Institute of Ag Professionals

Proceedings of the

2008 Crop Pest Management Shortcourse &

Minnesota Crop Production Retailers Association Trade Show

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Agronomic Practices to Maximize Yield and Minimize Risk in Continuous Corn

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Corn Yield Increase with Rotation: 1980s & 1990s
(8 to 20 years of data per state)

Data from Hoeft et al. (2000)
Corn Yield Increase Due to Rotation With Soy

61 site-years in Illinois (1999-2007)

- Dry years, poor hybrid selection, or both.

- 15 bu/ac advantage to rotation (8% advantage if 180 bu/ac continuous corn)

Data from Emerson Nafziger
Potential Risk When Corn Follows Corn Rather Than Soybean
Hybrid Considerations for Corn on Corn (Roots & Stalk)

- Drought tolerance
- Rootworm resistance
- Root & stalk strength
- Resistance to stalk rot & leaf diseases
- Emergence in cool soils
- Corn borer resistance?
40 lb more N for Corn on Corn

At $0.45/lb N and $3.50/bu corn:

Corn following soybean: 90-111 lb N/ac
Corn following corn: 128-150 lb N/ac
N Rates: What Happened Here?

State: Illinois - Central
Number of sites: 163
Rotation: Corn Following Soybean
Non-Responsive Sites Not Included

Nitrogen Price ($/lb): 0.45
Corn Price ($/bu): 3.50
Price Ratio: 0.13

MRTN Rate (lb N_acre): 153
Profitable N Rate Range (lb N/ac): 138 - 168

State: Illinois - Central
Number of sites: 66
Rotation: Corn Following Corn
Non-Responsive Sites Not Included

Nitrogen Price ($/lb): 0.45
Corn Price ($/bu): 3.50
Price Ratio: 0.13

MRTN Rate (lb N_acre): 159
Profitable N Rate Range (lb N/ac): 145 - 174
Profitable N Use When Corn Follows Corn

- Fall soil sample to 2 feet - residual nitrate
  - Always in western MN
  - In other parts of MN if:
    - Recent history of manure
    OR
    - Low rainfall during growing season
2008 Continuous Corn Tillage Study

- Boyd
- Heron Lake
- Holloway
- Lamberton
- Morris
Tillage Systems

1) Fall strip-till
   - No stalk chopping
   - N, P, K with strip-till

2) Fall chisel plow*

3) Fall moldboard plow*

*Chop stalks, broadcast P & K, ammonia in fall
Yield Results - 2008

10% Probability Level

Data from Liz Stahl

Yield (bu/ac)

<table>
<thead>
<tr>
<th></th>
<th>Strip-till</th>
<th>Chisel</th>
<th>Moldboard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boyd</td>
<td>150</td>
<td>140</td>
<td>140</td>
</tr>
<tr>
<td>Heron Lake</td>
<td>200</td>
<td>190</td>
<td>190</td>
</tr>
<tr>
<td>Holloway</td>
<td>175</td>
<td>175</td>
<td>175</td>
</tr>
<tr>
<td>Lamberton</td>
<td>135</td>
<td>135</td>
<td>135</td>
</tr>
<tr>
<td>Morris</td>
<td>110</td>
<td>110</td>
<td>110</td>
</tr>
</tbody>
</table>

Strip-till: Data from Liz Stahl
Chisel: Data from Liz Stahl
Moldboard: Data from Liz Stahl

10% Probability Level
Surface Residue Coverage After Planting
(average of 5 sites in 2008)

10% Probability Level

Data from Liz Stahl
Corn on Corn at Waseca, 2007
Very high P & K, Nicollet-Clarion clay loam

<table>
<thead>
<tr>
<th>Tillage system</th>
<th>Yield (avg. over starter trts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moldboard</td>
<td>180 a (3% higher)</td>
</tr>
<tr>
<td>Chisel</td>
<td>174 b</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Starter fertilizer</th>
<th>Yield (avg. over tillage trts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 gal 10-34-0 in furrow</td>
<td>181 a (3% higher)</td>
</tr>
<tr>
<td>None</td>
<td>176 a</td>
</tr>
</tbody>
</table>

10% Probability Level
Data from Randall & Vetsch
Continuous Corn at Rochester (1998-2000)
Very high P, high K, Port Byron silt loam

10% Probability Level

Data from Vetsch & Randall

Yield (bu/ac)

Chisel plow 168
Strip-till 165
Zone-till 162
No-till 154

10% Probability Level
Continuous Corn at Rochester (1998-2000)
Very high P & high K, Port Byron silt loam

6% average yield gain with 150 lb 9-23-30:
  2” x 2” with chisel, strip, or zone tillage
  5” in strip with fall strip-till

