Corn Rootworm Management, Nitrogen Management, and Tips in/for Corn following Corn

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Corn Rootworm Management
Clinton County YieldGard Corn
Urbana, IL Herculex Corn
Urbana, IL Agrisure
## Rootworm larval injury to Agrisure™. Ames, 2004

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Ratea</th>
<th>Placementb</th>
<th>Injuryc,e</th>
<th>Consistencyd,e</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agrisure</td>
<td>Bt</td>
<td>Bt</td>
<td>0.008</td>
<td>100</td>
</tr>
<tr>
<td>Agrisure + Cruiser</td>
<td>Bt + 0.125</td>
<td>Bt + ST</td>
<td>0.013</td>
<td>100</td>
</tr>
<tr>
<td><strong>Agrisure + Cruiser</strong></td>
<td><strong>Bt + 0.25</strong></td>
<td><strong>Bt + ST</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Force 3G</td>
<td>0.12</td>
<td>T-band</td>
<td>0.023</td>
<td>100</td>
</tr>
<tr>
<td>Lorsban 15G</td>
<td>1.22</td>
<td>T-band</td>
<td>0.030</td>
<td>100</td>
</tr>
<tr>
<td>Aztec 2.1G</td>
<td>0.14</td>
<td>T-band</td>
<td>0.132</td>
<td>88</td>
</tr>
<tr>
<td>Poncho 1250</td>
<td>11.25</td>
<td>ST</td>
<td>0.282</td>
<td>63</td>
</tr>
<tr>
<td>Cruiser 5FS</td>
<td>0.25</td>
<td>ST</td>
<td>0.390</td>
<td>63</td>
</tr>
<tr>
<td>Cruiser 5FS</td>
<td>1.25</td>
<td>ST</td>
<td>0.810</td>
<td>50</td>
</tr>
<tr>
<td><strong>CHECK</strong></td>
<td>- - -</td>
<td>- - -</td>
<td>0.810</td>
<td>50</td>
</tr>
</tbody>
</table>

- **Ratea**: Granules listed as ounces a.i. per 1,000 row-ft; Seed treatments as mg a.i. per seed.
- **Placementb**: T-band = insecticide applied at planting as band over row; ST = seed treatment.
- **Injuryc,e**: Iowa State Node-Injury Scale (0-3); number of full and/or partial nodes injured.
- **Consistencyd,e**: Consistency = percentage of times the node-injury was 0.25 (1/4 node destroyed) or less.
- **Means** that are not followed by lower-case letters are not statistically different.
## Rootworm larval injury to Agrisure™. Ames, 2005

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Rate(^a)</th>
<th>Placement(^b)</th>
<th>Injury(^c,\text{e})</th>
<th>Consistency(^d,\text{e})</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agrisure</td>
<td>Bt</td>
<td>Bt</td>
<td>0.11 a</td>
<td>88 a</td>
</tr>
<tr>
<td>Agrisure + Cruiser</td>
<td>Bt + 0.125</td>
<td>Bt + ST</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Agrisure + Cruiser</strong></td>
<td><strong>Bt + 0.25</strong></td>
<td><strong>Bt + ST</strong></td>
<td><strong>0.03 a</strong></td>
<td><strong>100 a</strong></td>
</tr>
<tr>
<td>Force 3G</td>
<td>0.12</td>
<td>T-band</td>
<td>0.02 a</td>
<td>100 a</td>
</tr>
<tr>
<td>Lorsban 15G</td>
<td>1.22</td>
<td>T-band</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aztec 2.1G</td>
<td>0.14</td>
<td>T-band</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poncho 1250</td>
<td>11.25</td>
<td>ST</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cruiser 5FS</td>
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<td>ST</td>
<td>0.47 b</td>
<td>54 b</td>
</tr>
<tr>
<td>Cruiser 5FS</td>
<td>1.25</td>
<td>ST</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CHECK</strong></td>
<td>- - -</td>
<td>- - -</td>
<td>0.45 b</td>
<td>50 b</td>
</tr>
</tbody>
</table>

