

Required Reading

- **Managing Cover Crops Profitably – 3rd Edition**
– www.sare.org
- **Overview of Cover Crops and Green Manures**
– www.attra.ncat.org

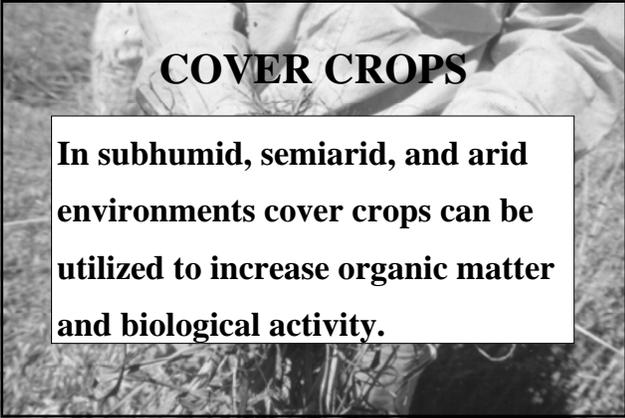
Presentation Content

- **How to select cover crop species**
- **Cover crop characteristics**
- **Examples of how cover crops are used**

COVER CROPS

In humid environments (tall-grass prairie or wetter) the goal should be to have something growing at all times.

In areas with a limited growing season this will require the use of cover crops and/or forage double crops.



COVER CROPS

In subhumid, semiarid, and arid environments cover crops can be utilized to increase organic matter and biological activity.



Cover Crops

- **Manage soil moisture**
- **Promote soil structure and diversity in soil fauna**
- **Provide nitrogen for the next crop**



Cover Crops

- **Enhancing nutrient cycling**
- **Enhance residue cycling**
- **Increase organic matter**
- **Reduce soil erosion**



Cover Crops

- **Suppress weed seed germination**
- **“False-out” some disease organisms**
- **Change previous crop residue color**

Before Selecting a Cover Crop

- Clarify your primary needs or objectives of the cover crop
- Identify the best time and place for a cover crop in your system
- Test a few options

Objectives

- Provide nitrogen
- Add organic matter
- Improve soil structure
- Reduce soil erosion
- Reduce compaction
- Manage nutrients
- Provide weed control
- Provide livestock grazing / forage

Ask Yourself the following Questions

- How will I seed the cover crop?
- What were the previous crop herbicides?
- What will soil temperature and moisture conditions be like?
- How vigorous will other crops (or pests) be?
- What weather extremes and field traffic must it tolerate?
- Will it winterkill in my area?
- Should it winterkill, to meet my goals?
- What kind of regrowth can I expect?

Ask Yourself the following Questions

- How do I kill it and plant into it?
- Will I have the time to make this work?
- What's my contingency plan—and risks—if the crop doesn't establish or doesn't die on schedule?
- Do I have the needed equipment and labor?

What to Look For in A Cover Crop

- Fast germination and emergence
- Competitiveness
- Tolerance to adverse climatic & soil conditions
- Ease of suppression or kill
- Fertility benefits
- Low-cost establishment

“The Wonder Cover Crop”

- More than likely doesn’t exist
- Mixtures or “cocktails” may be required to meet your objectives

Cover Crop Characteristics Table

[Spreadsheet table](#)

What Cover Crop(s) Should be Planted

- Add diversity to your crop rotation
 - i.e. Wheat – Corn – SB rotation
 - A major cover crop species should be a cool season broadleaf that will meet your objectives
 - Corn – SB rotation
 - Need to include a cool season grass and broadleaf
- Ideally, the cover crop to be planted should be an opposite type of the “cash crop” to be planted the following year.

