Nitrogen losses in 2001

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Nitrogen losses in 2001

Abstract
It has been another moist spring in Iowa. Some locations, like areas in southeastern Iowa, have experienced excessively wet soils several times this spring. Loss of applied nitrogen (N) is once again an issue. But yellow corn does not always equate to N deficiency; plant response to cold and wet conditions (slowed root activity and growth) also impacts foliage color. When corn is small the impact of cold, wet weather, not lack of N, is probably the cause of discoloration because the amount of N taken up by corn to the V6 stage is small (20 lb N/acre or less).

Keywords
Agronomy

Disciplines
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It has been another moist spring in Iowa. Some locations, like areas in southeastern Iowa, have experienced excessively wet soils several times this spring. Loss of applied nitrogen (N) is once again an issue. But yellow corn does not always equate to N deficiency; plant response to cold and wet conditions (slowed root activity and growth) also impacts foliage color. When corn is small the impact of cold, wet weather, not lack of N, is probably the cause of discoloration because the amount of N taken up by corn to the V6 stage is small (20 lb N/acre or less). With the recent return to warm temperatures, corn plants are resuming growth with improved coloration.

Reducing N losses

Several situations this spring should aid in reducing N loss. First, little anhydrous ammonia was applied last fall, and most of that was applied late. Early fall manure applications, however, are more at risk. Second, many soils did not have recharged subsoils entering the spring. Third, temperatures have been normal to cooler than normal. It is the conversion to nitrate, and subsequent excessively wet, warm soils, that enhance the potential for N losses. Fourth, many applications were delayed into late spring or sidedress. Use of N products containing more ammonium, use of a nitrification inhibitor, and application closer to a period of wet conditions result in less loss.

Deciding whether losses are substantial enough to warrant supplemental application includes consideration of several factors: 1) amount of nitrate present when wet conditions occur, which is affected by time of N application, form of N applied, rate applied, and use of a nitrification inhibitor; 2) when during crop development and the length of time soils are saturated; 3) soil potential for leaching; and 4) loss of yield potential from water damage. Furthermore, water movement into soil, leaching, and denitrification are not uniform across the landscape; thus, the potential for N loss is variable.

According to estimates of denitrification rates from the University of Nebraska, when soil temperature is 55 to 60°F, N loss is 10 percent when soil is saturated for 5 days and 25 percent when saturated for 10 days. Loss accelerates with warmer soils. Research conducted in Illinois (late May to early June excess application of water on silt loam and clay loam soils) indicates approximately 4 to 5 percent loss of nitrate-N present per day that soils are saturated.

Applying additional N

Before any decision is made to apply more N, you should consider the potential productivity
remaining after soils dry. Has the stand been damaged, will the plants recover, is growth severely retarded, is the area planted late or replanted, and is the yield potential reduced because of conditions other than N loss? It is possible that the combination of N remaining in the soil, plus N mineralized during the rest of the growing season, can supply adequate N. If corn stand is good and the corn appears to be growing well then application to replace lost N should be beneficial. In the Illinois work mentioned above, after keeping soils saturated for 3 to 8 days, addition of 50 lb N/acre after the excess water was sufficient to increase corn yields to approximately the same level where no excess water was applied. In field situations where manure or full rates of N were applied preplant, a suggestion is to limit additional N application to 60-90 lb N/acre.

**Corn response to in-season N applications**

The magnitude of yield response to in-season application depends upon the crop stage when N deficiency occurs, the severity of deficiency, and the ability of the crop to recover from stress conditions. When slight to severe N deficiencies are corrected early (by approximately V6-V8 growth stage), or slight deficiencies are corrected late in the season (by approximately VT-R1), full yield potential is possible. Large N deficiencies corrected late in the season may show yield increase but not recover fully. Recent work in Illinois (Table 1) shows the relationship between preplant or at planting N rate, time/rate of supplemental N application in-season, and successful corn response to in-season application. Note that the corn relative SPAD values (chlorophyll meter readings or measure of leaf greenness relative to adequately fertilized corn) at the in-season N application timings were close to 95 percent (plants were showing N deficiency, but not major deficiency). Only with the late N application (R2) did yield suffer or require higher N rates.

See the July 3, 2000 [1], and June 14, 1999 [2], issues of ICM newsletter for articles that provide information on tools to estimate N loss.

Table 1. **Impact of N application timing on corn yield (1997-1999) at DeKalb and Urbana, Illinois.**

<table>
<thead>
<tr>
<th>Preplant N Ratea (lb N/acre) and Stage of In-Season Application</th>
<th>30 + V5</th>
<th>90 + V9</th>
<th>90 + V12</th>
<th>90 + R2</th>
</tr>
</thead>
<tbody>
<tr>
<td>All N Preplant</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>lb N/acre</td>
<td>bu/acre</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>114</td>
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<td>150</td>
<td>184</td>
<td>182</td>
<td>182</td>
<td>184</td>
</tr>
<tr>
<td>Relative SPAD at N Application\textsuperscript{b}</td>
<td>180</td>
<td>187</td>
<td>187</td>
<td>189</td>
</tr>
<tr>
<td>---</td>
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<tr>
<td></td>
<td>0.94</td>
<td>0.96</td>
<td>0.95</td>
<td>0.94</td>
</tr>
</tbody>
</table>

Adapted from Mathesius et al., 2000. Department of Crop Sciences, University of Illinois.

\textsuperscript{a} The in-season N applications were applied at rates so the total N applied (preplant plus in-season) was equal to the all N preplant rates. The N source was 28 percent UAN.

\textsuperscript{b} The relative SPAD readings were taken at the indicated growth stage before the in-season N was applied. Values relative to adequately fertilized corn.

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