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<table>
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<th>Rate</th>
<th>Placement</th>
<th>Injury</th>
<th>Consistency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agrisure</td>
<td>Bt</td>
<td>Bt</td>
<td>0.01 a</td>
<td>100 a</td>
</tr>
<tr>
<td>Agrisure + Cruiser</td>
<td>Bt + 0.125</td>
<td>Bt + ST</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Agrisure + Cruiser</strong></td>
<td><strong>Bt + 0.25</strong></td>
<td><strong>Bt + ST</strong></td>
<td><strong>0.01 a</strong></td>
<td><strong>100 a</strong></td>
</tr>
<tr>
<td>Force 3G</td>
<td>0.12</td>
<td>T-band</td>
<td>0.08 a</td>
<td>100 a</td>
</tr>
<tr>
<td>Lorsban 15G</td>
<td>1.22</td>
<td>T-band</td>
<td>0.06 a</td>
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<td>T-band</td>
<td>0.04 a</td>
<td>100 a</td>
</tr>
<tr>
<td>Poncho 1250</td>
<td>11.25</td>
<td>ST</td>
<td>0.08 a</td>
<td>100 a</td>
</tr>
<tr>
<td>Cruiser 5FS</td>
<td>0.25</td>
<td>ST</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cruiser 5FS</td>
<td>1.25</td>
<td>ST</td>
<td>0.09 a</td>
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<tr>
<td>CHECK</td>
<td>-</td>
<td>-</td>
<td>0.29 b</td>
<td>71 b</td>
</tr>
</tbody>
</table>

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## Rootworm larval injury to Agrisure™

**Sutherland, 2005**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Rate (^a)</th>
<th>Placement (^b)</th>
<th>Injury (^c, e)</th>
<th>Consistency (^d, e)</th>
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</thead>
<tbody>
<tr>
<td>Agrisure</td>
<td>Bt</td>
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<td></td>
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<tr>
<td><strong>Agrisure + Cruiser</strong></td>
<td><strong>Bt + 0.25</strong></td>
<td><strong>Bt + ST</strong></td>
<td><strong>0.53 a</strong></td>
<td><strong>50</strong></td>
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<tr>
<td>Force 3G</td>
<td>0.12</td>
<td>T-band</td>
<td>0.56 a</td>
<td>29</td>
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<td>Lorsban 15G</td>
<td>1.22</td>
<td>T-band</td>
<td>0.86 a</td>
<td>46</td>
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<tr>
<td>Aztec 2.1G</td>
<td>0.14</td>
<td>T-band</td>
<td>0.34 a</td>
<td>62</td>
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<tr>
<td>Poncho 1250</td>
<td>11.25</td>
<td>ST</td>
<td>2.00 b</td>
<td>0</td>
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<tr>
<td>Cruiser 5FS</td>
<td>0.25</td>
<td>ST</td>
<td>1.91 b</td>
<td>0</td>
</tr>
<tr>
<td>Cruiser 5FS</td>
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<td>ST</td>
<td>1.80 b</td>
<td>0</td>
</tr>
<tr>
<td>CHECK</td>
<td>- - -</td>
<td>- - -</td>
<td>2.23 b</td>
<td>0</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Treatment</th>
<th>Mean node injury rating (July 17)</th>
<th>Percentage consistency</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIR 604</td>
<td>1.04 c</td>
<td>40</td>
</tr>
<tr>
<td>MIR 604 + Cruiser 5FS (0.25 mg a.i. per seed)</td>
<td>1.33 bc</td>
<td>25</td>
</tr>
<tr>
<td>Cruiser 5FS (1.25 mg a.i. per seed)</td>
<td>1.87 b</td>
<td>10</td>
</tr>
<tr>
<td>Force 3G (4 oz of product per 1,000 ft of row)</td>
<td>0.94 cd</td>
<td>60</td>
</tr>
<tr>
<td>Aztec 2.1G (6.7 oz of product per 1,000 ft of row)</td>
<td>0.26 e</td>
<td>100</td>
</tr>
<tr>
<td>Lorsban 15G (8 oz of product per 1,000 ft of row)</td>
<td>0.51 de</td>
<td>90</td>
</tr>
<tr>
<td>Poncho 1250</td>
<td>1.05 c</td>
<td>40</td>
</tr>
<tr>
<td>Check</td>
<td>3.00 a</td>
<td>0</td>
</tr>
</tbody>
</table>

1Planting date was May 23, 2006. Corn was planted (2006) into an area that had been planted to a trap crop (late-planted corn interplanted with pumpkins) the previous season (2005).

