Cover Crops—Benefits and Selection

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Agronomy Dept.
Purdue University

Cereal rye, SE Indiana
Outline for today

- Discuss cover crop selection criteria
- Show the MCCC cover crop selector tool
- Suggest a low-risk introductory approach to integrating cover crops into a corn-soybean rotation
- Discuss seeding methods, timing, when and how they fit (Rodney Rulon)
Cover crops in the Midwest

- Why cover crops?
  - Many potential benefits- soil health, crop productivity, water quality

- Why not used by everyone yet?
  - Some risks and challenges, learning curve, time constraints, costs, no short-term economic gains
Rationale for cover crops

- A living, growing plant at times of year when we normally have nothing growing.
- Capture sunlight, feed soil organisms, sequester carbon, trap and recycle nutrients, improve soil health
- Make better use of the resources and time available!
Cover crop grows and takes up N during some of that normally fallow season. This would shrink the “brown gap” and keep the land green for longer time.
Cover crops are part of a system!

- Different potential benefits and challenges for each type of cover crop
- Must adapt cropping system, including nutrient mgmt, NT (tillage) system, manure, pest mgmt, crop rotation
- Learning curve—need to do homework!
Why are you planting a cover crop?

- What is the main purpose?
- What are the resource concerns?

The main purpose(s), affect:
- Selection of cover crop(s)
- Management of cover crop(s)
How select cover crops?

- What is your main purpose?
- What is your cropping / tillage system?
  - Current cash crop and next cash crop?
  - No-till, strip till, or other systems?
- What time windows are available?
- How will you seed the cover crop?
- Soil types, climate, drought, manure, herbicide carryover, or other local considerations?

MCCC tool can help with these!
Grasses
Brassicas
Legumes
Midwest Cover Crops Field Guide Second Edition

- Purdue University (Indiana)
- Michigan State University
- USDA-Agricultural Research Service
- Iowa State University
- Ohio State University
- Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA)
- University of Guelph-Ridgetown Campus
- University of Minnesota
- University of Wisconsin
- North Dakota State University
- University of Illinois
- University of Missouri
- Kansas State University
- University of Nebraska-Lincoln
- South Dakota State University
- Other governmental and private organizations

www.mccc.msu.edu

Aug. 2014

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Avenue, SW, Washington, DC 20250-9410 or call (800) 795-3272 or (202) 720-6382 (TDD).

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What are potential benefits? What is your main purpose?

- Nitrogen scavenger (trap N that would otherwise leach away)
  - Save N for later use by cash crop
  - Decrease N loss to drainage water
- Nitrogen producer (legume)
  - Fix atmospheric N₂ for use by plants
7 Month “Brown Gap” for soybean and corn, fallow period

Cover crop grows and takes up N during some of that normally fallow season. This would shrink the “brown gap” and keep the land green for longer time.

Tile drain studies in Midwest consistently show reduction in nitrate leaching with cover crops

This scavenged N goes into YOUR soil N bank account!
Benefits and Purpose (2)

- Reduce erosion
- Improve soil health
  - Build soil organic matter
  - Increase biological activity and diversity
  - Improve aggregation
  - Build macropores, permeability, deeper rooting, reduce compaction
  - Buffer soil from variable weather
Tap root extended another 18+ inches beyond the end of tuber. These roots are probably of more benefit for soil structure and permeability than the tuber itself.

Photo by Eileen Kladivko
Benefits and Purpose (3)

- Conserve soil moisture
- Recycle nutrients
- Weed control, pest suppression
- Extra forage
- Increase crop yields over long term, and decrease year-to-year variability
Some considerations

- Want covers that winter-kill, or those that grow again in spring?
- If alive in spring, when terminate? (how tall, or growth stage, or biomass, or weather, or cash crop, or purpose)
- Single species, or mixtures?
- If you’re in WLEB, with P concerns, then want at least one species that doesn’t winter-kill, for ex.
Roots or shoots?