Cover Crop Choices

Cool Season Broadleaves -- nonlegumes

- **Brassicas and Mustards**
 - Canola – spring and winter
 - Rape (forage – dwarf essex rape, hybrids with turnips)
 - Turnip
 - Radish (oilseed and forage)
 - Crambe
 - Kale
 - Swede
 - Mustard (yellow, brown, oriental)

Brassicas

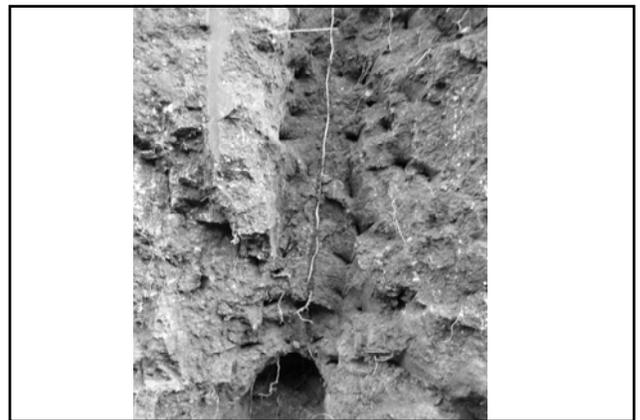
- **Rapid fall growth**
- **Great biomass production**
- **Excellent nutrient scavenging ability**
- **Pest management characteristics**
 - Most species release chemical compounds that may be toxic to soil borne pathogens and pests, such as nematodes, fungi, and some weeds. Mustards usually have higher concentrations of these chemicals.

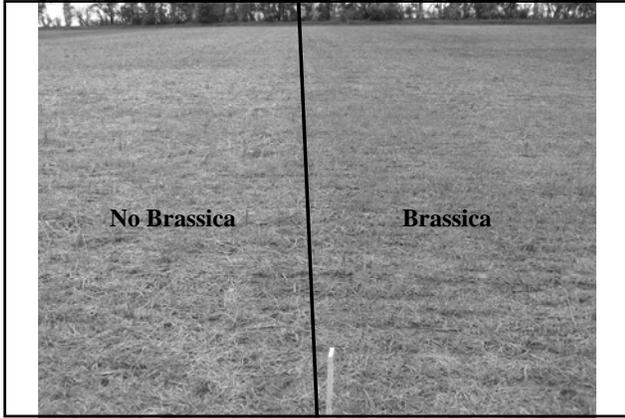
Brassicas

- **Some brassicas have a large taproot to break-up compaction and tillage pans**
 - More effective than mustards and cereal crops
 - Increase water infiltration
- **Residue decomposes very quickly**
 - Therefore immobilize less nitrogen than cereal cover crops
- **Tolerate cold temperatures very well**
 - Hardiness is higher when plants reach rosette stage

Brassica Hybrids

- **Hybrids of turnip and rape**
 - Pasja
 - Pasja root looks like a carrot
 - **Hybrid of turnip and winter canola**
 - T-Raptor and Hunter
 - **Hybrid of turnip and kale**
 - Winfred
- Seed cost is higher and seed size is generally larger





Brassicas

- Do not tolerate poorly drained soils – especially during establishment
- High sulfur user
 - May impact the following “cash crop”

Sulfur Deficiency

SULFUR 12 lbs/ac

SULFUR 18 lbs/ac

Brassicas

- Brassicas are very competitive and can overwhelm other species in the mixture
- Some brassicas have proved difficult to kill with glyphosate – requiring rates of at least 1 qt/ac and possibly multiple applications
 - Add 1 pt/acre 2,4-D if possible
- Sensitive to a number of herbicide carryovers

Canola, Turnip, and Lentil





Cover Crop Choices

Cool Season Broadleaves -- nonlegumes

- **Sugarbeet**
- **Flax**

Sugarbeet

- **Tolerant to salinity**
- **Residue decomposes quickly**
- **Good tap root**

Flax

- Small seed
- Produces a tap root
- Does not tolerate poorly drained soils or those high in soluble salts
- Fairly tolerant to frost once established
 - However, flax will winterkill