2Node injury ratings are based on the 0 to 3 node injury scale developed by Oleson et al. (2005): 0.00 = no feeding damage; 1.0 = one node (circle of roots), or the equivalent of an entire node, pruned back to within approximately 3.8 cm (1.5 inches) of the stalk (or soil line if roots originate above ground nodes); 2.0 = two complete nodes pruned; 3.0 = three or more complete nodes pruned (the highest rating that can be given). Five root systems were evaluated from each of four replications (n = 20 per mean).

3Percentage consistency is the percentage of roots with a node injury rating < 1.0.
## Corn Yield following Corn and Soybeans

### 2005

<table>
<thead>
<tr>
<th>Location</th>
<th>Hybrids Tested</th>
<th>Corn after Corn</th>
<th>Corn after Soybean</th>
<th>Yield Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urbana</td>
<td>35</td>
<td>157</td>
<td>179</td>
<td>-12%</td>
</tr>
<tr>
<td>DeKalb</td>
<td>35</td>
<td>173</td>
<td>225</td>
<td>-23%</td>
</tr>
<tr>
<td>Monmouth</td>
<td>33</td>
<td>157</td>
<td>211</td>
<td>-26%</td>
</tr>
</tbody>
</table>
Corn Yield following Corn and Soybeans Univ. of IL (2006)

<table>
<thead>
<tr>
<th>Location</th>
<th>Hybrids Tested</th>
<th>Corn after Corn</th>
<th>Corn after Soybean</th>
<th>Yield Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urbana</td>
<td>30</td>
<td>197</td>
<td>193</td>
<td>+2%</td>
</tr>
<tr>
<td>DeKalb</td>
<td>50</td>
<td>201</td>
<td>212</td>
<td>-5%</td>
</tr>
<tr>
<td>Monmouth</td>
<td>36</td>
<td>140</td>
<td>210</td>
<td>-33%</td>
</tr>
</tbody>
</table>
Yield Increase with C-SB vs. C-C
Monmouth, IL (2005)
Corn - Corn vs. Corn - Soybean
Monmouth, IL (2005)

Yield of corn following corn

Yield change with corn on soybean

Non-RW
RW

R² = 0.8271
R² = 0.3742
Corn - Corn vs. Corn - Soybean
Monmouth, IL (2006)

Yield change with corn on soybean

R2 = 0.20
R2 = 0.35

Yield (C-C)
Corn - Corn vs. Corn - Soybean
DeKalb, IL (2006)

Yield change with corn on soybean

-40
-20
0
20
40

Yield (C-C)

RW
Non-RW

R2 = 0.27
R2 = 0.42
Corn - Corn vs. Corn - Soybean
Urbana, IL (2006)

R² = 0.76

R² = 0.01

Yield change with corn on sq.

Yield (C-C)
Corn – Corn vs. Corn – Soybean
Sutherland, IA (2006)

Yield Change: Corn following
SB

Bt & RW
Bt
Bt + IS

R² = 0.9412
R² = 0.3694
Yields for Corn Rootworm Treatments*

*Summary of three Iowa locations, 2006

Root Injury     0.01   0.08  1.55            0.00   0.00 0.01

Following Soybeans

Following Corn

Bu/acre

YieldGard Plus

Force 3G

Check

YieldGard Plus

Force 3G

Check

Jim Oleson, Iowa State University
Corn-Soybean vs. Corn-Corn
Ames, IA (2004) [P. Pedersen]

