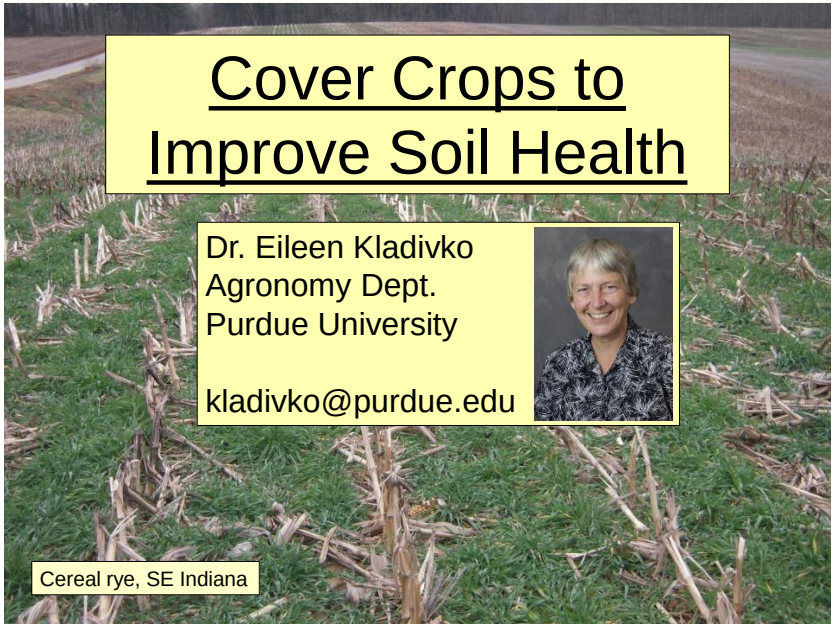

1

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!

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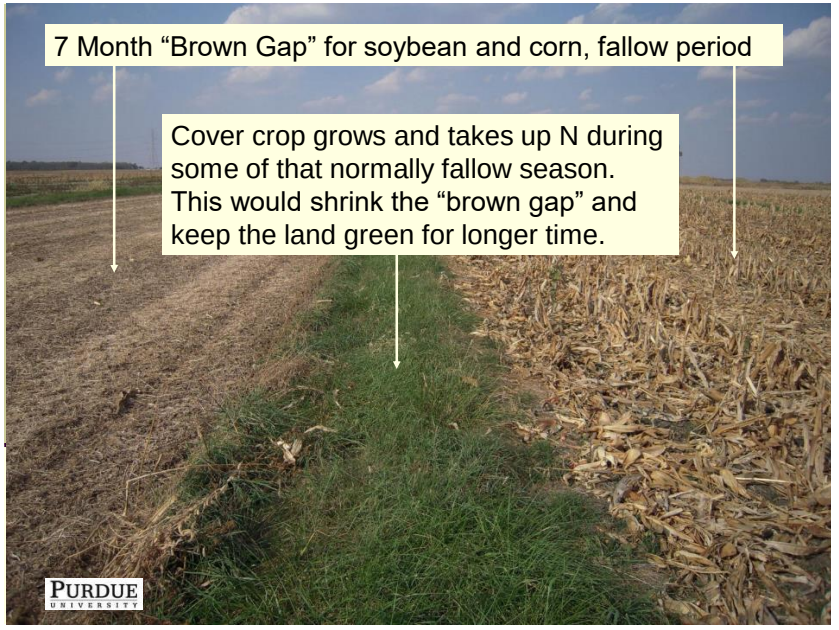

3

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!

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4

5

Characteristics of healthy soil

- Good water infiltration
- Adequate water retention, storage
- Resistance to erosion, crusting
- Filtering capacity
- Good rooting depth
- Trafficability
- Adequate aeration
- Nutrient availability

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6


Soil Health Principles
unlock the SECRETS in the SOIL
Provide Continuous Living Roots
Minimize Disturbance
Maximize Biodiversity
Maximize Soil Cover

7


Cover crops
Cereal rye, SE Indiana

8

9

10

11

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)

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What are the potential benefits? (What are your main goals?)

