

Cover Crops— Benefits and Selection

Eileen Kladviko
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

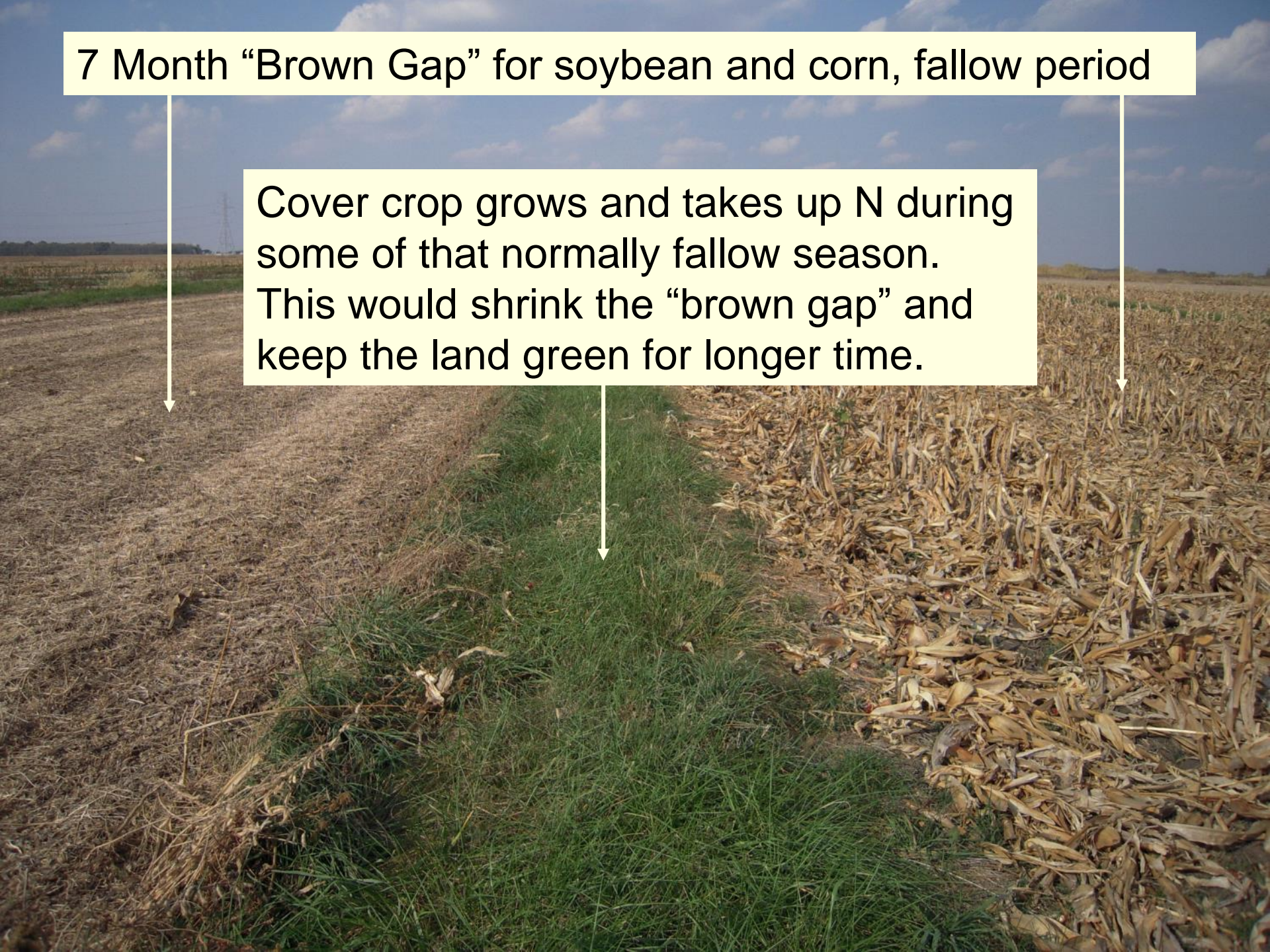
- Why cover crops?
 - Many potential benefits- soil health, crop productivity, water quality
- Why not used by everyone yet?
 - Some risks and challenges, learning curve, time constraints, costs, no short-term economic gains

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!

