Test cornfields for nitrate if manure was not incorporated

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Test cornfields for nitrate if manure was not incorporated

Abstract
Research during the past few years has shown that severe deficiencies of nitrogen (N) are common in fields where manure was applied without immediate incorporation. Data gathered in 2001 continue to support this conclusion and emphasize the need to use the late-spring test to check nitrate levels in such fields. Immediate incorporation of manure into soil is an effective way to reduce odor and losses of N soon after application. Incorporation reduces volatilization of ammonia, which can be a serious problem if manure is spread after it has been stored in pits or piles.

Keywords
Agronomy

Disciplines
Agricultural Science | Agriculture | Agronomy and Crop Sciences

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Test cornfields for nitrate if manure was not incorporated

Research during the past few years has shown that severe deficiencies of nitrogen (N) are common in fields where manure was applied without immediate incorporation. Data gathered in 2001 continue to support this conclusion and emphasize the need to use the late-spring test to check nitrate levels in such fields.

Immediate incorporation of manure into soil is an effective way to reduce odor and losses of N soon after application. Incorporation reduces volatilization of ammonia, which can be a serious problem if manure is spread after it has been stored in pits or piles. Much of the N in manure is converted to the ammonium form during such storage, and this ammonium-N can be rapidly volatilized as ammonia when the manure is dispersed into small pieces or drops and exposed to wind.

Research in 1995-1996

Studies in fall 1995 unexpectedly showed that most of the N as ammonium (or ammonia) was lost during application of liquid swine manure when a "fan-tail" spreader pumped the manure more than 8 feet into the air. The manure was incorporated within 5 minutes of application on some plots but not others.

Soil samples collected within a few days revealed that the manure had negligible effects on concentrations of nitrate or exchangeable ammonium in the soil. It seems that most of the ammonium was lost from the manure before it hit the ground.

Remote sensing of the crop canopy in August 1996 showed minimal effects of the immediate incorporation. Deficiencies of N were greater than could be corrected by sidedressing fertilizer N at 90 pounds of N/acre.

Research in 1989-1999

Large losses of N were detected again when this type of spreader was used in precision farming trials. Liquid swine manure was applied on a no-till field at a uniform rate of 150 pounds of N/acre in fall 1998. Additional fertilizer N was sidedressed at various rates in strips as shown in the figure, where rates and average yields are imposed on an aerial photograph of the field.

Aerial photographs during the summer showed that each additional increment of fertilizer N increased the greenness of the corn and, therefore, reduced deficiencies of N. Data from yield monitors on combines showed that each increment of added N increased yields. The
highest rate of N increased yields by 42 bushels/acre.

Aerial photograph (taken in August 1999) of corn color response to fertilizer N that was sidedressed in (horizontal) strips after uniform application of liquid swine manure by using a fan-tail spreader in fall 1998.

Research in 2000-2001

Precision farming trials in 2001 presented additional evidence of need to distinguish between where manure was, and was not, immediately incorporated. Serious N deficiencies were detected in four of five precision farming trials in fields where manure was not immediately incorporated (Table 1). Yield responses to fertilizer N applied after the manure ranged from 0 to 22 bushels/acre and averaged 12 bushels/acre. Applications of fertilizer N were very profitable for this category of sites.

The data in Table 1 are significantly different than the data of similar trials where manure was immediately incorporated into the soil. The mean response to fertilizer N across 18 trials was only 4 bushels/acre, which was not enough to pay for fertilization (see March 18, 2002, ICM newsletter article Should fertilizer nitrogen be applied after injected swine manure? [1]

Recommendation

Producers who applied manure without immediate incorporation and gave recommended fertilizer-N credits for manure-N should use the late-spring test for soil nitrate when corn plants are 6 to 12 inches in height this spring. Guidelines for using this test are given in Iowa State University Extension fact sheet PM 1714, Nitrogen Fertilizer Recommendations for Corn in Iowa [2]

Table 3 in PM 1714 gives information for interpreting soil-test results. Based on observations made in the past few years, however, it seems that the adjustment for excess rainfall should not be made where manure was not immediately incorporated into the soil. The adjustment for excess rainfall should be made where manure was injected into the soil.

Table 1. Summary of precision farming trials in 2001 to assess N fertilizer needs in fields where manure was applied without incorporation within 48 hours.

<table>
<thead>
<tr>
<th>Fertilizer N rate (pounds N/acre)</th>
<th>Yield (bushels/acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>140</td>
</tr>
<tr>
<td>50</td>
<td>163</td>
</tr>
<tr>
<td>100</td>
<td>175</td>
</tr>
<tr>
<td>150</td>
<td>182</td>
</tr>
</tbody>
</table>

Yield
<table>
<thead>
<tr>
<th>County</th>
<th>Type of Manure</th>
<th>Time of Application</th>
<th>Manure N Rate&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Fertilizer N Rate</th>
<th>Manure</th>
<th>Manure + Fertilizer N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boone</td>
<td>Turkey</td>
<td>Fall</td>
<td>100</td>
<td>50</td>
<td>152</td>
<td>161</td>
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<tr>
<td>Buchanan</td>
<td>Swine</td>
<td>Fall</td>
<td>200</td>
<td>75</td>
<td>153</td>
<td>165</td>
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<tr>
<td>Washington</td>
<td>Swine</td>
<td>Fall</td>
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<td>114</td>
<td>189</td>
<td>211</td>
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<td>Swine</td>
<td>Fall</td>
<td>95</td>
<td>50</td>
<td>130</td>
<td>146</td>
</tr>
<tr>
<td>Buchanan</td>
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<td>Spring</td>
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<tr>
<td>Mean</td>
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<td></td>
<td>133</td>
<td>68</td>
<td>163</td>
<td>175</td>
</tr>
</tbody>
</table>

<sup>a</sup> Total N by analysis.

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[2] [http://www.extension.iastate.edu/Publications/PM1714.pdf](http://www.extension.iastate.edu/Publications/PM1714.pdf)