- Nitrogen scavenger
- Nitrogen producer (legume)
- Reduce erosion
- Improve soil quality– aggregation, infiltration, soil biological activity, rooting depth
- Increase soil organic matter (sequester C)
- Conserve soil moisture
- Recycle nutrients
- Weed control, pest suppression, extra forage
- **Increase crop yields over long-term, and decrease year-to-year variability in yields**

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Soil physical properties improved

- Aggregation (esp. fibrous-rooted)–
  - roots enmesh particles
  - exudates feed microbes; they produce "glues"
- Porosity, permeability (esp. tap-rooted)
  - Deep roots, macropores, → aid water infiltration, aeration, rooting
- Soil surface protected, plus better aggregation→ less crusting or erosion
- Roots give strength to soil for trafficability

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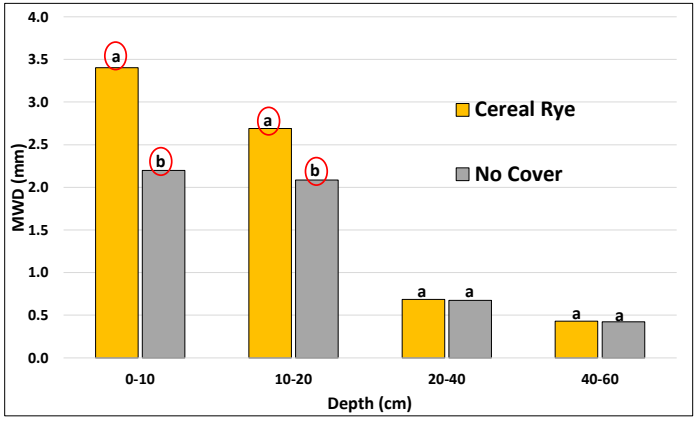
Aggregate Stability

SEPAC 2015

J.D. Rorick, M.S. Thesis, 2016



SUSTAINABLE CORN.ORG

PURDUE AGRICULTURE

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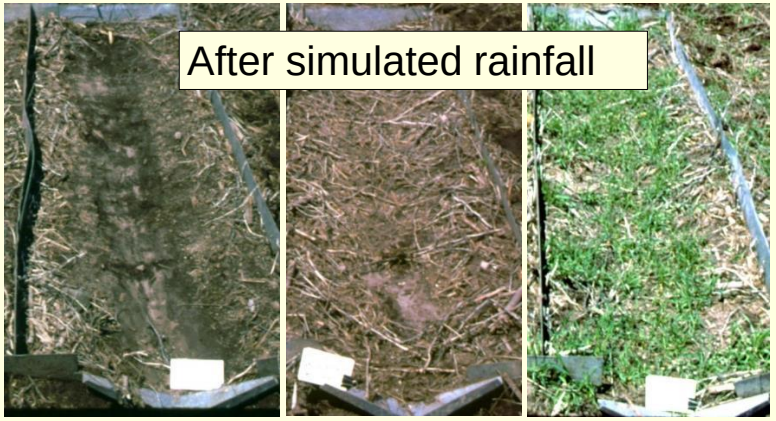
Cover Crops and No-Till Soil Structure

T. Kaspar, Iowa

16

Classic purpose of cover crops—cover the soil to reduce erosion



NO COVER CROP **OAT COVER** **RYE COVER**

Tom Kaspar, Iowa

17

Corn silage land with and without a cereal rye cover crop

Tom Kaspar, Iowa

18

Roots or shoots?

- When building soil quality, 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.

