Manure Nitrogen Rates for Corn Production

Interpretation of University of Minnesota nitrogen guidelines

Minn. R. ch. 7020 (feedlot rules) limits the rate of manure applied to cropland. In general, the feedlot rules require adherence to the University of Minnesota Extension Service recommendations. This document will outline how recent changes to the University nitrogen (N) recommendations for corn production will be implemented within the regulatory framework of the feedlot rules.

This document does not address recommendations for corn production on irrigated sandy soils, which are discussed in the Minnesota Pollution Control Agency (MPCA) factsheet titled Manure management for corn on irrigated sandy soils.

Allowable nitrogen application

The University recommendations provide a “maximum return to N value” (MRTN). The MRTN is the rate that maximizes profit using a cost of fertilizer relative to the value of corn ratio. At N application rates that exceed the MRTN, there is an increased likelihood of N leaching/loss. Therefore, the MPCA expects N application rates to be consistent with the appropriate MRTN values. The maximum MRTN values are:

- 180 lb N/acre for corn following corn
- 140 lb N/acre for corn following soybeans

Deviations from the MRTN

The University recommendation includes an “acceptable range” for N application as well as the MRTN. This acknowledges that there are situations when a deviation (more or less) from the MRTN may be warranted. The feedlot rule allows deviations in excess of the MRTN for the following situations:

- Site nutrient management history, soil conditions, or cool weather warrant N application at the upper end of the University’s recommendation range.
  
  **Note:** It is not intended to apply N at rates greater than the MRTN as a standard practice (ie. planned rate). Sufficient justification for more N (up to 20%) should accompany the required manure application records.

- Measurements and/or observations show N deficiencies during the growing season and sidedress N can still be added.

- The results of a soil nitrate test suggests additional N is recommended.

- Recommendations from a land grant college in a contiguous state with similar soils and climatic conditions suggest a higher rate of N application.

Considerations for lower productivity soils

For corn production on medium or fine textured soils considered to be of low or medium productivity, or where field history suggests lower productivity, producers should consider choosing N rates lower than the MRTN to limit potential leaching/loss of N without sacrificing profit.

For corn grown on non-irrigated loamy fine sands with less than 3% organic matter, the University recommends reducing the nitrogen application as follows:

- 100 lb N/acre for corn following corn or
- 70 lb N/acre for corn following soybeans.
Accounting for all sources of nitrogen

In determining the proper rate, producers must account for all sources of N including but not limited to:

- N credits from previous crops (discussed below)
- commercial fertilizer N applications (including starter)
- nitrates and/or N fertilizer in irrigation water
- N credits from manure application to the previous crop

The total amount of N applied from all sources should be consistent with the MRTN unless one of the deviations discussed above is warranted.

Accounting for nitrogen from previous crops

Previous crops can provide a source of N for the current corn crop. The credits in Table 1 below must be subtracted from the corn/corn MRTN to account for N contributions from previous crops.

Table 1. Nitrogen credits for different previous crops.

<table>
<thead>
<tr>
<th>Previous Crop</th>
<th>N Credit (lb N/acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red clover*, alsike clover, birdsfoot trefoil, grass/legume hay, grass pasture, or fallow</td>
<td>75</td>
</tr>
<tr>
<td>Edible bean or field pea</td>
<td>20</td>
</tr>
</tbody>
</table>

*A credit of 35 should also be given when red clover is grown two years before the corn crop

As an example, the N recommendation for corn following edible beans is calculated as follows:

\[180 \text{ lbs N/acre (MRTN)} - 20 \text{ lbs N/acre (credit from previous edible bean crop)} = 160 \text{ lbs N/acre}\]

Nitrogen application for rotations that include alfalfa

When alfalfa is grown one or two years prior to the current corn crop, the N recommendations include consideration of a number of factors when selecting the appropriate amount of N to apply. Given the complexity of the recommendations, the MPCA expects N rate decisions to comply with the recommendations as given but should not exceed the values in Table 2, unless one of the deviations discussed above is warranted*.

Table 2. Maximum N application for first- and second-year corn following alfalfa

<table>
<thead>
<tr>
<th>Alfalfa Age (years)</th>
<th>First-year corn following alfalfa (lb N/acre)</th>
<th>Second-year corn following alfalfa (lb N/acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>80</td>
<td>120</td>
</tr>
<tr>
<td>2 or more</td>
<td>40</td>
<td>80</td>
</tr>
</tbody>
</table>

* The supplemental N worksheet, referenced in the University publication, with not be allowed to justify additional N.

More information

For more information, consult the University of Minnesota publication: AG-FO-3790-D Fertilizing Corn in Minnesota.

You can also contact your regional MPCA feedlot program staff. Contact info is available at: www.pca.state.mn.us/quick-links/staff-contacts-and-offices.

For additional nutrient planning resources, visit the MPCA feedlot program land application page at: www.pca.state.mn.us/quick-links/land-application.