

BENEFITS

Erosion Control: Cover crops reduce soil erosion in several ways. They protect the soil surface from raindrop impact, increase water infiltration, trap and secure crop residues, and provide a network of roots which protect soil from flowing water.

Reduce Nitrate Loss: Nitrate losses from Indiana cropland can find its way to surface waters through surface runoff and tile. Studies show that as much as 80% of these losses can occur during the winter fallow period and into the spring. Many cover crops are good scavengers of nitrogen and will take up excess nitrogen and store it in plant tissues through the winter and early spring. Studies at the USDA National Soil Tilth Laboratory have shown that a winter cover crop of Cereal Rye can reduce the total nitrate loading in drainage systems by 60%. Most of this nitrogen will be available to the following crop or stored in the soil organic matter.

Reduce Phosphorus Loss: Phosphorus loss from Indiana fields occurs in both soluble and particulate (i.e. attached to soil particles or organic manure or crop residues) forms. Cover crops reduce runoff of soluble phosphorus through increased infiltration and plant uptake. Particulate phosphorus loss is reduced by trapping organic residues and reducing soil erosion.

Fix Atmospheric Nitrogen into the Soil: Legume cover crops have been shown to produce most or all of subsequent crop nitrogen needs. Be sure the correct strain of fresh inoculant is added to assure good nitrogen fixation. Fixation is maximized from more growth through earlier planting dates and/ or later termination.



Improve Soil Quality: Cover crops have the potential to increase soil organic matter. This increase is greater where less tillage is used to establish the cover crop and more growth is allowed prior to spring termination. Studies show that tillage prior to seeding or as a part of seeding may cause a greater net loss of carbon than the cover crop can regain. Increased bio diversity from cover crops can increase populations of beneficial organisms such as earthworms and fungi which greatly increase nutrient cycling, aeration and improve soil structure.

Weed Suppression: Cereal Grains, especially Cereal Rye, are very effective in providing a mulch that will create a weed barrier by blocking sunlight and producing natural chemicals which suppress weed growth.

Supplemental Forage Production: Cover crops can be used in a grazing management system to provide additional grazing or forage for livestock as well as increased protection from soil erosion and compaction when crop fields are needed for supplemental grazing.

SITE PREPARATION AND WEED CONTROL

Preceding crop residues should be spread evenly before seeding or following aerial seeding. Existing weeds should be eliminated by applying herbicide if it is determined that sufficient pressure exists to hinder the establishment and growth of the cover crop or perennial weeds are present. If spraying, work with a local consultant or Purdue Extension Specialist to determine the best herbicide combination and timing. Follow the manufacturer's label rates and guidelines when applying herbicides. Herbicide residue or carryover from previous crop can cause problems with cover crop establishment.



SEEDING

Selection of Plant Materials: Use certified seed or seed that has been cleaned and/or is free from noxious weeds. Select a species that is adaptable to the desired planting date with ample time to germinate and reach an acceptable growth stage prior to a killing freeze or adequate root growth to survive the winter. **See Table 1.** Select a species or mix which will meet the intended purpose and maximize the desired benefits. **See references.**

No-till Seeding: Ensure the drill is designed to handle the crop residues and seed being planted (especially important for small seeds or mixture with varying size and/or density). Set and operate the drill to provide an ideal planting depth.

Broadcast Seeding: Seed may be broadcast using a broadcast seeder if capable of spreading seed in a uniform manner. Pre-mixing the seed with needed fertilizer or pelletized lime and utilizing an airflow applicator can also be effective.

Aerial Seeding: Over seeding into existing crop in August through September can be an effective method of establishing to acquire more fall growth. Seed spread on the surface is more rain dependant and generally requires a higher seeding rate. Applying cover crop just ahead of soybean leaf drop will aid in mulching the seed and conserving moisture.

Inoculating Seed: Many legumes require a Rhizobium Bacteria to fix nitrogen. In many cases these are specific strains to individual species of legumes. Assure the proper inoculant is applied to the seed just before planting. Use only fresh inoculant (check the date). See Reference: (SARE) "Managing Cover Crops Profitably", page 122, *Nodulation* and Chart 3B. *planting*.

Lime and Fertilizer: Fertilizer is not recommended (this includes nitrogen) for the establishment of the cover crop, but may be used to increase forage production. The cover crop may be used to sequester or trap nutrients from manure or fertilizer applied for the subsequent crop. Lime application in conjunction with a cover crop is advantageous to improve soil quality benefits where pH is less than 6.4. Apply all soil amendments where possible, prior to seedbed preparation, or before planting if a no-till drill is used.

OPERATION AND MAINTENANCE

The cover crop should be integrated as a part of a conservation cropping system with practices such as: Continuous No-till/Strip-till, Nutrient Management, Pest Management and Waste Utilization.

Termination

For most cropping systems, it is not desirable to allow the cover crop to produce seed. Harvest for grain is not a purpose of this practice standard.

Use of Herbicides: If the cover crop is to be terminated with herbicides, assure that timing and selection of herbicides achieve a complete kill. Translocated herbicides will normally perform better under conditions that are ideal for active growth. A minimum daytime temperature above 50° and night time temperature above 40° is needed for good translocation. During cool

weather periods, application should be made during the warming time of day (i.e. 9:00am-3:00pm). Avoid tank mixing herbicides that are antagonistic to translocation. Follow all federal, state, and local guidelines as well as the manufacturer's label rates and guidelines when applying non-selective herbicides. For additional information on herbicide controls, contact a local consultant or Purdue Extension Specialist.