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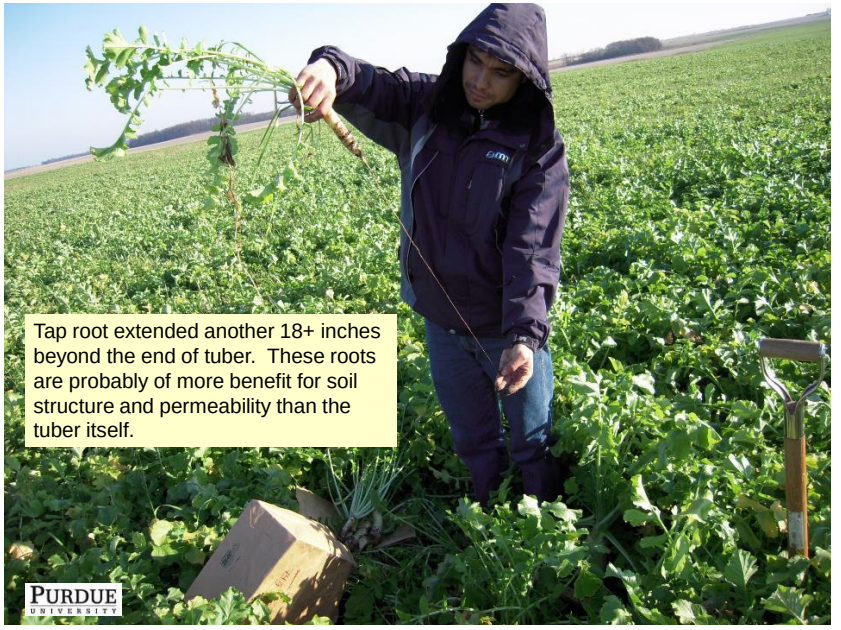
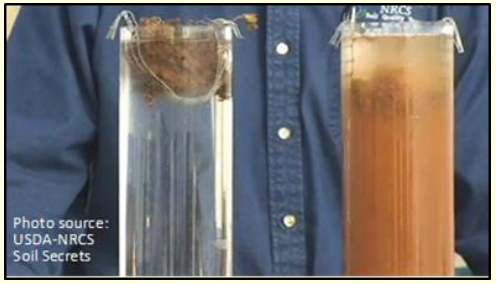


20

Why is improved soil health important for stormwater?



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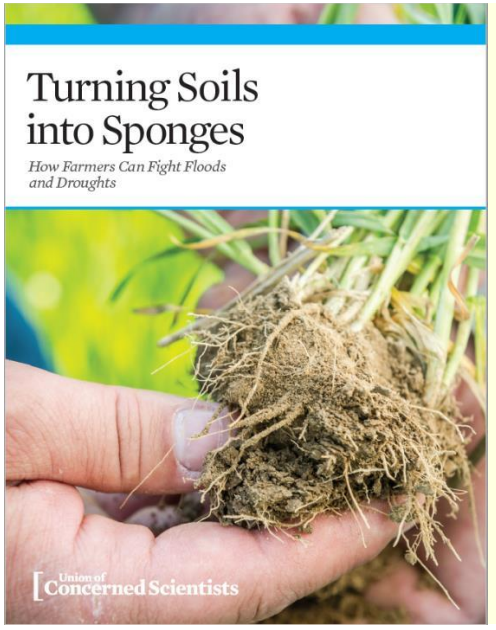

- Report analyzed 150+ field experiments from six continents, incl perennials, cover crops, NT, others. Continuous living cover was best strategy.
- Increased water infiltration, decreased runoff, increased soil water holding capacity **(more water for crop use including in drought years; less runoff and flooding in wet and dry years)**

Basche, A., 2017
www.ucsusa.org/food-agriculture/advance-sustainable-agriculture/turning-soils-sponges#.Whr5m1WnHIU

22

Of course there's a limit!

