Effect of Controlled-Release N Fertilizer on Corn Grain Yield

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Effect of Controlled-Release N Fertilizer on Corn Grain Yield

Abstract
We are continuing to look for technology that will enable us to manage nitrogen (N) fertilizer efficiently. Past research has studied the effect of nitrification inhibitors, sulfur coating, and time of application on N-use efficiency. Recently a controlled-release polymer-coated urea material (ESN) has become available. Evaluation of the material in terms of efficiency of use on corn is necessary to help crop producers decide if the extra cost of ESN can be recovered either by applying less material or by producing higher yields at current N rates. The objective of this study is to evaluate the effect of spring applications of ESN and urea on a corn-soybean cropping system.

Keywords
Agronomy

Disciplines
Agricultural Science | Agriculture | Agronomy and Crop Sciences

This northwest and allee research and demonstration farm is available at Iowa State University Digital Repository:
http://lib.dr.iastate.edu/farms_reports/1137
Effect of Controlled-Release N Fertilizer on Corn Grain Yield

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Jeff Moore, research assistant
Department of Agronomy

David Haden, farm superintendent

Introduction
We are continuing to look for technology that will enable us to manage nitrogen (N) fertilizer efficiently. Past research has studied the effect of nitrification inhibitors, sulfur coating, and time of application on N-use efficiency. Recently a controlled-release polymer-coated urea material (ESN) has become available. Evaluation of the material in terms of efficiency of use on corn is necessary to help crop producers decide if the extra cost of ESN can be recovered either by applying less material or by producing higher yields at current N rates. The objective of this study is to evaluate the effect of spring applications of ESN and urea on a corn-soybean cropping system.

Materials and Methods
This study was conducted at the Northwest Research and Demonstration Farm and the Northern Research and Demonstration Farm from 2003 to 2005. ESN and urea were hand applied in late April at rates of 0, 30, 60, 90, 120, 150, and 180 lb N/acre. The previous crop was soybean in all years. The corn was planted in May and machine harvested in October in all years. Plot yields were weighed in the field and a subsample was retained in order to determine moisture content. Yields were adjusted to a moisture content of 15.5% and are reported on a per acre basis.

Results and Discussion
Northwest Research and Demonstration Farm.
Grain yields at the Northwest Farm ranged from 116 bushels/acre to 164 bushels/acre for ESN treatments and from 108 bushels/acre to 162 bushels/acre in urea treatments in 2003 (Table 1). Grain yield increased with the N rate up to a rate of about 120 lb N/acre. The yield of the ESN treatments averaged over N rates was 148 bushels/acre. The yield of the urea treatments averaged over N rates was 144 bushels/acre. Unfortunately, the experiment was damaged by hail in 2004 so data was not collected that year. Yields were higher in 2005 than in 2003 and increased with addition of N fertilizer (p>F=<0.01). Yield of the ESN treatments averaged over N rates was 190 bushels/acre. Yield of the urea treatments averaged over N rates was 178 bushels/acre, a difference that was statistically significant.

Northern Research and Demonstration Farm.
Grain yields increased with N rate all three years at this location and were especially high in 2004 and 2005 (Table 2). Averaged across N rates, the yield of ESN treatments was 162 bushels/acre in 2003, 186 bushels/acre in 2004, and 199 bushels/acre in 2005. The average yield of urea treatments was 163 bushels/acre in 2003, 178 bushels/acre in 2004, and 191 bushels/acre. The differences in yields due to N materials were statistically significant in 2004 and 2005.

Discussion. The results of these five studies suggest that use of ESN may be beneficial for farmers in northern Iowa, depending on the extra cost of this material. Yields of the ESN treatments averaged over locations and years were 177 bushels/acre compared with average urea yields of 171 bushels/acre. Further studies need to be conducted to find how the ESN material performs when not incorporated into the soil, and to study its efficiency as a fall-applied fertilizer.
Table 1. Corn grain yield response to N rate and N material at the Northwest Research Farm, 2003 and 2005.\textsuperscript{a}

<table>
<thead>
<tr>
<th>N rate (lb/acre)</th>
<th>2003 ESN</th>
<th>2003 Urea</th>
<th>2005 ESN</th>
<th>2005 Urea</th>
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<tbody>
<tr>
<td>0</td>
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<td>180</td>
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<td>161</td>
<td>193</td>
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<tr>
<td>Average</td>
<td>148</td>
<td>144</td>
<td>190</td>
<td>178</td>
</tr>
</tbody>
</table>

Statistics: \(p>F\)
- N rate (N): <0.01, <0.01, <0.01
- Material (M): 0.08, <0.01, <0.01
- N*M: 0.53, 0.02, 0.02

\textsuperscript{a}The experiment was lost to hail in 2004.

Table 2. Corn grain yield response to N rate and N material at the Northern Research Farm, 2003–2005.

<table>
<thead>
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<tr>
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<td>163</td>
<td>186</td>
<td>178</td>
<td>199</td>
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</tr>
</tbody>
</table>

Statistics: \(p>F\)
- N rate (N): <0.01, <0.01, <0.01
- Material (M): 0.71, 0.06, 0.07
- N*M: 0.61, 0.50, 0.98