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.



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?



Grasses



Brassicas



Legumes



- 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

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD).

To file a complaint of discrimination, write USDA, Director Office of Civil Rights, 1400 Independence Avenue, SW, Washington, DC 20250-0410 or call (800) 795-3272 or (202) 720-6382 (TDD).

USDA is an equal opportunity provider and employer.

ID-433

Midwest Cover Crops Field Guide

Second Edition

MIDWEST Cover Crops

Field Guide

Second Edition

EXPERT
REVIEWED



www.mccc.msu.edu



Purdue Crop
Diagnostic
Training and
Research Center

www.ag.purdue.edu/egry/dtc

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

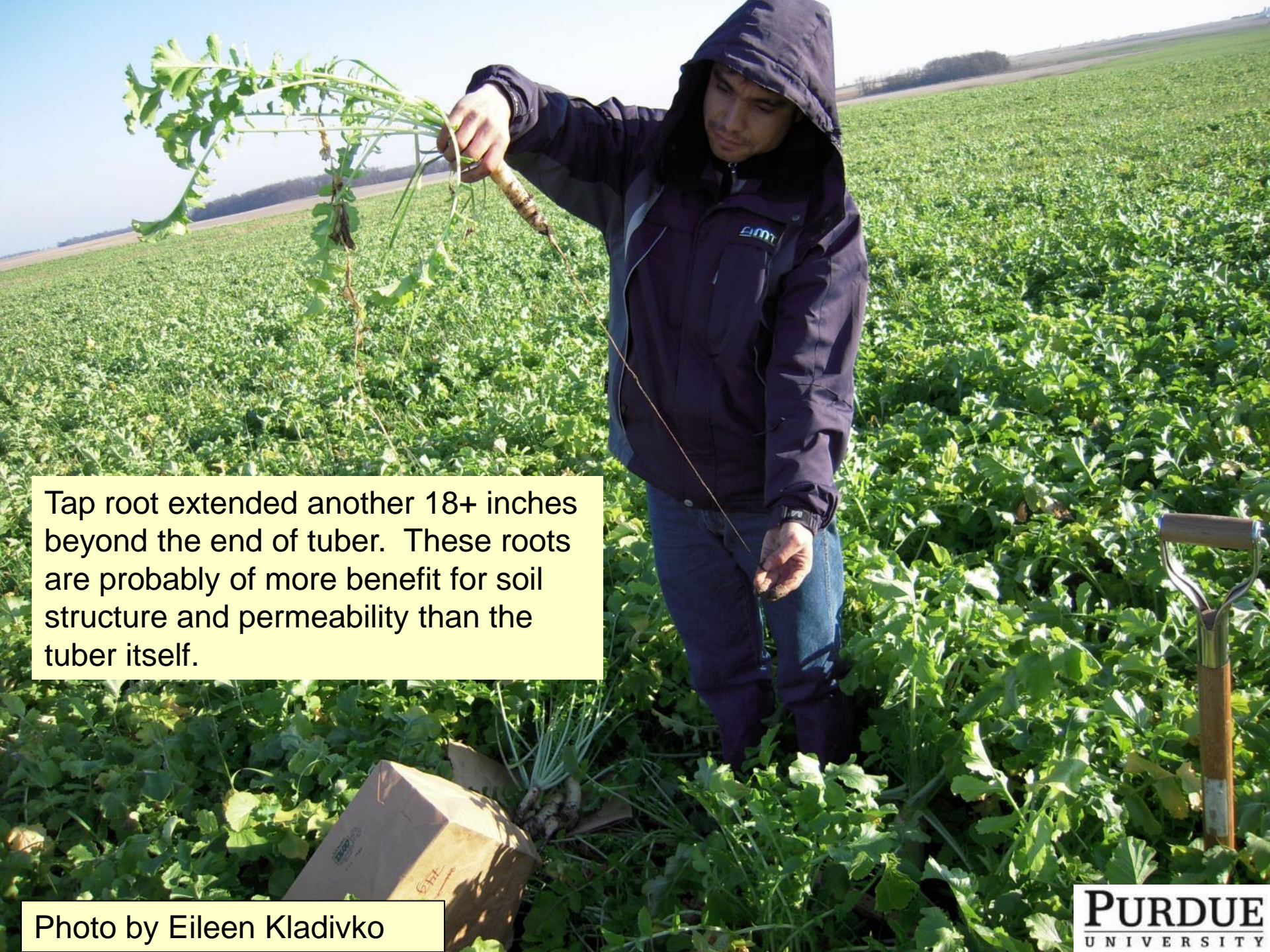
Cover crop grows and takes up N during some of that normally fallow season. This would shrink the “brown gap” and keep the land green for longer time.

