ECONOMICS OF WEED CONTROL AND NITROGEN RATE DECISIONS FOR CORN

Carrie Laboski, Chris Boerboom, Todd Andraski, Tim Trower
Dept. of Soil Science and Dept. of Agronomy, UW-Madison
N rate guidelines for corn

- Under continued scrutiny
  - Max. economic returns
  - Min. water quality impacts

- N rate research database
  - Sites where N and crop management BMPs are followed

- However, in-season crop stress can potentially affect corn N needs for optimum production
Weeds and yield loss

- Postemergence weed control has become more common
  - Glyphosate resistant corn hybrids

- Delaying weed control has the potential to alter corn response to applied N
  - Early-season weed competition for sunlight
  - Soil moisture
  - Soil N and other nutrients

- Delaying weed control beyond a 4- to 6-inch weed height results in corn grain yield losses of 7 to 20%
Objectives

- To determine the effect of weed control timing on
  - Corn N uptake
  - Weed N uptake
  - Economic optimum N rate (EONR) for corn
  - Economic return to N and weed control
Materials and Methods
Treatments

- Split plot RCBD, 4 reps
  - Main plot – N rates
    - 6 rates (0-200 lb N/a)
    - UAN broadcast incorporated prior to planting
  - Sub plot – Weed control
    - Pre-emerge (weed free control, 2.4 qt/a Camix)
    - 4 inch weed height (22 oz/a WeatherMax)
    - 12 inch weed height (22 oz/a WeatherMax)
    - No weed control
Location & measurement details

- Arlington, WI
  - 2006 and 2007
  - Corn following soybean
  - Plano silt loam (fine-silty, mixed, superactive, mesic Typic Argiudoll)
  - Natural weed seed bank

- Measurements
  - Weed biomass and total N concentration at time of weed control
    - For preemerge there was no sample
    - For no weed control
      - 2006 sampled at VT
      - 2007 sample just prior to harvest
  - Corn biomass and total N at VT
  - Grain yield
How weedy was it?
July 19, 2006

0 lb N/a

- Preemerge
- 4 inch height
- 12 inch height
- No control

160 lb N/a

- Preemerge
- 4 inch height
- 12 inch height
- No control
Effect of N rate & timing of weed control on corn whole plant N uptake at VT

<table>
<thead>
<tr>
<th>N rate</th>
<th>2006 Weed Control</th>
<th>2007 Weed Control</th>
<th>Corn N uptake at VT, lb/a</th>
</tr>
</thead>
<tbody>
<tr>
<td>lb/a</td>
<td>Pre</td>
<td>4 inch</td>
<td>12 inch</td>
</tr>
<tr>
<td>0</td>
<td>57</td>
<td>51</td>
<td>39</td>
</tr>
<tr>
<td>40</td>
<td>78</td>
<td>66</td>
<td>54</td>
</tr>
<tr>
<td>80</td>
<td>81</td>
<td>82</td>
<td>63</td>
</tr>
<tr>
<td>120</td>
<td>101</td>
<td>98</td>
<td>78</td>
</tr>
<tr>
<td>160</td>
<td>92</td>
<td>101</td>
<td>93</td>
</tr>
<tr>
<td>200</td>
<td>101</td>
<td>96</td>
<td>93</td>
</tr>
<tr>
<td>Mean</td>
<td>85 a</td>
<td>82 a</td>
<td>70 b</td>
</tr>
</tbody>
</table>

† Means separation based on Fisher’s protected LSD at $\alpha = 0.05$. 
Effect of N rate & timing of weed control on weed N uptake, 2006

<table>
<thead>
<tr>
<th>N rate (lb/a)</th>
<th>4 inch</th>
<th>12 inch</th>
<th>None</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>7</td>
<td>13</td>
<td>39</td>
<td>20 b †</td>
</tr>
<tr>
<td>40</td>
<td>14</td>
<td>22</td>
<td>61</td>
<td>32 ab</td>
</tr>
<tr>
<td>80</td>
<td>11</td>
<td>28</td>
<td>62</td>
<td>33 ab</td>
</tr>
<tr>
<td>120</td>
<td>11</td>
<td>34</td>
<td>98</td>
<td>47 a</td>
</tr>
<tr>
<td>160</td>
<td>14</td>
<td>35</td>
<td>81</td>
<td>43 a</td>
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<tr>
<td>200</td>
<td>13</td>
<td>19</td>
<td>101</td>
<td>45 a</td>
</tr>
<tr>
<td>Mean</td>
<td>12 c</td>
<td>25 b</td>
<td>74 a</td>
<td></td>
</tr>
</tbody>
</table>

† Means separation based on Fisher’s protected LSD at α =0.05.

2007 similar results
Effect of N rate & timing of weed control on corn grain yield, 2006

The graph shows the relationship between N rate (lb N/a) and corn grain yield (bu/a) for different weed control strategies: Preemerge, 4 inch, 12 inch, and None. The yield increases with higher N rates for all methods, but the impact varies depending on the control technique. The table provides specific N needs to attain yield at preemerge (EONR) at a 0.10 N:corn price ratio:

- **Preemerge**: YMNR = 112, EONR = 100, N need to attain yield at preemerge EONR = 100
- **4 inch**: YMNR = 150, EONR = 133, N need to attain yield at preemerge EONR = 120
- **12 inch**: YMNR = ≥200, EONR = ≥200, N need to attain yield at preemerge EONR = 164
- **None**: YMNR = ≥200, EONR = ≥200, N need to attain yield at preemerge EONR = >200

EONR at 0.10 N:corn price ratio
Effect of N rate & timing of weed control on corn grain yield, 2007

<table>
<thead>
<tr>
<th>Weed Control</th>
<th>YMNR</th>
<th>EONR</th>
<th>N need to attain yield at preemerge EONR</th>
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</thead>
<tbody>
<tr>
<td>Preemerge</td>
<td>46</td>
<td>43</td>
<td>43</td>
</tr>
<tr>
<td>4 inch</td>
<td>104</td>
<td>89</td>
<td>104</td>
</tr>
<tr>
<td>12 inch</td>
<td>≥200</td>
<td>≥200</td>
<td>200</td>
</tr>
<tr>
<td>None</td>
<td>≥200</td>
<td>≥200</td>
<td>&gt;200</td>
</tr>
</tbody>
</table>

EONR at 0.10 N:corn price ratio
Economic return to N and herbicide, 2006

EONR at 0.10 N:corn price ratio; $4/bu and $0.40/lb N
Pre is $40/a, Post is $11/a
Economic return to N and herbicide, 2007

EONR at 0.10 N:corn price ratio; $4/bu and $0.40/lb N
Pre is $40/a, Post is $11/a
Conclusions

- EONR increased as weed control was delayed
- Additional N needed to attain same yield as preemerge EONR
  - 4 inch – 20 to 61 lb N/a
  - 12 inch – 64 to 157 lb N/a
  - None – No amount of N could compensate
- Additional N needed was greater than weed biomass N
- With no weed control, weed + corn N uptake was greater than corn N uptake with preemerge
Conclusions

- At current N prices
  - Failure to control weeds in a timely fashion is very costly
  - Preemerge and 4” post weed control can provide similar economic returns in some situations
    - If N prices increase and all other prices remain the same, then preemergent weed control is favored over 4-in. postemergent control