. Anhydrous ammonia should be applied in late fall after soils cool to 50° F.

fall. Corn and soybean nutrient removal can vary based on soil conditions, yields, product differences, and fertilizer rates (Table 1). Soil tests can give an estimate of how much fertilizer is needed based on crop yield.

Table 1. Nutrient Removal (lbs/bu) in corn and soybean.<sup>1</sup>

Nutrient	Corn	Soybean
Nitrogen	0.67	3.30*
Phosphorus (P <sub>2</sub> O <sub>5</sub> )	0.35	0.73
Potassium (K <sub>2</sub> O)	0.25	1.20

\*Most N harvested comes from the atmosphere.

<sup>1</sup>International Plant Nutrition Institute. 2014

### Sources:

<sup>1</sup> Nutrient removal in the harvested portion of selected crops, Table 4.5. 2014. International Plant Nutrition Institute. <http://www.ipni.net>

<sup>2</sup> Hoelt, R. G., et al. 2000. Modern corn and soybean production. Chapter 6. Nutrient management for top profit. pp. 107-171. MCSP Publications, Champaign, IL.

<sup>3</sup> Sawyer, J. and A. Mallarino. 2009. Getting ready for fall fertilization. Integrated crop management news. Iowa State University. <http://www.extension.iastate.edu>  
Web sources verified 6/23/14.

For additional agronomic information, please contact your local seed representative. Developed in partnership with Technology, Development, & Agronomy by Monsanto.

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.** All other trademarks are the property of their respective owners. ©2015 Monsanto Company. 130717060322 081314DLB