- When building soil health, esp. with NT, the cover crop ROOTS are probably more significant than the shoot growth.
- Still need good shoot growth for erosion control, mulch effects for moisture conservation, weed suppression, etc.
Amount of growth affects the magnitude of cover crop impacts on soil or cash crop!

~710 lb/A

~2500 lb/A
How select cover crops?

- What is your main purpose?
- What is your cropping / tillage system?
  - Current cash crop and next cash crop?
  - No-till, strip till, or other systems?
- What time windows are available?
- How will you seed the cover crop?
- Soil types, climate, drought, manure, herbicide carryover, or other local considerations?

MCCC tool can help with these!
### Illinois: Henry County Seeding Dates

<table>
<thead>
<tr>
<th>Cash Crop</th>
<th>Plant Date</th>
<th>Harvest Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn - Grain</td>
<td>04/25/2012</td>
<td>09/15/2012</td>
</tr>
</tbody>
</table>

Select cover crop to create information sheet: 50% HV/50% Oats

- **Nonlegumes**
  - Buckwheat
  - Millet, Japanese
  - Millet, Pearl
  - Oats, Spring
  - Rye, Winter Cereal
  - Ryegrass, Annual
  - Sorghum-sudangrass
  - Sudangrass
  - Triticale, Winter
  - Wheat, Winter

- **Brassicas**
  - Mustard, Oriental
  - Radish, Oilseed
  - Rapeseed/Canola
  - Turnip, Forage type

- **Legumes**
  - Alfalfa - Dormant
  - Clover, Crimson
  - Clover, Red
  - Cowpea
  - Pea, Field/Winter
  - Sweetclover
  - Vetch, Hairy

- **Mixes**
  - 50% HV/50% Oats
  - 50% W.Pea/50%OSR
  - 60% A Ryegr/40% OSR
  - 60% Cr Cl/40% A Ryegr
  - 60% Cr Cl/40% Oats
  - 100% Oats/100% OSR

**Cash Crop Growing Period:** Requires Aerial Seeding or Interseeding of Cover Crop
# Illinois: Henry County Seeding Dates

## Attribute Information

<table>
<thead>
<tr>
<th>Goal #1</th>
<th>Nitrogen Scavenger</th>
<th>Goal #2</th>
<th>Soil Builder</th>
<th>Goal #3</th>
<th>Select an attribute</th>
</tr>
</thead>
</table>

Select cover crop to create information sheet. 50% HV/50% Oats

### Attribute Ratings: 0-Poor, 1-Fair, 2-Good, 3-Very Good, 4-Excellent

<table>
<thead>
<tr>
<th>Reliable Establishment</th>
<th>Freeze Risk to Establishment</th>
<th>Frost Seeding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash Crop Growing Period: Requires Aerial Seeding or Interseeding of Cover Crop</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Soil Builder

### Nitrogen Scavenger

#### Nonlegumes

<table>
<thead>
<tr>
<th>Crop Type</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buckwheat</td>
<td>2</td>
</tr>
<tr>
<td>Millet, Japanese</td>
<td>4</td>
</tr>
<tr>
<td>Millet, Pearl</td>
<td>4</td>
</tr>
<tr>
<td>Oats, Spring</td>
<td>3</td>
</tr>
<tr>
<td>Rye, Winter Cereal</td>
<td>4</td>
</tr>
<tr>
<td>Ryegrass, Annual</td>
<td>4</td>
</tr>
<tr>
<td>Sorghum-sudangrass</td>
<td>4</td>
</tr>
<tr>
<td>Sudangrass</td>
<td>4</td>
</tr>
<tr>
<td>Triticale, Winter</td>
<td>4</td>
</tr>
<tr>
<td>Wheat, Winter</td>
<td>3</td>
</tr>
</tbody>
</table>