Cover Crop Choices

Cool Season Broadleaves -- legumes

- Alfalfa
- Sweet clover
- Red clover
- White clover
- Alsike clover
- Hairy vetch
- Chickling vetch
- Field pea
- Lentils

Clovers

- Red clover and sweetclover both perform best on well-drained soils, but will tolerate poorly drained soils. Alsike thrives in wet soils.
- Red clover has two distinct types
 - Medium (multi-cut) – seed generally more expensive
 - Mammoth (single-cut) – generally slower growing
 - Altaswede (Canadian) is not as shade tolerant as Michigan

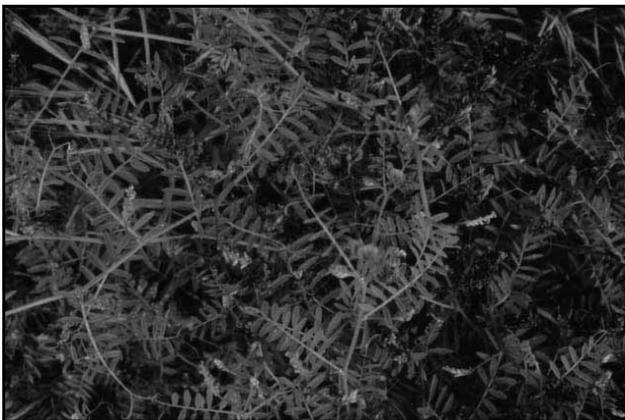


Clovers (cont.)

- Sweetclover is the most drought tolerant of the forage legumes and is quite winter hardy.
- Sweetclover produces 50% or more hard seed.
- White clover stands up well to heavy field traffic and thrives under cool, moist conditions and shade.
- White clover stores up to 45% of its N contribution in its roots.

Hairy Vetch

- A winter annual that grows slowly in the fall
- Can produce a significant amount of N
- Mixes easily with any small grain
- Good tolerance to shade
- About 10 - 20% is “hard” seed
 - Vetch seed is about the same size as wheat and barley kernels
- Soybean cyst nematode host



Chickling Vetch

- Excellent N fixer
- Drought tolerant
- Efficient soil water user
- Does not tolerate poorly drained or excessively wet soils
- Can be grazed by cattle and sheep (Variety called AC Greenfix)
 - Harmful to horses
- Seed cost can be high (approx. \$0.68 / lb)

Chickling Vetch – Gettysburg, October 25, 2007



Lentils

- Major cover crop types are:
 - Indianhead lentil
 - Redberry lentil
 - CDC Rosetown (extra small red)
 - Winter lentil
- Smaller seeds result in cheaper cost
- Slow growing and not very aggressive
- Prefers cooler weather when growing

Indianhead Lentil – Gettysburg, October 25, 2007



Indianhead lentil & Canola – Gettysburg, September 27, 2007



Cover Crop Choices

Warm Season Broadleaves

Legume

- Cowpeas
- Soybean

Nonlegume

- Sunflower
- Buckwheat

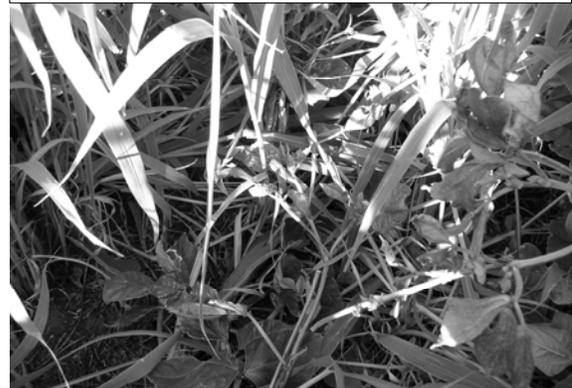
Buckwheat

- Speedy short season crop
- Residue decomposes quickly
- Not drought tolerant – wilts under hot, dry conditions
- Dense, fibrous roots cluster in the top 10 inches
- Scavenges nutrients (phosphorus) that are unavailable to other crops
- Can become a weed
 - Kill within 7-10 days after flowering begins

