Cash Crop Establishment Into/After Cover Crops

Sjoerd W. Duiker, Soil Management Specialist
Penn State University
Why No-Till: Reduced Sheet Erosion
Why No-Till: Reduced Gully Erosion
Why No-Till: Water Conservation

Reduced evaporation

- Conventional till
- No-till

- Reduced evaporation
- Increased infiltration

Monthly evaporation (inches)

Conventional tillage

July 2006

No-tillage

PennState Extension
Why No-Till:
Greater Surface Organic Matter Content
Why No-Till: Soil Structure Improvement

This soil can become like this
Why No-Till: Great Biological Activity

<table>
<thead>
<tr>
<th># Earthworms/A</th>
<th>No-Till</th>
<th>Plow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cont. Corn</td>
<td>75,000</td>
<td>40,000</td>
</tr>
<tr>
<td>Cont. Soybean</td>
<td>500,000</td>
<td>230,000</td>
</tr>
<tr>
<td>Clover/Rye.</td>
<td>2,000,000</td>
<td></td>
</tr>
<tr>
<td>Pasture+manure</td>
<td>5,000,000</td>
<td></td>
</tr>
</tbody>
</table>

Data from Indiana
Crop and management systems continuous for at least 10 years
Soil tillage is hard work!

Relax! Do no tillage!

Why No-Tillage? - Labor Savings

Soil tillage is hard work!
No-Till for Faster Cover Crop Establishment
Why No-Till: to let cover crops develop more growth in Spring
Effects of uneven residue distribution

Equipment Considerations: No-Till Starts at Harvest
Uneven residue distribution
Chaff not spread out
Straw Residue Effect on NT Sorghum-sudangrass
Equipment Considerations: Planters vs Drills

- Better residue flow through machine
- More options for residue handling attachments
- More down-pressure per opener possible
- Fertilizer and pesticide handling capacities
- Better seed depth control
- Better seed metering
- More expensive
- Fewer seed sizes handled
Equipment Considerations: Enough Weight on Planter or Drill
Example of Improved Planter Set-up for No-Till

- 4-row White 6100 pull-type corn planter
- 7 rows for soybeans with splitters
- Liquid side-dress at 2+2
- Converted for no-till in 2006
previous setup

Conventional depth tires

Rubber closing wheels

Worn, frame-mounted bubble coulter

No seed firmers
Equipment Considerations: Drills

- Seeding Rate – calibrate
- Depth Control
- Press wheels for seed to soil contact
- Read the Manual
  - Note all references are for new equipment
Drills

- Seeding depth more critical than rate
- Single disk openers
  - Better residue handling capacity
  - Better depth control
- Double disk openers
  - Better for small seeded crops
- Shoe type
  - Limited residue handling ability
  - Depth control limited
  - Not very common
Drills

- Shoe type
Coulters

• Purpose – cut through residue
• Narrow design –
  o Less soil disturbance
  o Work better under wide soil conditions
• Close to seed openers
• Run at planting depth
• The more iron to push into the soil – the more weight required on drill
Bubbled coulter

Turbo coulter

13-wave fluted coulter
1” waves
16” -20” diameter

8-wave fluted coulter
1 ¼” waves,
14 5/8”-20” diameter

Coulters for no-tillage and zone-tillage

Rippled coulter
Depth Control

- Depth gauge wheel or press wheel
Press Wheels

• Purpose –
  o Seed-to-soil contact
  o Control seeding depth
• 2 inch or V shaped preferred
• 1 inch – poor depth control
• >2 inch poor closing action
‘Planting Green’

What: Planting main crops in actively growing cover crops

Why:
• To allow the cover crops to put on more biomass
• To improve soil
• To avoid hair-pinning problems
• To improve weed control
• To save water in summer
• To increase natural enemies of insect pests attacking main crop
‘Planting Green’ – attachment
Designed and developed by farmer and engineer, Charles Martin, Perry County, Pennsylvania
Cover crop partially dead – difficult to cut by coulter, ‘hairpinning’
Partially killed cover crop problems

Cover crop ‘bales’ created by row cleaners
Some 2015 Planting Green Experiences

Planting corn into hairy vetch in a 3-year corn-soybean-wheat/vetch rotation
Vetch biomass increased 500 lbs/A in 4 days!

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
<th>Vetch Biomass (lbs/A)</th>
<th>Typical N content (lbs/A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 8th</td>
<td>Tillage time</td>
<td>1829</td>
<td>73</td>
</tr>
<tr>
<td>May 12th</td>
<td>Planting time</td>
<td>2326</td>
<td>93</td>
</tr>
</tbody>
</table>
Planting Green – corn into 1 ton hairy vetch DM
Herbides: glyphosate, Lexar, 2,4-D May 18th
Visual soil improvement with hairy vetch
Vetch plowed in with moldboard plow
Vetch plowed in with chisel plow
After plowing you also need to disk harrow.
And harrow some more
Field cultivator presents some challenges in heavy cover crop
Moldboard/disk/harrow