#### Brassicas

<table>
<thead>
<tr>
<th>Crop Type</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mustard, Oriental</td>
<td>3</td>
</tr>
<tr>
<td>Radish, Oilseed</td>
<td>3</td>
</tr>
<tr>
<td>Rapeseed/Canola</td>
<td>3</td>
</tr>
<tr>
<td>Turnip, Forage</td>
<td>3</td>
</tr>
</tbody>
</table>

#### Legumes

<table>
<thead>
<tr>
<th>Crop Type</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alfalfa - Dormant</td>
<td>2</td>
</tr>
<tr>
<td>Clover, Crimson</td>
<td>1</td>
</tr>
<tr>
<td>Clover, Red</td>
<td>1</td>
</tr>
<tr>
<td>Cowpea</td>
<td>1</td>
</tr>
<tr>
<td>Pea, Field/Winter</td>
<td>1</td>
</tr>
<tr>
<td>Sweetclover</td>
<td>1</td>
</tr>
</tbody>
</table>

#### Mixes

<table>
<thead>
<tr>
<th>Crop Type</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>50% HV/50% Oats</td>
<td>2</td>
</tr>
<tr>
<td>50% W.Pea/50% Oats</td>
<td>2</td>
</tr>
<tr>
<td>60% A Ryegr/40% OSR</td>
<td>4</td>
</tr>
<tr>
<td>60% Cr Cl/40% A Ryegr</td>
<td>4</td>
</tr>
<tr>
<td>60% Cr Cl/40% Oats</td>
<td>2</td>
</tr>
<tr>
<td>60% Oats/40% OSR</td>
<td>3</td>
</tr>
</tbody>
</table>
# Cover Crop Information Sheet

**Considerations for using 60% Oats/40% OSR in Indiana**

There are no special considerations

Web links to information on using Cover Crops in Indiana can be found at: [http://mocc.msu.edu/states/indiana.html](http://mocc.msu.edu/states/indiana.html)

