Tillage Systems to Sustain Soil and Yield in “Continuous” Corn

Tony J. Vyn & Graduate Students, T.D. West, Colleagues, & Farmers
Does ethanol really change the conservation tillage decisions for corn production?

Picture courtesy of B. Moebius, Cornell University, 2007
Tillage Choices for Corn after Soybean versus Corn after Corn?

Photo credit: Greg Stewart
Answer: Depends on Soil Type, Erosion Risk, Technology Adoption and Crop Management

Picture courtesy of Jeff Vetsch, Univ. of Minnesota
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
Triplett - Van Doren
Tillage and Rotation Plots in Ohio
Corn Yield Response to Rotation/Tillage (Wooster, OH; 1963-2006)

Source: Dr. Warren Dick, OSU
Wooster Site

Source: Dr. Warren Dick, OSU
Tillage Effects on Organic C (Wooster) from 1962 to 2003

Source: Dr. Warren Dick, OSU
Corn Yield Response to Rotation/Tillage
(Hoytville, OH; 1963-2006)

Source: Warren Dick, OSU
Tillage Effects on Organic C (Hoytville) (1980 to 2005)

Source: Dr. Warren Dick, OSU
Long-term Rotation and Tillage Plots
Silty clay loam, W. Lafayette, IN 1975-2006

- **Plow**
  - C-S: 4% 18%
  - CC: 7% 13%
- **Chisel**
  - C-S: 16% 13%
  - CC: 15% 11%
- **No-Till**
  - C-S: 2% 13%
  - CC: 4% 11%

1975-2007

1998-2007
Long-term Tillage Effects on Soil Organic Matter (1975-2003, West Lafayette, IN)

Source: Gál, Vyn et al., 2007, Soil Tillage Research
Long-term Tillage and Rotation Effects on Total Soil Carbon to 40” depth (1975-2003)

Source: Gàl, Vyn et al., 2007, Soil Tillage Research
Continuous versus Short-term No-till Influence on Soil Carbon Weight

Source: Omonode, Gál, Stott, Abney & Vyn* 2006, SSSAJ 70:419-425
Strip Tillage for Corn after Corn?
Strip-Till Corn after Corn

Split the middle w/o guidance

Source: Norm Larson, Elburn Co-op, IL
Questions about Corn Stover Removal

Feasibility for ethanol production?
Effects on soil properties?

Pictures from Dr. Stuart Birrell, Ag and Biological Engineering, Iowa State
Corn Yield Response to Residue Removal in Corn after Corn


Across 5 Mollisol environments in Illinois

<table>
<thead>
<tr>
<th>Residue removed</th>
<th>Yield (bu/ac)</th>
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<tr>
<td>All</td>
<td>210</td>
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<td>Half</td>
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P ≤ 0.1

Across 2 Alfisol environments in Illinois

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P ≤ 0.1

*NS = Not Significant*
The rotation effect lasts two years increasing corn grain yield 19% for 1C and 7% for 2C.
Corn Yield Response to Tillage After 5 Years of Soybean
(Arlington, WI; 1987 to 2006; Control Treatments)

Cropping Sequence
C = Corn, S = Soybean, Number = consecutive year of corn

Control treatments during 1987-2006 at Arlington, WI

Source: Lauer, unpublished
Management Issues Include Automatic Guidance, Fertility, Prior Compaction, and Seed Row Uniformity
Row Position in No-Till Continuous Corn
Corn Yield Response to Tillage and Rotation, Sebewa Loam soil, Wanatah, IN (1997-2007)

- Fall Chisel
- Fall Disk
- No-Till

Corn after Soy: 7%
Fall Disk: 10%
No-Till: 13%

Cont. Corn: 13%

- **Corn after soybean**: Fall chisel, disk, field cultivate
- **Continuous Corn**: No-till

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<tr>
<th>Degrees F</th>
<th>Corn after soybean</th>
<th>Continuous Corn</th>
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What do Average Heights Tell us?
Uniformity More Difficult to Achieve in Corn after Corn
Chisel Plow

No-Till

Boomsma and Vyn, 2007 (Purdue AY 329-W)
Tony’s Top Five for Conservation-till Corn after Corn

1. Be realistic about costs before switching to 2nd-year Corn or Continuous Corn. Rotation advantage very tillage & soil dependent, and may decline with time in corn-soybean rotations.

2. Pick your best drained and most productive fields.

3. Consider strip tillage as an alternative to no-till or conventional tillage.

4. Optimize conservation-till corn performance with superior management (e.g. hybrids, fertilizer rate and placement, pest control).

5. Aim for plant-to-plant uniformity in the row.
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- Fluid Fertilizer Foundation
- John Deere & Co.

Equipment:
- John Deere Cropping Systems Unit
- Case-DMI (Goodfield, IL)
- Remlinger (Kalida, OH)

Seed:
- Pioneer Hi-Bred, Int.
- Beck’s Hybrids
Thanks!

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