- Once the soil is saturated, and water table is at the surface, little difference at that moment in surface runoff.
- But healthy soils will remain more stable even under exceptionally wet conditions, and recover faster.
- Spring 2019 was extremely challenging!
- Need healthy soils along with other practices, to deal with storm water issues

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Muddy runoff from conventionally tilled corn field
June 23, 2017, Gibson Co., IN
Photo credit: SW Indiana USDA-NRCS

Conservation Cropping Systems Initiative

24

Clear runoff from cover-cropped, no-till soybean field
June 23, 2017, Gibson Co., IN
Photo credit: SW Indiana USDA-NRCS

25

Clear runoff from cover-cropped, no-till soybean field.
Note muddy water in foreground, clear water running off field.
June 23, 2017, Gibson Co., IN
Photo credit: SW Indiana USDA-NRCS

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Let's look at the N scavenging benefit of cover crops……

- Even well-managed corn and soybean fields have nitrate losses to tile drains that pose water quality problems as well as an economic loss to the producer

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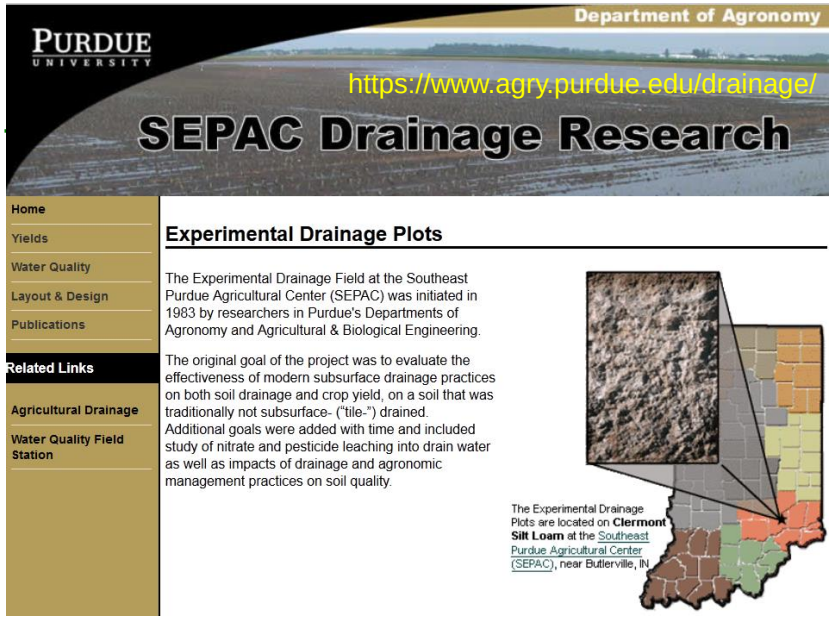

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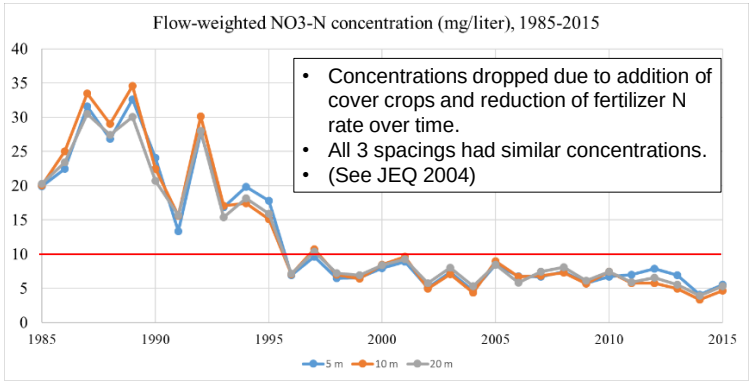
SEPAC Drainage Site