<table>
<thead>
<tr>
<th>Location Information</th>
<th>Cultural Traits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Location:</strong> Indiana - All Counties Average</td>
<td><strong>Scientific Name:</strong> Avena sativa</td>
</tr>
<tr>
<td><strong>Cash Crop:</strong> None or Prevented Planting</td>
<td><strong>Scientific Name:</strong> Raphanus sativus</td>
</tr>
<tr>
<td><strong>Plant Date:</strong> None</td>
<td><strong>Life Cycle:</strong> Cool Season Annual</td>
</tr>
<tr>
<td><strong>Harvest Date:</strong> None</td>
<td><strong>Life Cycle:</strong> Cool Season Annual</td>
</tr>
<tr>
<td><strong>Soil Drainage Class:</strong> None</td>
<td><strong>Growth Habit:</strong> Upright</td>
</tr>
<tr>
<td><strong>Artificial Drainage:</strong> No</td>
<td><strong>Growth Habit:</strong> Upright</td>
</tr>
<tr>
<td><strong>Flooding:</strong> No</td>
<td><strong>Preferred Soil pH:</strong> 6.0-6.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cover Crop Selection Information</th>
<th>Potential Advantages</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cover Crop Selected:</strong> Mix of 60% Oats/40% OSR</td>
<td><strong>Soil Impact - Subsoil:</strong> Very Good</td>
</tr>
<tr>
<td><strong>Cover Crop Attribute #1:</strong> None</td>
<td><strong>Soil Impact - Frees P and K:</strong> Good</td>
</tr>
<tr>
<td><strong>Cover Crop Attribute #2:</strong> None</td>
<td><strong>Soil Impact - Loosens Topsoil:</strong> Very Good</td>
</tr>
<tr>
<td><strong>Cover Crop Attribute #3:</strong> None</td>
<td><strong>Soil Ecology - Nematodes:</strong> Very Good</td>
</tr>
<tr>
<td><strong>Use within the State:</strong> Common</td>
<td><strong>Soil Ecology - Disease:</strong> Good</td>
</tr>
<tr>
<td></td>
<td><strong>Soil Ecology - Allelopathic:</strong> Very Good</td>
</tr>
<tr>
<td></td>
<td><strong>Soil Ecology - Choke Weeds:</strong> Excellent</td>
</tr>
<tr>
<td></td>
<td><strong>Other - Attract Beneficials:</strong> Fair</td>
</tr>
<tr>
<td></td>
<td><strong>Other - Bears Traffic:</strong> Good</td>
</tr>
<tr>
<td></td>
<td><strong>Other - Short Windows:</strong> Excellent</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Planting Information</th>
<th>Potential Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Drilled Seeding Depth:</strong> 1/4-1 Inches</td>
<td><strong>Delayed Emergence:</strong> Rarely a problem</td>
</tr>
<tr>
<td><strong>Drilled Seeding Rate:</strong> 18-36 lb/AC PLS</td>
<td><strong>Increased Weed Potential:</strong> Rarely a problem</td>
</tr>
<tr>
<td><strong>Broadcast Seeding Rate:</strong> 4-8 lb/AC PLS</td>
<td><strong>Increased Insects/Nematodes:</strong> Occasionally a minor problem</td>
</tr>
<tr>
<td><strong>Aerial Seeding Rate:</strong> 2.2-4.4 lb/AC PLS</td>
<td><strong>Increased Crop Diseases:</strong> Rarely a problem</td>
</tr>
<tr>
<td><strong>Aerial Seeding Rate:</strong> 2.2-4.4 lb/AC PLS</td>
<td><strong>Hinders Crops:</strong> Rarely a problem</td>
</tr>
<tr>
<td><strong>Seed Count:</strong> 19,600 Seeds/1 lb</td>
<td><strong>Establishment Challenges:</strong> Rarely a problem</td>
</tr>
<tr>
<td><strong>Seed Count:</strong> 34,000 Seeds/1 lb</td>
<td><strong>Till Kill Challenges:</strong> Could be major problem</td>
</tr>
<tr>
<td><strong>Frost Seed:</strong> No</td>
<td><strong>Mow Kill Challenges:</strong> Could be major problem</td>
</tr>
<tr>
<td><strong>Flx-Free Date:</strong> No</td>
<td><strong>Mature Incorporation Challenges:</strong> Rarely a problem</td>
</tr>
<tr>
<td><strong>Inoculation Type:</strong> Comments:</td>
<td><strong>Comments ProfCon:</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Termination Information</th>
<th>Performance and Roles</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Termination Methods:</strong> Freeze</td>
<td><strong>Legume Nitrogen Source:</strong> No</td>
</tr>
<tr>
<td><strong>Comments:</strong></td>
<td><strong>Total Nitrogen:</strong> 10-60 lb/AC</td>
</tr>
<tr>
<td></td>
<td><strong>Dry Matter:</strong> 1700-5500 lb/ACyr</td>
</tr>
<tr>
<td></td>
<td><strong>Nitrogen Scavenger:</strong> Excellent</td>
</tr>
<tr>
<td></td>
<td><strong>Soil Builder:</strong> Very Good</td>
</tr>
<tr>
<td></td>
<td><strong>Erosion Fighter:</strong> Good</td>
</tr>
<tr>
<td></td>
<td><strong>Weed Fighter:</strong> Very Good</td>
</tr>
</tbody>
</table>

| Comments: | |
Cereal rye (*Secale cereale* L.) often chosen because most winter-hardy and widely adaptable across northern regions.
In eastern Cornbelt, other “basic” options

- Slightly longer growing season, gives a few more options than just cereal rye
- When beginning, still want to minimize management challenges, to ensure success
- Suggested plan includes winter-kill cover crops before corn, as detailed next…….
An Introduction to Integrating Cover Crops Into a Corn-Soybean Rotation

- Take a long-term view
- Do your homework and start slowly
- Adjust your planter and practices
- Scout for insects
- Be timely
- Use good quality seed
- Designed to implement NT and cover crops together, but ease the way into NT corn (NT soybeans is common already).