Cowpeas

- Most productive heat-adapted legume used agronomically
 - Once established they are rugged survivor of drought
- Germinate quickly
- Red ripper is the one most used for cover crops
- Not adapted to alkaline or waterlogged soils
- Not tolerant to frost

Cowpeas and German Millet, ND, September 15, 2007



Cowpeas Interseeded in Corn



Calculating the Amount of N That Will Be Available for Next Year's Crop

- Take cuttings from several areas in the field
 - Use a yardstick or metal frame of known dimensions
- Dry and weigh the sample
- Submit subsample to lab for forage analysis
 - Lab will measure crude protein
- Crude protein divided by 6.25 = % Nitrogen
- Total N in cover crop (lb/ac) = yield (lb/ac) X $\frac{\%N}{100}$

Calculating the Amount of N That Will Be Available for Next Year's Crop

- To estimate what will be available to your crop next year, divide this quantity of N by:
 - 4, if it will be left on the surface in a no-till system

Source: Managing Cover Crops Profitably

Estimating % N in Cover Crops

- Annual legumes typically have 3.5 – 4% N prior to flowering and 3 – 3.5 percent at flowering
 - After flower, N in the leaves quickly decrease
- Most cover crop grasses contain 2 – 3% N before flowering and 1.4 – 2.5% after flowering
- Brassicas will generally be similar to grasses in their N content

Source: Managing Cover Crops Profitably

Example

- Field sampled contained 1.5 tons / ac of biomass
 - Biomass = 70% rape and 30% lentil
 - 2100 lbs/ac rape
 - 900 lbs/ac lentil
 - N content: 2% for rape and 3.5% for lentil
- Rape = 2,100 lbs/ac X .02 = 42 lbs N per acre
 Lentil = 900 lbs/ac X .035 = 31.5 lbs N per acre
- How much Nitrogen is available for next corn crop = $73.5 / 4$
 = 18 lbs/ac

Percent of Biologically Fixed Nitrogen in Legume Tops and Roots

CROP	Tops %N	Roots %N
Soybeans	93	7
Vetch	89	11
Cowpeas	84	16
Red clover	68	32
Alfalfa	58	42

Source: Overview of Cover Crops and Green Manures

Cover Crop Choices

Cool Season Grasses

- Rye
- Wheat
- Barley
- Oats
- Triticale
- Annual Oregon ryegrass
- Tall wheatgrass

Rye

- The hardiest of cereals
 - Grows late in the fall and early in the spring
- Excellent N scavenger
- Exceptional weed suppression
- High C:N ratio
 - Mix with legume OR
 - Kill while rye is succulent, but at least 1 foot tall OR
 - Rolling stalk chopper when it is 24 inches tall

Rye

- Rye is more cold and drought tolerant than wheat
- Oats and barley do better than rye in hot weather
- Rye is harder to burn down than wheat or triticale

Aerially Applying Rye



Winter Wheat

- Slower growing than other small grains
 - Less rush to kill in the spring
 - Biomass production and N uptake are fairly slow in the fall
- Does not have the potential to become a weed problem compared to other small grains

Barley

- **Fast growing – produces more biomass in a shorter time than any other cereal crop**
- **More salt tolerant than other small grains**
- **Barley tillers more than oats and is more drought tolerant**
- **Barley and oats do better than rye in hot weather**
- **Six-rowed cultivars are more heat and drought tolerant**
- **Greater forage nutritive value than oats, wheat, or triticale**

Oats

- **Oat is more tolerant to wet soil than is barley, but require more moisture**
- **Oats outperform most other cereal grains as a companion/nurse crop**
- **Oats are more palatable than rye**
- **Winterkills**

Triticale

- **Triticale is cross between rye and wheat**
- **Spring and winter types**
- **Primary purpose is forage**