See Extension publication and video, at www.agry.purdue.edu/drainage/

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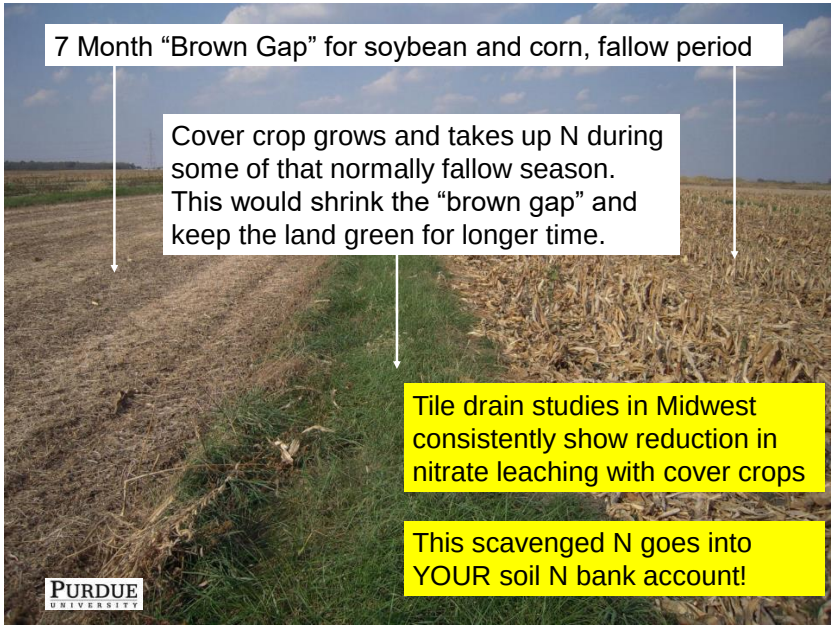

30

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?
- Want winter-hardy or winter-kill?
- How will you seed the cover crop?
- Soil types, climate, drought, manure, herbicide carryover, or other local considerations?

MCCC tool can help with these!

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Details are very important!

- Not all cover crops work equally well for different purposes
  - Select the proper cover crop(s)
  - Manage those covers for intended purpose (ie, same cover can be managed differently—termination time, seeding rates, alone or in mix, ……)

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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 a watershed with P concerns, then want at least one species that doesn't winter-kill, for ex.

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Three main categories of cover crops have different effects

- Grasses
- Brassicas
- Legumes

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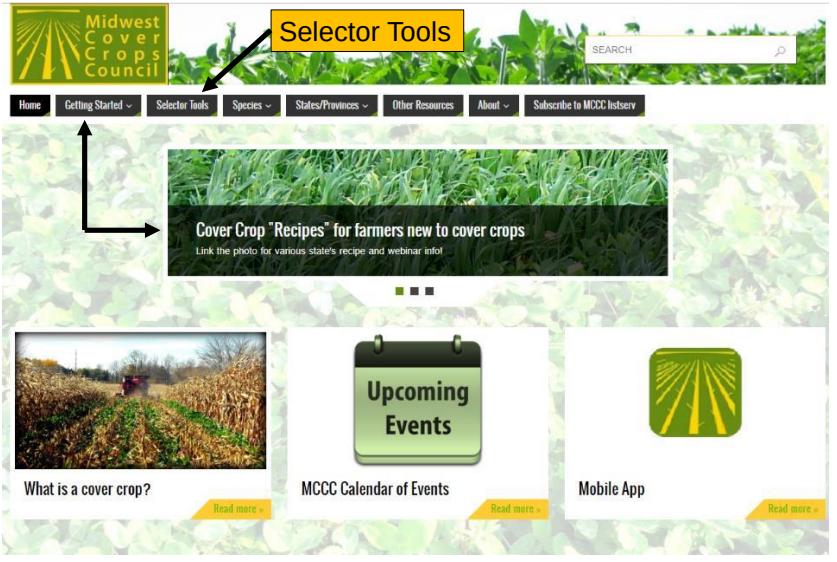
www.midwestcovercrops.org



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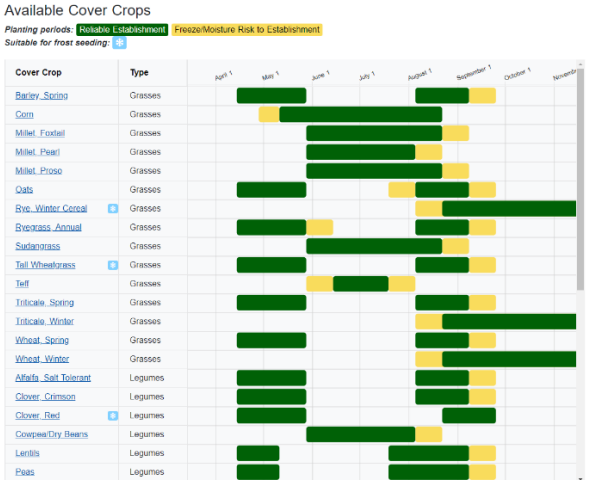
South Dakota, all county ave