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 Kladviko



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**

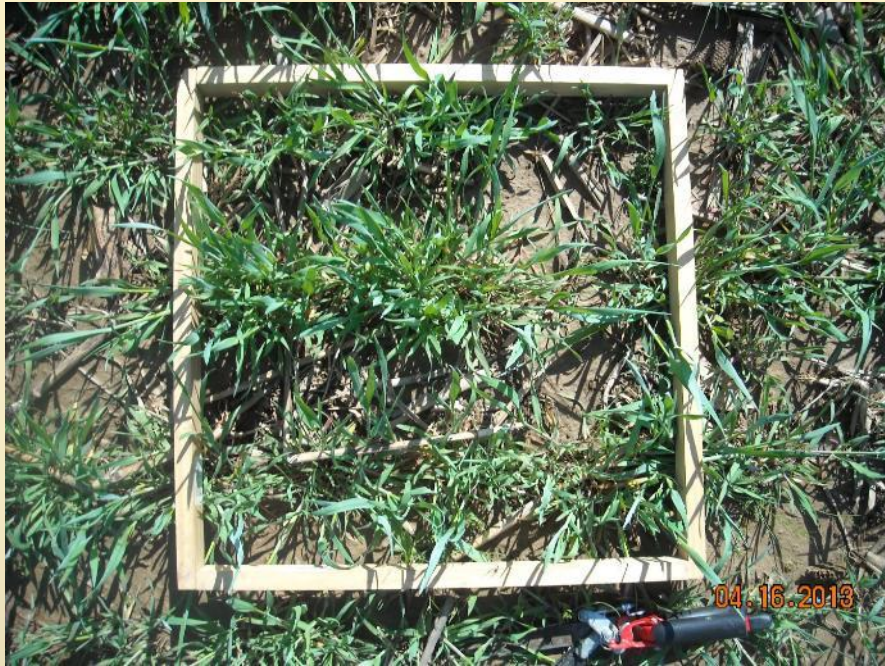
Some considerations

- 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?

Illinois: Henry County Seeding Dates

- Location Information
- Cash Crop Information
- Soil Information
- Attribute Information

Cash Crop: Plant Date: Harvest Date:

Select cover crop to create information sheet:

Reliable Establishment
Freeze Risk to Establishment
Frost Seeding

Cash Crop Growing Period: Requires Aerial Seeding or Interseeding of Cover Crop

	Mar 15	Apr 1	Apr 15	May 1	May 15	Jun 1	Jun 15	Jul 1	Jul 15	Aug 1	Aug 15	Sep 1	Sep 15	Oct 1	Oct 15	Nov 1	Nov 15	Dec 1	Dec 15	Jan 1	Jan 15	Feb 1	Feb 15	
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																								

www.mccc.msu.edu

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://mccc.msu.edu/states/Indiana.html>

Location Information

Location: Indiana - All Counties Average
Cash Crop: None or Prevented Planting
Plant Date: None
Harvest Date: None
Soil Drainage Class: None
Artificial Drainage: No
Flooding: No

Cultural Traits

Scientific Name: Avena sativa	Oats
Scientific Name: Raphanus sativus	Radish, Oilseed
Life Cycle: Cool Season Annual	Oats
Life Cycle: Cool Season Annual	Radish, Oilseed
Growth Habit: Upright	Oats
Growth Habit: Upright	Radish, Oilseed
Preferred Soil pH: 6.0-6.5	
Min. Germination Temp.: 45F	
Heat Tolerance: Fair	
Drought Tolerance: Fair	
Shade Tolerance: Fair	
Flood Tolerance: Fair	
Low Fertility Tolerance: Fair	
Winter Survival: Seldom	
Comments:	

