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Nitrogen application questions

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Abstract
Producers face many options related to nitrogen (N) management for corn production. Several questions should be considered this fall to help gain the most return from applied N. Some producers like fall anhydrous ammonia applications because they fit into their management system. They also apply N in the fall for several important reasons: often drier soils, potentially less compaction, getting the job done, avoiding planting delays or stand problems, and reducing work loads in busy spring or sidedress time periods.

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Producers face many options related to nitrogen (N) management for corn production. Several questions should be considered this fall to help gain the most return from applied N.

When should N be applied?

Some producers like fall anhydrous ammonia applications because they fit into their management system. They also apply N in the fall for several important reasons: often drier soils, potentially less compaction, getting the job done, avoiding planting delays or stand problems, and reducing work loads in busy spring or sidedress time periods. In the past, the N price is cheaper in the fall and the supply-distribution system can more easily get N products to the field when application occurs over a wider time period.

Does this mean fall N application is the most efficient and cost-effective for meeting corn N needs? No, typically use efficiency is not as high as with spring or sidedress application, costs can be higher and returns lower, and crop production less consistent. However, if fall applications are targeted then success can be improved. For example, do not apply until soils are cold (<50°F and cooling to slow nitrification), use only anhydrous ammonia, and do not apply to soils with potential for excess nitrate leaching or denitrification (for example, soils that are sandy, shallow to fractured bedrock, in sensitive groundwater areas, or subject to ponding). Use of a nitrification inhibitor in combination with cold soils (<50°F) can help to further slow conversion to nitrate.

Spring or sidedress application closer to corn use is preferable, especially when soils in the fall are fully recharged with moisture (increased potential to be excessively wet the next spring). Traditionally, the majority of N in Iowa is applied in the spring.

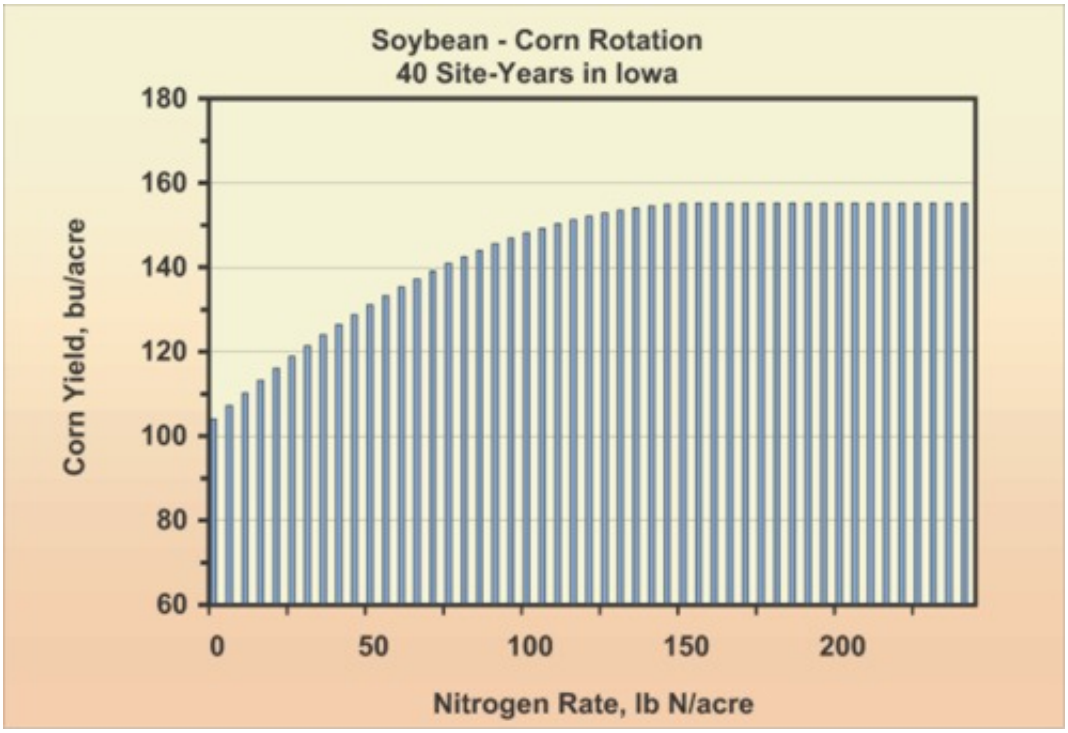
Where should N be applied and at what rate?

Allocate N to where it is needed most or to where the greatest potential response will occur. Table 1 gives suggested preplant corn N rates for several rotations. Also closely evaluate the rate required within each rotation for your soils and geographic location. If you have been applying N at rates above ranges listed in Table 1 then consider reducing them into the suggested ranges. If you are already within a range, and have not observed N deficiencies in the past, then consider decreasing rates to the lower part of the range. Research conducted in Iowa indicates that in many years N rates in the lower part of the ranges are adequate. Also, data from diagnostic tools (late-spring soil nitrate and fall cornstalk nitrate tests, or canopy sensing) may further clarify adequate rates and aid in making adjustments.

Fields requiring little to no fertilizer N include those with adequate amounts of crop available N from manure, biosolids, and by-products; and first-year corn after alfalfa. Use crop rotations and adjust rates for rotation effects.

If N prices are high and corn prices remain low, and depending upon the specific situation, it might be justified to reduce rates. Remember, greatest yield increase comes from the first units of applied N, and least from the last. For an average corn yield response to applied N from 40 site-years in Iowa for the soybean-corn rotation (Figure 1), the increase per unit of applied N is much greater at N rates less than 120 lb N/acre than above 120 lb N/acre. At a corn:N price ratio of 10:1 ($2.00/bu corn and $0.20/lb N), the economic N rate would be approximately 135 lb N/acre with a yield of 154 bu/acre. At a corn:N price ratio of 5:1 ($2.00/bu corn and $0.40/lb N), the economic N rate reduces to 110 lb N/acre (19 percent reduction) with an expected yield of 150 bu/acre (a 4 bu/acre or 2.6 percent lower yield).

Figure 1. **Average corn yield response to applied N in the soybean-corn rotation.**



What type and how is N applied?

Take into account all N applied to cornfields. Nitrogen recommendations are for the total amount of N fertilization needed. Therefore, add up the N coming from various fertilizers, such as monoammonium phosphate (MAP) and diammonium phosphate (DAP), weed and feed urea-ammonium nitrate solution (UAN), and starter. These amounts should be subtracted from recommendations such as those shown in Table 1. Now is a good time to closely measure the nutrient content of animal manure and carefully apply agronomic rates. Calibrate fertilizer and manure applicators, apply materials accurately, and use the correct method and timing for each product.

Summary

Applying these practices can help increase returns from dollars spent on N. Improved N

management can help increase return on fertilizer N investments and reduce potential for nitrate movement to water systems.

Table 1. **Suggested N rates for corn production based on crop rotation.**

Rotation	Nitrogen Rate, lb N/acre
Corn after established alfalfa	0-30
Second-year corn after alfalfa	0-60
Corn after corn	150-200
Corn after soybean	100-150

Adapted from Table 1 of Iowa State University Extension publication PM 1714, Nitrogen Fertilizer Recommendations for Corn in Iowa [1].

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