www.midwestcovercrops.org
Cover crop decision tool



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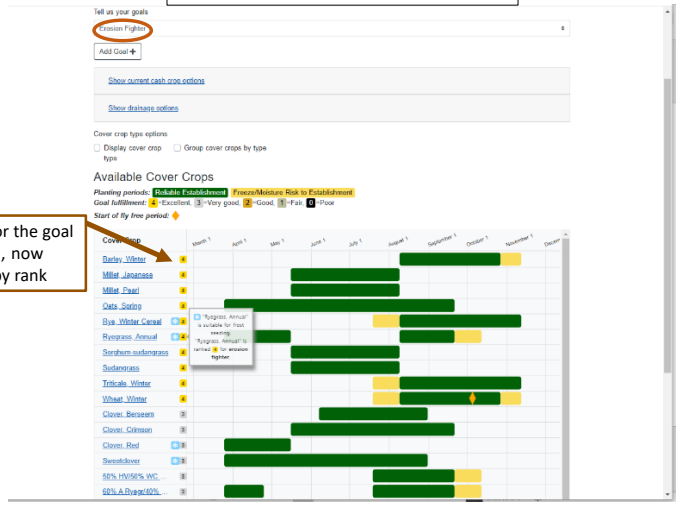
Erosion fighter was the goal selected here. Can choose up to 3 goals.



Ranks for the goal selected, now sorted by rank

Lawrence Co., IN

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How to get started?

- Many farmers and crop advisors are interested in using cover crops
- Many reasons, incl. soil health, N scavenging, erosion control, weed suppression
- But how to start? Many options, for species and management. Sometimes overwhelming.
- These “recipes” are aimed at new cover crop users, to learn basic mgmt., get experience, w/ relatively low risk. Then many other options possible after learning basics.

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Cover Crop "Recipes"


SOUTH DAKOTA COVER CROP RECIPE

Post Corn, Going to Soybean: Use Cereal Rye

SOUTH DAKOTA COVER CROP RECIPE

Post Small Grains, Going to Soybean or Corn: Use a Cool-Season Mix

Publication numbers:

- MCCC-135
- MCCC-136

Available at www.midwestcovercrops.org
go to "getting started" tab
Recipes now available for all states in Midwest, plus Ontario and Manitoba

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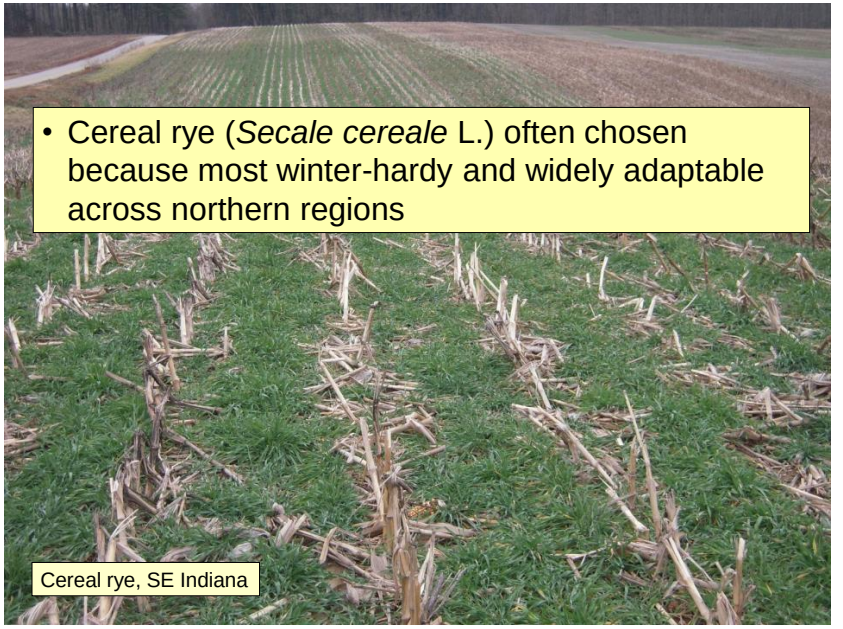