Always apply herbicides according to labeled directions. See references.

Mechanical: Most cereal grains are easily terminated by mowing, crimping, or tillage once the cover crop has reached a reproductive growth stage.



REFERENCES

Sustainable Agriculture Research and Education (SARE) "**Managing Cover Crops Profitably**" explores how and why cover crops work and provides all the information needed to build cover crops into any farming operation. <http://www.sare.org/publications/>

USDA-Natural Resources Conservation Service, electronic **Field Office Technical Guide (eFOTG)** <http://www.nrcs.usda.gov/technical/efotg/>

Purdue University- "**Weed Control Guide for Indiana and Ohio**" <http://btny.purdue.edu/Pubs/WS/WS-16/>

The Cover Crops Program at the W.K. Kellogg Biological Station / Michigan State University focuses on integrating cover crops into Michigan field crop systems. Their goal is to make information from research readily available so farmers can make better decisions about using cover crops on their farms. <http://www.covercrops.msu.edu/>

Helping People Help the Land

USDA is an equal opportunity provider and employer

Table 1a - Winter Cover Crops

Plant Species	Seeding Rate (lbs/Ac of PLS ^{1,3})	Seeding Dates	
		North of I-70	South of I-70
Annual Ryegrass Cereal Grains ³	15 - 20	8/15 to 10/1	8/15 to 10/10
Cereal Rye ³	56 - 84	8/1 to 10/31	8/15 to 11/10
Winter Wheat ²³	60 - 90	FFD ² to 10/15	FFD ² to 10/31
Spring Oats ³	32 - 48	8/15 to 9/15	8/15 to 9/30
Winter Triticale ³	75	8/1 to 10/15	8/15 to 10/31
<u>Legumes⁴:</u>			
Hairy Vetch	30	8/1 to 9/15	8/1 to 9/30
Field Peas/ Winter Peas	50 drilled, 70-90 broadcast	8/1 to 9/15	8/1 to 9/30
Cow Peas	40 drilled, 70-90 broadcast	7/1 to 9/1	7/1 to 8/15
<u>Mixtures:</u>			
Hairy Vetch and Cereal Rye	20/40	8/15 to 9/15	8/15 to 9/30
Spring Oats and Brassicas	40/3-8	8/15 to 9/15	8/15 to 9/30
<u>Other:</u>			
Brassicas-Rape/Canola/Turnips	4 drilled, 8 broadcast	8/15 to 9/15	8/1 to 9/30
Oil Seed Radish	10 drilled, 12 broadcast	8/15 to 9/15	8/1 to 9/30

Table 1b - Supplemental Forage for Livestock

Plant Species	Seeding Rate (lbs/Ac of PLS ^{1,3})	Seeding Dates	
		North of I-70	South of I-70
Spring Oats ³	64 - 96	3/15 to 5/31	3/1 to 5/15
		8/1 to 9/1	8/15 to 9/15
Cereal Rye ³	60 - 90	8/1 to 10/15	8/15 to 10/31
Winter Wheat ^{2 3}	60 - 90	FFD ² to 10/15	FFD ² to 10/31
Winter Triticale ³	75 - 120	8/1 to 10/15	8/15 to 10/31
Sudangrass & Sorghum- Sudangrass	20	5/15 to 6/15	5/1 to 5/31
Red Clover (spring seeded) ⁴	3 - 6	3/15 to 5/31	3/1 to 5/15
Turnips	4 drilled, 8 broadcast	3/15 to 9/1	3/1 to 9/1
Rape/Winter Canola	4 drilled, 8 broadcast	3/15 to 7/15	3/1 to 8/1
Kale	4 drilled, 8 broadcast	3/15 to 7/15	3/1 to 8/1
Millet	15	5/15 to 7/15	5/1 to 8/1
Annual Ryegrass	20	3/15 to 7/15	3/1 to 8/1
		8/1 to 9/1	8/15 to 9/15
Perennial Ryegrass	40	3/15 to 7/15	3/1 to 8/1
		8/1 to 10/15	8/15 to 10/31
Crabgrass, "Red River" (<i>Digitaria ciliaris</i>)	5	5/15 to 6/15	5/1 to 7/1

Table 1c - Summer Cover Crops

Plant Species	Seeding Rate (lbs/Ac of PLS ¹)	Seeding Dates	
		North of I-70	South of I-70
Spring Oats ³	60	3/15 to 5/31	3/1 to 5/15
Annual Ryegrass	15 - 20	3/15 to 6/15	3/1 to 5/31
Sudangrass & Sorghum- Sudangrass	20	5/15 to 6/15	5/1 to 5/31
Red Clover ⁴ (spring seeded)	3 - 6	3/15 to 5/31	3/1 to 5/15
Red Clover ⁴ (Frost-seeded into fall planted small grains)	4 - 6	12/15 to 3/15	12/15 to 2/15
Buckwheat	30 - 50	6/15 to 7/15	7/1 to 8/1
Millet	15	5/15 to 7/15	5/1 to 8/1

¹ Pure Live Seed (PLS) ² Not to be planted prior to Fly Free Date (FFD).² Not to be planted prior to Fly Free Date (FFD)³ Use the upper seeding rates of bulk seed for cereal grains that are cleaned but not certified.⁴ Seed size can vary greatly. Rate can be adjusted up for large seed and down for small. Inoculate seed.