Tillage Systems and Soil Conservation for Corn-on-Corn

Tony J. Vyn, assisted by colleagues, graduate students, technicians, and farmers
Ratio of Corn to Soybean Acres (2005)

Appendix Figure 6. Corn Acres Divided by Soybean Acres, 2005

Source: G. Shnitkey, Univ. of Illinois, Farm Economics Facts and Figures (Sept. 15, 2006)
4-State No-till Adoption in 2004

Source: CTIC National Crop Residue Survey
Tillage Choices for Corn after Soybean versus Corn after Corn?
What Kind of Corn-Dominant Rotation?

- Continuous Corn
- Soybean-Corn-Corn
- Soybean-Corn-Corn-Corn
- Soybean-Corn-Corn-Soybean-Corn
- Soybean-Wheat-Corn-Corn-Corn
- Alfalfa-Alfalfa-Alfalfa-Corn-Corn-Corn
Corn Yield Means After 5 Years of Soybean
(Arlington, WI; 1987 to 2005; Control Treatments)

Source: J. Lauer and T. Stanger, Univ. of Wisconsin
Soybean Yield Means after 5 Years of Corn
(Arlington, WI; 1987 to 2005; Control Treatments)

Source: J. Lauer and T. Stanger, Univ. of Wisconsin
Corn Yield Response to Tillage After 5 Years of Soybean (Arlington, WI; 1987 to 2005; Control Treatments)

Source: J. Lauer and T. Stanger, Univ. of Wisconsin
Corn Yield Response to Rotation & Tillage: Southern Iowa Region (2002-2005)
Crawfordsville & Chariton, IA

Source: M. Al Kaisi, Iowa State
Corn Yield Response to Rotation and Tillage: North-Central Iowa Region (2002-2005)
Ames & Kanawha, IA

Source: M. Al Kaisi, Iowa State
Nitrogen Management Issues for Corn after Corn with Conservation Tillage

- **Timing:** Starter more important (Residues? Planting Date?)

- **Rate:** More N for any version of corn after corn than typical corn-soybean rotation?
## Corn Yield Response to Tillage and Rotation, Silty Clay Loam, West Lafayette, IN, 1975-2006.

<table>
<thead>
<tr>
<th>Tillage</th>
<th>Corn/Soybean</th>
<th>CON'T. Corn</th>
<th>Yield Gain for Rotation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>bu/ac</td>
<td>bu/ac</td>
<td></td>
</tr>
<tr>
<td>Plow</td>
<td>179.8</td>
<td>172.4</td>
<td>4%</td>
</tr>
<tr>
<td>Chisel</td>
<td>180.1 100%</td>
<td>167.7 97%</td>
<td>7%</td>
</tr>
<tr>
<td>No-till</td>
<td>175.2 97%</td>
<td>148.8 86%</td>
<td>18%</td>
</tr>
</tbody>
</table>

- **Corn/Soybean**: Yield per acre (% of plow yield).
- **Con't. Corn**: Yield per acre (% of plow yield).
- **Yield Gain for Rotation**: Percentage yield gain compared to plow tillage.
Average Maximum Soil Temperatures in First 4 Weeks after Planting (1997-2002)

- Corn after soybean
- Continuous Corn

- Fall chisel, disk, field cultivate
- No-till
Ridge-till vs. No-till Continuous Corn
Mean Plant Heights?
Plant Height Variability in Corn after Corn
Long-term Tillage Effects on Soil Organic Matter (1975-2003, West Lafayette, IN)

Source: Gál and Vyn, 2007

Source: Gál and Vyn, 2007
Long-term Tillage and Rotation Effects on Total Soil Carbon to a 39.3” depth (1975-2003)

Source: Gál & Vyn, 2007
Chisel Plow or Combination Tillage Tools for Corn after Corn?
Corn Yield Response to Tillage and Rotation, Sebewa Loam soil, Wanatah, IN (1997-2006)

<table>
<thead>
<tr>
<th>Tillage</th>
<th>Corn/Soybean</th>
<th>Con’t. Corn</th>
<th>Yield Gain for Rotation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>bu/ac</td>
<td>% of chisel, d.,fc. yield</td>
<td>bu/ac</td>
</tr>
<tr>
<td>Fall chisel, disk, field cultivate</td>
<td>195.3</td>
<td>- - -</td>
<td>180.7</td>
</tr>
<tr>
<td>Fall chisel, field cultivate</td>
<td>193.5</td>
<td>99%</td>
<td>181.9</td>
</tr>
<tr>
<td>Fall disk, field cultivate</td>
<td>197.4</td>
<td>101%</td>
<td>178.3</td>
</tr>
<tr>
<td>No-till</td>
<td>189.7</td>
<td>97%</td>
<td>167.2</td>
</tr>
</tbody>
</table>

Source: West and Vyn, 2006
No-till Corn Yields – Continuous as % Of Rotation – Loam Soil, Wanatah, IN (1997-2006)

Source: West and Vyn, 2006
Corn after Corn with Stover Removal?

Stuart Birrell, Ag and Biological Engineering, Iowa State
Questions about Corn Stover Removal

Feasibility for ethanol production?

Effects on soil properties (physical and chemical)?

Improved situation for No-till Continuous Corn?
Successful Strip Tillage after Soybean and with Reasonable Soil Moisture Conditions

Source: Norm Larson, Elburn Co-op, IL
Strip Tillage for Corn after Corn?
Surface Residue Cover (%) after Planting Loam Soil, Wanatah, IN, 2001-2004

Previous Crop

Soy
Corn

Chisel
Strip-till
No-till
Strip Tillage for Corn after Soybean and Corn in N. Indiana, Loam Soil (2001-2006)

![Graph showing yield comparison between previous crops and tillage methods](image)

- Soybean:
  - Fall Chisel: 202
  - Strip-till: 204
  - No-till: 197

- Corn:
  - Fall Chisel: 188
  - Strip-till: 187
  - No-till: 176

Legend:
- Orange: Fall Chisel
- Blue: Strip-till
- Green: No-till
Increased Corn Demand Drives Rotation and Tillage Choices?
Successful Continuous, Conservation-till Corn Depends on:

1. Soil properties (texture, drainage, slope, structure, nutrient status)
2. Tillage system selected and how it is adapted (e.g. strip-till versus no-till, depth/timing adjustments)
3. Associated management (hybrid selection, fertility, etc.)

Don't go beyond second-year corn unless you have superior soil structure.
Successful Continuous, Conservation-till Corn Depends on:

4. Compaction patterns / controlled traffic?

5. Long-term factors: (e.g. Number of years of corn in succession; manure; corn stalk harvest?)

6. Research investment over the next decade!
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John Deere & Co.

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John Deere Cropping Systems
Remlinger (Kalida, OH)

Seed:
Allen County SWCD
Pioneer Hi-Bred, Int.
Beck’s Hybrids