Planted green
Soil after Planting Green
After Moldboard/disk/harrow – harvest time
After Planting Green – harvest time
# Corn Yields 2015

<table>
<thead>
<tr>
<th>Method</th>
<th>Yield (bu/a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moldboard/disk/harrow</td>
<td>187 a</td>
</tr>
<tr>
<td>Chisel/disk/harrow</td>
<td>211 b</td>
</tr>
<tr>
<td>Planted Green</td>
<td>203 b</td>
</tr>
</tbody>
</table>

Used 90 lbs/A Nitrogen fertilizer
Farmer-Cooperator Experiments

- Centre County (soybeans only)
- Clinton County (corn + soybean)
- Lancaster County (corn only)

Termination timing
  - Early
  - Late (planted green)
2015: Dry spring, wet summer

![Bar chart showing precipitation for Spring and Summer in Rock Springs and Southeast. Bars for 2015 are in orange, 30-Yr Normal in blue, and 30-Yr Normal in tan.](image-url)
<table>
<thead>
<tr>
<th>Site</th>
<th>Rye Planting Date</th>
<th>Rye Seeding Rate</th>
<th>Early Termination Date</th>
<th>Late Termination Date</th>
<th>Cash Crop Planting Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinton Co.</td>
<td>31-Oct</td>
<td>54 kg ha⁻¹</td>
<td>18-May</td>
<td>7-Jun</td>
<td>27-May</td>
</tr>
<tr>
<td>Lancaster Co.</td>
<td>20-Oct</td>
<td>41 kg ha⁻¹</td>
<td>2-May</td>
<td>13-May</td>
<td>11-May</td>
</tr>
<tr>
<td>Landisville</td>
<td>30-Sep</td>
<td>54 kg ha⁻¹</td>
<td>5-May</td>
<td>29-May*, 21-May</td>
<td>19-May</td>
</tr>
<tr>
<td>Rock Springs</td>
<td>30-Sep</td>
<td>54 kg ha⁻¹</td>
<td>8-May</td>
<td>18-May</td>
<td>14-May</td>
</tr>
</tbody>
</table>

Penn State Research Centers are indicated in bold text.

---

**Rye Biomass at Early Termination and Planting**

Horizontal axis: Site (Clinton Co., Lancaster Co., Landisville, Rock Springs)

Vertical axis: Mg ha⁻¹

Bars represent biomass at early (brown) and late (green) termination, with a significant difference indicated by an asterisk (*).
Corn Experiment

- Corn populations were no different between treatments at 3/4 study sites. At Rock Springs, population was reduced by 9%.
Corn Experiment

- Corn grain yield was significantly lower (9%) at half of the study sites. Yield was numerically lower at all four sites.

![Grain Yield Chart]

- **Clinton Co.**
- **Lancaster Co.**
- **Landisville**
- **RockSprings**

* Early
* Late

Mg ha⁻¹

---

PennState Extension
Plots were planted on the same day.  
(Landisville, PA)
Planting green increased beneficial insect populations and predation in the rye treatment

**Average Total Predators**

- **Arthropods Per Trap**
  - **Early** line decreases from June to August.
  - **Late** line decreases from June to August.

**Waxworm Survival**

- **Proportion Remaining**
  - **Early** line increases from June to August.
  - **Late** line increases from June to August.
## Soybean Experiment

<table>
<thead>
<tr>
<th>Site</th>
<th>Rye Planting Date</th>
<th>Rye Seeding Rate</th>
<th>Early Termination Date</th>
<th>Late Termination Date</th>
<th>Soybean Planting Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Centre Co.</td>
<td>28-Oct</td>
<td>41 kg ha $^{-1}$</td>
<td>4-May</td>
<td>9-May</td>
<td>9-May</td>
</tr>
<tr>
<td>Clinton Co.</td>
<td>31-Oct</td>
<td>54 kg ha $^{-1}$</td>
<td>18-May</td>
<td>23-Jun</td>
<td>22-May</td>
</tr>
<tr>
<td>Landisville</td>
<td>30-Sep</td>
<td>24, 41, or 54 kg ha $^{-1}$</td>
<td>5-May</td>
<td>21-May</td>
<td>19-May</td>
</tr>
<tr>
<td>Rock Springs</td>
<td>30-Sep</td>
<td>24, 41, or 54 kg ha $^{-1}$</td>
<td>8-May</td>
<td>18-May</td>
<td>14-May</td>
</tr>
</tbody>
</table>

Penn State Research Centers are indicated in bold text.

### Rye Dry Matter

![Graph showing Rye Dry Matter](image)

- Early
- Late

- Centre Co.
- Clinton Co.
- Landisville
- Rock Springs
Soybean Experiment

- Soybean populations were reduced by an average of 7% in late-terminated plots in 3 of 4 locations.
Early terminated Landisville

Planted Green Landisville
Planting green increased soil cover by almost 15% in all treatments

Average Soil Cover
(Through 6/15)

Percent Residue Cover

Early
Late

Landisville Soy
Soybean Experiment

- Soybean yield was not affected by rye termination time at any of the 4 locations.