Lower yields in C-C than C-SB.
No difference between hybrids

LSD (0.05) Variety = NS  
LSD (0.05) Rotation = 21.6 bu/a  
LSD (0.05) VXR = NS
Corn-Soybean vs. Corn-Corn
Ames, IA (2005) [P. Pedersen]

AGAIN...
Lower yields in C-C than C-SB.
No difference between hybrids

LSD (0.05) Variety = NS
LSD (0.05) Rotation = 19.1 bu/a
LSD (0.05) VXR = NS
Corn-Soybean vs. Corn-Corn

Ames, IA (2006) [P. Pedersen]

Yields are the SAME in C-C and C-SB. No difference between hybrids.

Yield (bu/acre)

216.0
202.1
203.8
201.1

LSD (0.05) Variety = NS
LSD (0.05) Rotation = NS
LSD (0.05) VXR = NS
Yields for Corn Rootworm Treatments*

Preliminary data – Jim Oleson, Iowa State University

*Summary of three Iowa locations, 2006
Summary/Conclusions

• Corn yields are LOWER with C-C relative to C-SB (Range 2 to 23%, 9% average loss). This will affect average yields across the state.
Summary/Conclusions

• Continuous corn yields **DO NOT ATTAIN** the yield level of corn following soybeans.

• Bt Rootworm Hybrids may help reduce these yield penalties.

• Management can help **MITIGATE** these expected losses.
Nitrogen Management
Apply nitrogen before corn emergence and…

Category: not use the LSNT

Corn on recently manured soils 0-90
Corn after established alfalfa 0-30
Corn after corn 150-200
Corn after soybean (no manure) 100-150
Average Economic Optimum N Rate

Six Nitrogen Rate by Crop Rotation Sites
2000-2004 C-S and C-C Rotations

C-S Economic Yield: 161 bu/acre
C-S Economic N Rate: 108 lb N/acre
C-C Economic Yield: 137 bu/acre
C-C Economic N Rate: 167 lb N/acre

C-C 15% Lower Yield
C-C 59 lb N/acre Higher N Need

J.E. Sawyer, Iowa State Univ., 2004
Monmouth, IL 20 years

![Graph showing yield vs. N rate for C-C and S-C systems.]

- Optimum N rate for C-C system: 98 lb N
- Optimum N rate for S-C system: 146 lb N

Yield, bu/acre

N rate, lb N/acre
Return to N
121 C-S Site-Years Across Iowa (1992-2004)
Return to N
56 C-C Site-Years Across Iowa (1992-2004)
Corn Nitrogen Rate Calculator
Finding the Maximum Return To N and Most Profitable N Rate
A Regional (Corn Belt) Approach to Nitrogen Rate Guidelines

State: Iowa
Number of sites: 64
Rotation: Corn Following Corn
Non-Responsive Corn Sites Not Included

<table>
<thead>
<tr>
<th>N Price ($/lb N)</th>
<th>$0.32</th>
<th>$0.32</th>
<th>$0.32</th>
<th>$0.32</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn Price ($/bu)</td>
<td>$3.25</td>
<td>$3.60</td>
<td>$3.75</td>
<td>$4.00</td>
</tr>
<tr>
<td>Price Ratio</td>
<td>0.10</td>
<td>0.09</td>
<td>0.09</td>
<td>0.08</td>
</tr>
<tr>
<td>MRTN Rate (lb N/acre)</td>
<td>180</td>
<td>181</td>
<td>186</td>
<td>189</td>
</tr>
<tr>
<td>Profitable N Rate Range (lb N/acre)</td>
<td>163 - 198</td>
<td>167 - 202</td>
<td>170 - 205</td>
<td>173 - 207</td>
</tr>
<tr>
<td>Net Return to N at MRTN Rate ($/acre)</td>
<td>$207.17</td>
<td>$227.50</td>
<td>$248.01</td>
<td>$268.54</td>
</tr>
<tr>
<td>Percent of Maximum Yield at MRTN Rate</td>
<td>98%</td>
<td>98%</td>
<td>98%</td>
<td>98%</td>
</tr>
</tbody>
</table>