Cover Crop Selection Information

Cover Crop Selected: Mix of 60% Oats/40% OSR
Cover Crop Attribute #1: None
Cover Crop Attribute #2: None
Cover Crop Attribute #3: None
Use within the State: Common

Planting Information

Drilled Seeding Depth: 1/4-1 Inches
Drilled Seeding Rate: 18-36 lb./A PLS Oats
Drilled Seeding Rate: 2-4 lb./A PLS Radish, Oilseed
Broadcast Seeding Rate: 19.8-39.6 lb./A PLS Oats
Broadcast Seeding Rate: 2.2-4.4 lb./A PLS Radish, Oilseed
Aerial Seeding Rate: 21.6-43.2 lb./A PLS Oats
Aerial Seeding Rate: 2.4-4.8 lb./A PLS Radish, Oilseed
Seed Count: 19,600 Seeds/lb. Oats
Seed Count: 34,000 Seeds/lb. Radish, Oilseed
Frost Seed: No
Flg-Free Date: No

Potential Advantages

Soil Impact - Subsoiler: Very Good
Soil Impact - Frees P and K: Good
Soil Impact - Loosens Topsoil: Very Good
Soil Ecology - Nematodes: Very Good
Soil Ecology - Disease: Good
Soil Ecology - Allelopathic: Very Good
Soil Ecology - Choke Weeds: Excellent
Other - Attract Beneficials: Fair
Other - Bears Traffic: Good
Other - Short Windows: Excellent
Comments:

Inoculation Type:
Comments:

Termination Information


Termination Methods: Freeze
Comments:

Potential Disadvantages

Delayed Emergence: Rarely a problem
Increased Weed Potential: Rarely a problem
Increased Insects/Nematodes: Occasionally a minor problem
Increased Crop Diseases: Rarely a problem
Hinders Crops: Rarely a problem
Establishment Challenges: Rarely a problem
Till Kill Challenges: Could be major problem
Mow Kill Challenges: Could be major problem
Mature Incorporation Challenges: Rarely a problem
Comments Pro/Con:

Performance and Roles

Legume Nitrogen Source: No
Total Nitrogen: 10-60 (lb./A)
Dry Matter: 1700-5500 (lb./A/yr.)
Nitrogen Scavenger: Excellent
Soil Builder: Very Good
Erosion Fighter: Good
Weed Fighter: Very Good

- 
- Cereal rye (*Secale cereale* L.) often chosen because most winter-hardy and widely adaptable across northern regions

Cereal rye, SE Indiana

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).**

PURDUE EXTENSION | **LOCAL FACES**
COUNTLESS CONNECTIONS

AY-353-W
EXPERT REVIEWED

MANAGING COVER CROPS

An Introduction to Integrating Cover Crops Into a Corn-Soybean Rotation

Authors: Eileen Kladivko, Robert Nielsen, Shaun Casteel, Keith Johnson, and James Camberato, Purdue Department of Agronomy, Christian Krupke, Purdue Department of Entomology, William Johnson, Bryan Young, and Kjersten Wise, Purdue Department of Botany & Plant Pathology

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

who have successfully implemented cover crops; and consult resources from Purdue and other land-grant universities, state and federal conservation agencies, and the Midwest Cover Crops Council (www.mccc.msu.edu).

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 coulters,

AY-353-W

to the and
p-
ping 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

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.