Data from Vetsch & Randall
Size Residue With Disk Gangs and/or Stalk Chopper

- Speed up decomposition
- Reduce problems with spring tillage and planting
Row Cleaners and Coulters

• Move residue and clods off the row

• Help double-disk openers slice through residue in seed trench

• Row cleaners should move residue, **not soil**

• Row cleaners should turn ~ 1/3 of time
Continuous Corn Research, 2006-2007

- Residue removed in fall:
  - All, half, or none

- Tillage:
  - Chisel vs. no-till

- 4 N rates
All Residue Removed
Soil temperature at 2” over the first 4 weeks after planting

- Chisel
- No-till

5% Probability Level
Tillage Increased Early Growth
Residue and Tillage Influenced Yield

5% Probability Level
Removing Residue Reduced N Need

Yield (bu/ac) vs. Nitrogen fertilizer (lb N/ac)

- All or half residue removed
- No residue removed

Comparison of yield under different nitrogen fertilizer levels and residue removal conditions.
Lamberton, MN (2005-2008)

Yield (bu/ac)

High-input system:
- Beef manure
- 40 lb more N/ac
- 10-34-0 in furrow
- 38,000 seeds/ac

(Data from Bruce Potter)
Continuous corn with chisel plow tillage
(12 site-years in central & northern IL, 2003-2007)

(Data from Emerson Nafziger)
Can deep tillage reduce water stress in continuous corn?
Continuous corn with normal fertility
(12 site-years in central & northern IL, 2003-2007)

Yield (bu/ac)

<table>
<thead>
<tr>
<th></th>
<th>32,000 ppa</th>
<th>40,000 ppa</th>
</tr>
</thead>
<tbody>
<tr>
<td>10&quot; - Chisel</td>
<td>198</td>
<td>186</td>
</tr>
<tr>
<td>15&quot; - Rip</td>
<td>200</td>
<td>196</td>
</tr>
</tbody>
</table>

(Data from Emerson Nafziger)
Foliar Fungicide in Corn?

- Northern Corn Leaf Blight
- Gray Leaf Spot

- Both survive in corn residue left on soil
- Hybrids differ in susceptibility

Photo by Dean Malvick
2008 Corn on Corn Fungicide Study

- Browntown: Garst 87G94 (99 day RM, quad stack)
- Lamberton: DKC 53-18 (103 day RM, RR2)
Treatments Evaluated...

• Untreated control

• Fungicide timing
  – V14, V14+VT, VT, VT+R2, R2

• Fungicide rate
  – 3, 6, or 9 oz Headline/acre
  – All applications included 0.25% v/v NIS
Results from Brownton, 2008

- No statistically significant effect of fungicide rate or timing
Brownton, 2008
(averaged across fungicide rates)

Yield (bu/ac)

- Untreated: 178
- V14: 171
- V14+VT: 174
- VT: 182
- VT+R2: 180
- R2: 179

10% Probability Level
Adjuvant not recommended with ground or aerial applications prior to tasseling

0.25% v/v NIS in my V14 applications…

Photo from Brownton, 2008
Disease Pressure at Brownton

- % infected leaf area on ear leaf and leaf above ear leaf in early September...
  - Northern corn leaf blight:
    - Less than 0.1% (no treatment effect)
  - Gray leaf spot:
    - None found
Results from Lamberton, 2008

• No statistically significant effect of fungicide rate or timing
Lamberton, 2008
(averaged across fungicide rates)

Yield (bu/ac)

- Untreated: 143
- V14: 143
- V14+VT: 145
- VT: 142
- VT+R2: 145
- R2: 144

10% Probability Level
Disease Pressure at Lamberton

• % infected leaf area on ear leaf and leaf above ear leaf in early September...
  – Northern corn leaf blight:
    • Less than 1% (no treatment effect)
  – Gray leaf spot:
    • None found
2007 Corn Fungicide Strip Trials (southern & central MN)

84% of sites at or below break-even level

Break-even level at $18 for fung + application & $3.50 corn

Yield increase with fungicide (bu/ac)

Data from Potter and Malvick
Successful Corn on Corn: Pick the Low Fruit First

- Avoid dry regions and low productivity soils
- Hybrid selection (roots and stalk)
- More nitrogen (40 lb N/ac)
  - Consider residual nitrate
- Size residue + \textit{fall} tillage
- Row cleaners + coulters
- Starter fertilizer
Additional Opportunities?
(with added economic & environmental risk)

- Residue removal
  - No more than 50% removal unless manure applied
- Deep tillage
- Higher plant populations
  - With more N and deep tillage?
- Foliar fungicide
Questions or Comments?

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