Interest in cover crops has increased among farmers in the eastern Corn Belt. Cover crops have many potential benefits, but farmers need to manage them carefully to avoid or reduce the risks to crop production. This publication outlines an introductory approach to integrating cover crops into a corn-soybean cropping system and is intended to help farmers who are new to growing cover crops. As farmers and advisers gain more experience with the management of cover crops and how they work on their particular soils, they can implement more complex systems.

General Considerations

Before you start using cover crops in your corn-soybean rotation, it’s important to keep these principles in mind:

- Take a long-term view. The benefits of cover crops accrue over a number of years, and most soil health benefits will not be evident in the first year or two. Cover crops have their greatest potential when you consider them as a practice that will increase the resiliency and long-term sustainability of your soils resource.
- Do your homework and start slowly. This publication provides basic recommendations for a two-year cover crop sequence for a corn-soybean rotation. Still, there are many details to learn and apply, even for those who are experienced in cover cropping.

Plan ahead, start with a small part of your farm, and expect to fine-tune your management over the first few years. If you use an ag retailer to apply your herbicides, have a discussion with them about your cover crops, how they will affect the timing and choice of herbicides, and then formulate a plan together.

- Adjust your planter and practices. Many cover crop considerations are similar to those for no-till, but cover crops result in additional surface residue cover on the soil. Be sure to adjust the planter so that it operates properly and effectively for conditions in the field. Also, be prepared for greater than expected cover crop growth in the spring.

Consider equipping your planter/drill with coulter, but not to the point of crowding or overlapping your corn planter with 2x2 starter fertilizer applicators, and aim for a starter fertilizer rate that provides no less than 30 pounds of actual N per acre.
A Two-year Plan for Corn-Soybean Rotation

Step 1: Plant Cereal Rye into Corn Stalks
- drill
- VT w/ air-seeder

Cereal rye can be planted late, and is the most winter-hardy of covers
Step 2: Terminate in Spring

Step 3: No-till Plant Soybean into Cereal Rye

Consider short-season variety, earlier planting. (Plant your earliest beans early, on fields going to cover.)
Step 4: Plant Cover Crops that Winter-kill

Oats/daikon radish.

Low C:N ratio.

Winter-kill, so no termination timing issues before corn.
Step 5: No-till Plant Corn into Dead Cover

(alternatives of fall strip till; or shallow vertical till in spring)
Lots of variations on the theme!

- As farmers and advisors gain more experience with managing cover crops on their soils, more complex systems can be implemented.
- If have wheat in rotation and not double-crop, can seed bigger mix (“cocktail mix”) after wheat, for great diversity of plants and roots.
- Can add crimson clover, cereal rye, to oats/daikon radish before corn.
Cover crop mixtures

- Basic concept—more plant diversity provides multi-functionality. Can provide more diverse benefits (functions).

- Plant canopy structure, root form and depth, growth periods.

- Complementary rather than overlapping functions probably more important

- Spreads risk—if one species doesn’t grow, perhaps another will.
Examples from eastern Cornbelt

- Daikon radish w/ oats or cereal rye
- Radish/oats/cereal rye/legume (crimson clover or Austrian winter pea or hairy vetch)
- Radish/oats/rapeseed/cereal rye
- Some alternating rows—radish or pea in next yr’s corn row, grass between rows (whether 15” split rows or drill rows)
- Some winter-kill, some grow in spring; sometimes terminate grass before legume
Resources

2nd Edition now available!

Purdue Extension Education Store
1-888-EXT-INFO
www.the-education-store.com

Phone app under dev’p right now!

www.mccc.msu.edu

Cover Crop Selector Tools
(link on top menu bars)

Check out our revised web pages!