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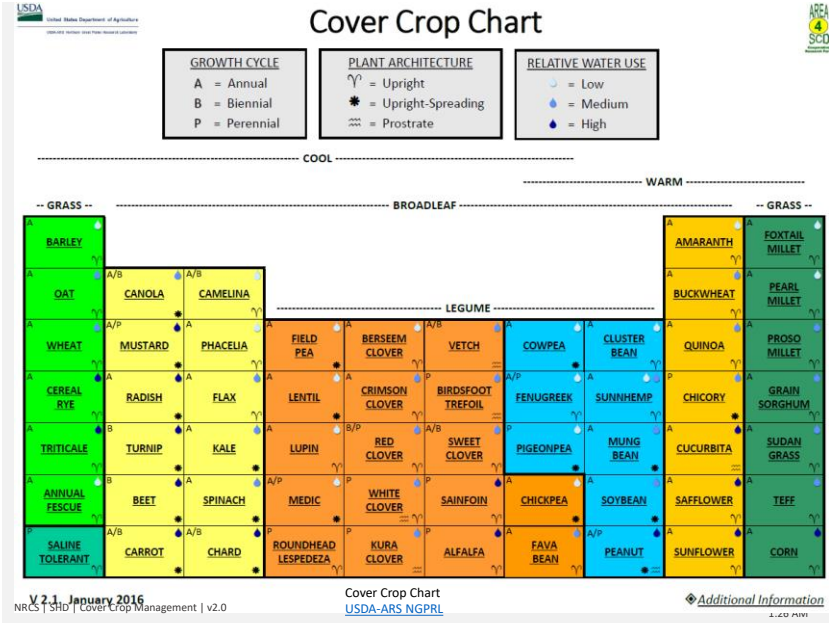

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Lots of variations on the theme!

- 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.
- Corn silage; seed corn; other short-season crops

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If cover crops and no-till are so good, why isn't everyone using them?

- Short-term costs, often no short-term economic gain
- **Site specific; details matter; steep learning curve**; time constraints; negative local "history"
- **Technical assistance and education needed**
- Still some R&D needed to optimize systems for diff soils, crops, regions

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How do we measure soil health?

- Integrated soil health tests are new
  - Biology is especially difficult to assess
  - Physical properties also difficult
  - Fertility (chemical) tests well established for decades
- Once measured, what does it mean?
  - Biology not well understood—so many organisms, interactions, redundancy, dynamic changes w/ weather, food, ….

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Earthworm counts
Aggregate stability
Water infiltration rate
Penetrometer

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USDA
United States Department of Agriculture
Natural Resources Conservation Service
Google: NRCS Soil Health
unlock the SECRETS IN THE SOIL
- Raised awareness
- Expanded demand for system adapted information
- Raising many good questions
PROFILES IN soil health
unlock
THE SCIENCE OF SOIL HEALTH
Farming Changes Focus on Soil Health
This information is provided as a public service and constitutes no endorsement by the USDA-NRCS of any service, supply, or equipment listed.
The USDA-NRCS does not make pesticide recommendations

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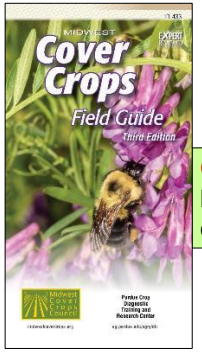
Resources



www.midwestcovercrops.org

Cover Crop Selector Tools
(link on top menu bars)

Check out the "recipes" under Getting Started tab!
Including video/webinar of Indiana recipes explained in detail!

3rd Edition available!

Purdue Extension Education Store
www.edustore.purdue.edu

Also Google
North Central SARE, for many resources on cover crops, sustainable ag

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Speaker contact:
kladivko@purdue.edu

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