Annual Ryegrass

- **Establishes cover quickly even in poor soils**
 - Tolerates flooding once established
- **Produces a very palatable forage**
- **Can be broadcasted late in growing soybeans and corn**
- **Has been shown to develop herbicide resistance**
 - Especially Australian and Italian to glyphosate
 - Oregon claims there seed is NOT resistant
- **Should winterkill**

Cover Crop Choices

Warm Season Grasses

- Grain and forage sorghum
- Millet
- Sudangrass and sorghum-sudan hybrids
- Corn
- Teff grass

Sorghum-Sudangrass Hybrids

- Tall, fast-growing, heat-loving summer annual grasses that smother weeds, suppress some nematode species and penetrate compacted subsoil if mowed once.
- Tolerate high pH soils and are used to reclaim alkaline soils
- Suppress several annual weeds
- Potential for prussic acid poisoning in livestock



Teff Grass

- Teff is a warm season annual grass
- Very small seed – 1.3 million seeds per pound
- Slow growth until a good root system is established
- Good nutritive value for livestock (hay)
- Adapted to a wide range of soils and environments, tolerating drought to water logged conditions

Summary

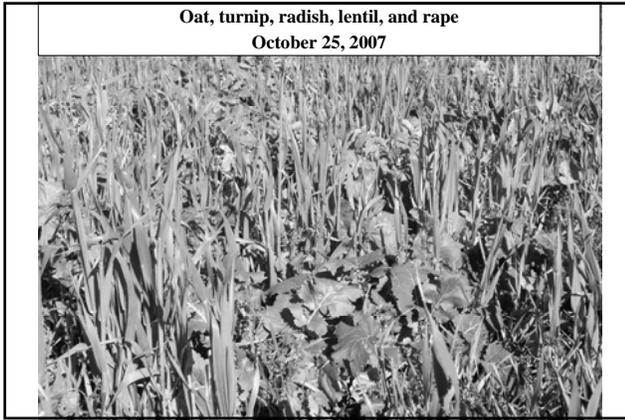
Wheat going to Corn

Objective	Potential Cover Crop Species
Grazing	Turnips, rape, radish, lentil, Rye, oat, triticale, sorghum- sudan
Compaction	Radish, canola, sugarbeet, sunflower, sorghum-sudan, turnip (and hybrids)
Moisture	Rape, clovers, w. wheat, rye, triticale



Oat, turnip, radish, lentil, and rape
September 27, 2007





Summary

Wheat going to Corn

Objective	Potential Cover Crop Species
N – Fixation	Lentil, clovers, vetches, cowpea, soybean, field pea, chickling vetch
Residue Cycling	Brassicas
Nutrient Cycling	Small grains, brassicas, sugarbeet, sunflower
Salinity	Barley, sugarbeet, rape, canola

- ### SWheat-WWheat-Corn-Sunflower
- Objective: increased nutrient cycling, increase water infiltration, fix nitrogen
 - No livestock
 - Plant one of the following cover crops and/or mixtures:
 - Lentil
 - Radish and/or turnip AND lentil
 - Dwarf essex rape AND lentil or hairy vetch

- ### SWheat-WWheat-Corn-Sunflower
- Objective: increased nutrient cycling, increase water infiltration, fix nitrogen
 - Intention is to graze
 - Plant one of the following cover crops and/or mixtures:
 - Radish and/or turnip AND lentil
 - Dwarf essex rape AND lentil or hairy vetch
 - Oat, turnip, radish, lentil, and rape

Corn - SB

- **Objective:** increase rotation diversity, scavenge nitrogen, increase water infiltration
 - **No livestock**
1. **ADD small grain to rotation**
 - 2a. **Aerially apply rye in mid September in corn**
 - 2b. **Drill if corn is cut for silage**
 3. **Aerially apply Dwarf essex rape in SB before leaf drop**

Summary

The benefits of cover crops accrue over several years. You will see improvements in crop yield, pest management, and soil tilth if you commit to cover crop use whenever and wherever possible in your rotation.

Questions

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