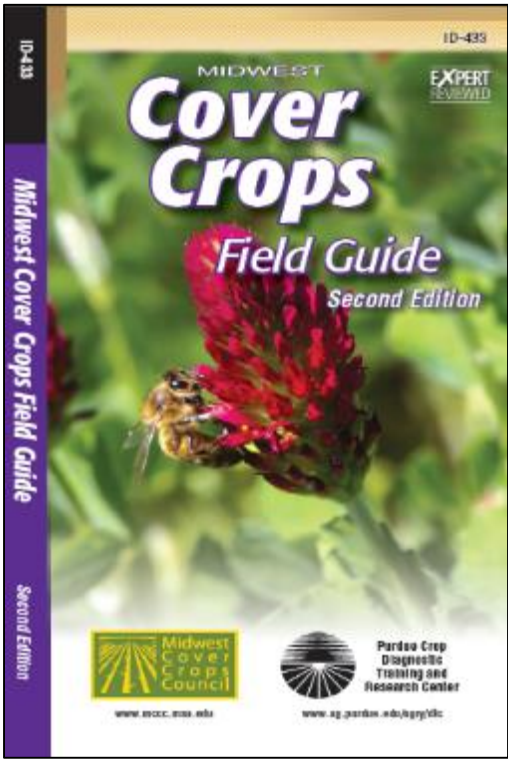
Cover crop mixtures

- 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

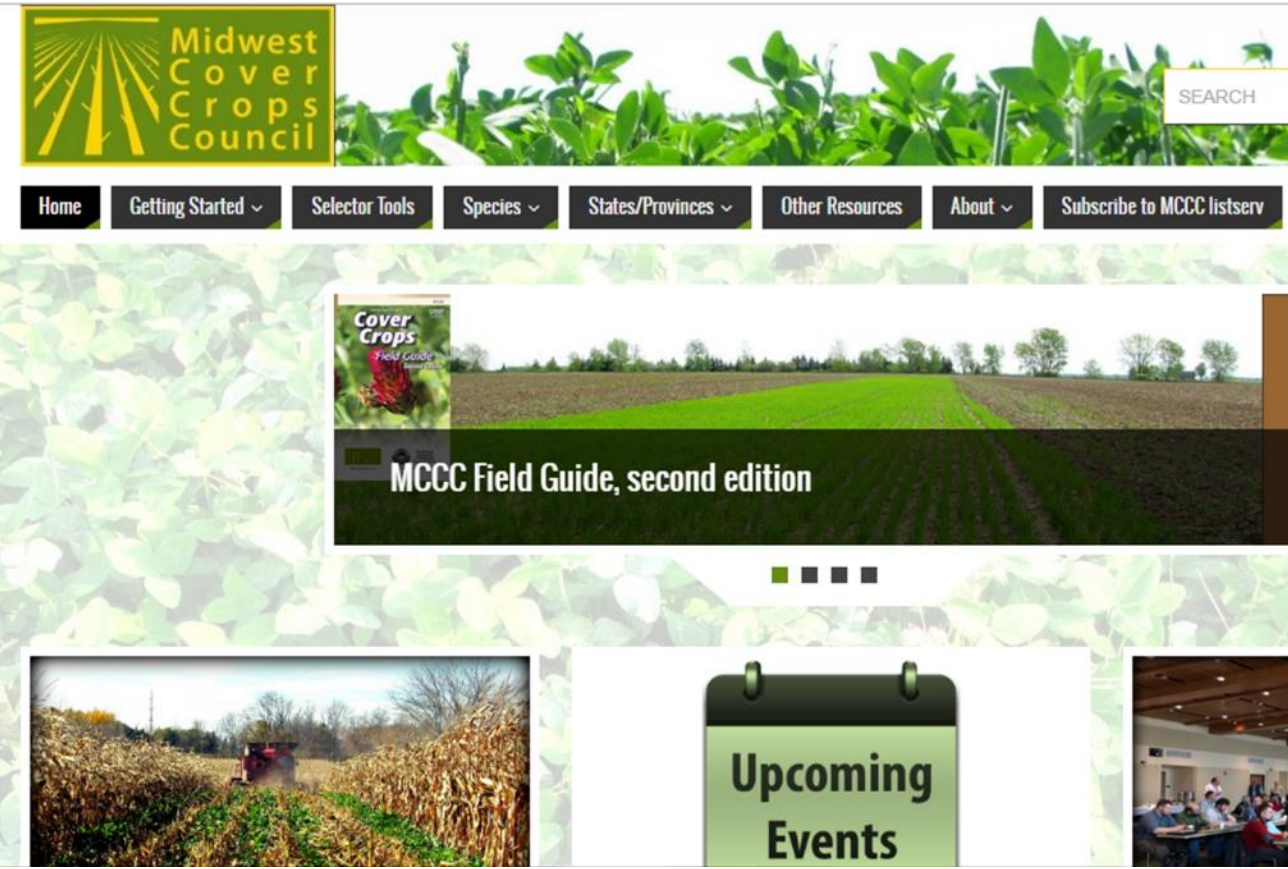
Resources



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!