Anhydrous Ammonia (82% N) at MRTN Rate (lb product/acre):
<table>
<thead>
<tr>
<th>MRTN Rate (lb N/acre)</th>
<th>180</th>
<th>181</th>
<th>186</th>
<th>189</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anhydrous Ammonia (82% N) Cost at MRTN Rate ($/acre)</td>
<td>$57.60</td>
<td>$57.92</td>
<td>$59.20</td>
<td>$60.48</td>
</tr>
</tbody>
</table>

Most profitable N rate is at the maximum return to N (MRTN).
Profitable N rate range provides economic return within $1/acre of the MRTN.
Corn Nitrogen Rate Calculator

- http://extension.agron.iastate.edu/soilfertility/nrate.aspx
Select the Right Genetics

- Proven ability to perform following a corn crop
  - Bt gene boost in yield?
- Good disease package
  - Northern Corn Leaf Blight
  - Gray Leaf Spot

![Graph showing yield increase with corn following soybean.](image)
Manage Corn Rootworms

- Bt and granular insecticides are most consistent
Work With your Soil

- Avoid the soil terrible too’s
  - Hot
  - Cold
  - Wet
  - Dry
  - Firm
  - Loose
Soil Temperature

• Wait for warm soil temperatures or until about April 20.
  – Cold soils slow root growth.
  – Cold soils promote seed / seedling diseases.
  – Cold soils allow more time for insect activity.

• In heavy residue, use row cleaners to allow sunshine to hit the soil.
Soil Density

- Avoid compacting operations, especially when the soil is wet.
  - Fertilizer
  - Lime
  - Manure
- Watch for “sidewall compaction.”
- Be sure there is good seed-to-soil contact at planting.
Deep and Sidewall Compaction
Nitrogen

- Use enough, but not too much
Remember your Planter’s Goals

- Unit penetrates the soil and residue
- Unit makes a firm seed trench
- Unit places the seed at the proper depth and spacing
- Unit closes the trench to give proper seed-soil contact
More Residue to Manage

- Tillage
- Residue Managers
  - Just “tickle” the soil
Coulter Depth

Illustration of excessive coulter tillage with maximum soil disruption.

Coulter blades operating below seed placement may result in poor seed germination. Aggressive coulter blades, recommended by some companies, may cause excessive soil disturbance.

Illustration of coulter tillage set-up minimizing soil disturbance.

Seed deposited into firm soil, soil below the seed has not been loosened. Unit mounted coulter set at the correct depth (1" - 1 1/4" into soil) loosened soil to firm around the seed.
Are the openers properly adjusted?

- 2 – 2.5 inches?
• “Pinch point” usually 1.5 inches deep
• “Pinch point” should be at or slightly above seed
• Be sure closing assembly straddles the row
• Adjust “Pinch point” with shims
Know the Limitations of Spider Wheel Closers

- Is there adequate seed-soil contact for a dry spring?
- May urge us to run when it is too wet
  - We may be causing severe compaction.
  - We may throw kernels on the surface.
Is the planter sidewall crumbling in?

- Use a spade or trowel at planting
If the sidewall in not crumbling in

- Adjust the down pressure on the closing wheels
- Wait until it is drier
Uniform Plant Spacing

- Non-uniform spacing (Doubles, Skips, etc)
  - Lack of or improper maintenance on metering device
  - Driving at the wrong speed (usually too fast)
  - Planter not level
    - Seeds not move down chute properly
    - Markers perpendicular to soil (most planters)
Planter Suggestions

• Maintain and adjust planter
  - Metering device
  - Residue managers
  - Furrow openers
  - Furrow closers
  - Planter level
  - Coulters at or slightly above planting depth

• Shoot for a corn planting depth at least 1.5 inches deep.

• Watch your speed.
Be Timely

- Planting
- Fertilizing
- Pest Management
- Harvest
Questions?

Thank YOU!!!