Making Fertilization Decisions As Fertilizer Prices Escalate and Production Costs Are High - Part 2

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Abstract
This article continues the discussion begun in Making Fertilization Decisions As Fertilizer Prices Escalate and Production Costs Are High - Part 1 where soil testing and phosphorus and potassium applications were discussed.

Keywords
Agronomy

Disciplines
Agricultural Science | Agriculture | Agronomy and Crop Sciences

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Making Fertilization Decisions As Fertilizer Prices Escalate and Production Costs Are High - Part 2

By John Sawyer and Antonio Mattrino, Department of Agronomy

This article continues the discussion begun in Making Fertilization Decisions As Fertilizer Prices Escalate and Production Costs Are High - Part 1 where soil testing and phosphorus and potassium applications were discussed.

Limestone Applications
Liming soils and maintaining soil pH is a long-term investment and payback should not be expected in just the year of application. Decisions to apply or not apply should therefore look at expectations for multiple crops as well as potential yield increase from liming (or yield loss if not applied).

For row crop production, PM 1688, A General Guide for Crop Nutrient and Limestone Recommendations in Iowa, states that pH 6.0 is sufficient for grass pasture and grass haylands, 6.5 for corn and soybean, and 6.9 for alfalfa. Because of high pH in the subsoil, pH 6.0 is sufficient for corn and soybean in the Clarion-Nicollett-Webster, Gaia-Primghar-Sac, Moody, Ida-Monona, Marshall, and Lutton-Onawa-Salix soil associations. For corn and soybean, liming rates are suggested to raise pH to 6.5. If lime is going to be applied, the rate needed to achieve the suggested pH should be used. Corn is often less sensitive to soil acidity than soybean and much less than alfalfa. However, N fertilization is a major cause of soil acidification. Therefore, monitoring soil pH is important with continuous corn.

Nitrogen Fertilization
Nitrogen applications should be tailored for the crop rotation (Figure 1). First-year corn following well established alfalfa often needs no N fertilization, and when required only 30-40 lb N/acre. Unfortunately, corn in other rotations almost always needs N application, and yield increase to fertilization on the long-term is quite good (Figures 1 and 2). Hence, there are not many opportunities to eliminate application when N prices are high or in short supply.
Nitrogen can be supplied from manure, but that is also a valuable commodity when fertilizer prices are high and the amount of manure produced in Iowa cannot meet the needs of all corn production. Second-year corn following alfalfa has reduced N fertilization requirement, and similar yield response and rate as with corn following soybean (Figure 1). Compared to continuous corn, corn in rotation with soybean has lower N requirement, on the order of 50 lb N/acre less (Figures 1 and 2). If N fertilizer is in short supply or purchases have to be limited, it is better to apply some N to all fields than to skip fields (other than corn after alfalfa) as the largest yield gains come from the first increments of applied N (Figure 4).

Application rates can be adjusted downward somewhat when N fertilizer costs are high relative to corn prices. However, closely observe both N and corn prices before deciding on reducing N applications. Despite the high N prices, corn prices are also high and therefore the ratio between the two has not changed dramatically.

The Corn Nitrogen Rate Calculator was updated this summer with Iowa data from N rate trials conducted in 2007. Based on that dataset, the suggested N rates and rate ranges for four N: corn price ratios are listed in Table 1 and
shown in Figure 3. The advantage of the calculator is that specific N and corn prices can be compared. The output from the calculator gives suggested N rate ranges that provide similar profitable return. With high N costs, high production costs, and perhaps the need to allocate limited funds for N fertilizer purchase, one can consider using rates in the lower part of the range. Those rates should provide similar yields, but risk of N supply shortage to the crop is greater if N losses occur or if there is greater corn N need.

The rates suggested from the Corn Nitrogen Rate Calculator are the same whether N is applied in late fall, spring, or sidedress, therefore do not decrease the rate for sidedress application timing. Fall application carries more risk of loss, however, that risk cannot be predicted and it is not appropriate to guess and just increase the rate in an attempt to cover potential losses. When N is expensive, applications above Maximum Return to N (MRTN) result in large economic losses. This can be seen in graphs produced from the Corn Nitrogen Rate Calculator (Figure 3).

![Return to N graph](image)

**Figure 3.** Effect of N:corn grain price ratio on return to N application with corn following soybean, based on the current Corn Nitrogen Rate Calculator dataset.

<table>
<thead>
<tr>
<th>Price N Rate</th>
<th>Corn Following Soybean</th>
<th>Corn Following Corn</th>
</tr>
</thead>
<tbody>
<tr>
<td>$/lb:$/bu</td>
<td>Rate²</td>
<td>Range²</td>
</tr>
<tr>
<td>0.05</td>
<td>150</td>
<td>138 - 164</td>
</tr>
<tr>
<td>0.10</td>
<td>128</td>
<td>117 - 140</td>
</tr>
<tr>
<td>0.15</td>
<td>113</td>
<td>104 - 123</td>
</tr>
<tr>
<td>0.20</td>
<td>100</td>
<td>92 - 110</td>
</tr>
</tbody>
</table>

1 Price per lb N divided by the expected corn price. For this table, corn was held at $6.00/bu and N varied from $0.30, $0.60, $0.90 to $1.20/lb N (for example, anhydrous ammonia at $492, $984, $1476, to $1968/ton).

2 Rate is the lb N/acre that provides the Maximum Return To N (MRTN). All rates are based on results from the Corn N Rate Calculator as of July 1, 2008 (http://extension.agron.iastate.edu/soilfertility/nrate.aspx).

3 Range is the range of profitable N rates that provides a similar economic return to N (within $1.00/acre of the MRTN).

**Table 1.** Nitrogen rates suggested for corn following soybean and continuous corn based on the current Corn Nitrogen Rate Calculator dataset

If possible, grow more corn after soybean than after corn. Yields will typically be higher with the rotation and N application need lower (Figures 1 and 2). If fall fertilization is considered, apply only anhydrous ammonia and wait until
soils are cold and remain so, less than 50 degrees F and cooling (the colder the better), which usually means waiting to apply until early- to mid-November. Good application timing helps reduce N loss and allows the best yield return from applied N. Typically best efficiency is obtained with spring or split spring/sidedress application. Having plant-available N in the root zone is important for good early corn growth, and especially for corn following corn.

Resources
The above mentioned publications, as well as other nutrient management information, are available on the ISU Agronomy Extension Soil Fertility Web site. Another resource focusing on N rate management is publication PM-2015, Concepts and Rationale for Regional Nitrogen Rate Guidelines for Corn.

John Sawyer and Antonio Mallarino are professors of agronomy, both with research and extension responsibilities in soil fertility and nutrient management.

This article was published originally on 9/23/2008. The information contained within the article may or may not be up to date depending on when you are accessing the information.

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