

TECHNICAL NOTE

Iowa Agronomy Technical Note 38: Cover Crop Management



COVER CROP 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, improve soil aggregate stability and provide a network of roots which protect soil from flowing water.

Nitrate Loss Reduction: Nitrate losses from Iowa 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-ARS National Laboratory for Agriculture and the Environment (NLAE) have shown that a winter cover crop of Cereal Rye can reduce the total nitrate loading in drainage systems by 55%. Some of this nitrogen will be available to the following crop and most of the rest is stored in the soil organic matter.

Phosphorus Loss Reduction: Phosphorus loss from Iowa 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.

Atmospheric Nitrogen Fixation into the Soil: Legume cover crops can fix nitrogen, and if they grow enough they can reduce subsequent crop nitrogen needs. All legumes require Rhizobium Bacteria to fix nitrogen. In many cases these are Rhizobium strains specific 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, 3rd edition", page 122, *Nodulation* and Chart 3B. *planting*.



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.

Soil Health Improvement: Cover crops have the potential to increase soil organic matter and increase the biodiversity of organisms in the soil. 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. Additionally, cover crop roots can penetrate compacted soil layers and maintain or open channels or macropores through the soil, which increases infiltration, aeration, and rooting depth. Increased biodiversity from cover crops can increase populations of beneficial organisms such as earthworms and other soil organisms such as mycorrhizae which greatly improve nutrient cycling, aeration and improve soil structure. Select cover crop species to achieve one or more of the following: a species mix with different maturity dates and/or physiology, attract beneficial insects, attract pollinators, increase biological diversity to a crop rotation, serve as a trap crop for damaging insects, and/or provide food and cover for wildlife habitat management.

Cover Crop Grazing: Research has shown that cover crop grazing can improve soil health more rapidly than cover crops along as part of a cropping system. The conversion of above ground biomass to urine and manure creates a beneficial environment to move that biomass into the soil. Grazing should be used as a tool primarily in the later part of the cover crop growth cycle to: terminate the cover crop, convert biomass into urine and manure, and potentially create more cash flow. Generally, the cover crop should be 6 inches or taller to begin grazing. Higher density strip grazing or a similar method will maximize the benefit by ensuring even distribution of animal wastes.

SITE PREPARATION & 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 Iowa State University 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. A bioassay test is recommended to determine if a herbicide carry over is present.

SEEDING

Selection of Plant Materials: Use certified (Tested) seed that has been cleaned and 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 "Typical Cover Crops"**. Select a species or mix which will meet the intended purpose and maximize the desired benefits. **See references.**

No-till Seeding: Ensure the drill or planter (15" rows or less) 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/planter to provide an ideal planting depth. Since a planter is capable of much more precise spacing and depth control, it is possible to reduce overall seeding rates by up to 50%. To meet criteria for soil erosion and soil quality at least two species of cover crops should be planted either in alternating rows or combined together.

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 the existing crop in August through September can be an effective seeding method to acquire more fall growth. Seed spread on the surface is more rain dependant and generally requires a higher seeding rate. Seeding cover crops just ahead of soybean leaf drop will aid in mulching the seed and conserving moisture. Results are dependent on adequate rainfall.

Lime and Fertilizer: Fertilizer is not recommended (this includes nitrogen) for the establishment of the cover crop, but may be used to increase biomass production on poor or damaged sites. 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 prior to seedbed preparation where possible, or before planting if a no-till drill is used.

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. When applicable, ensure cover crops are managed and are compatible with crop insurance and /or USDA Program criteria

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 55° and night time temperature above 45° 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 herbicides. For additional information on herbicide controls, contact a local consultant or ISU Extension Specialist. Always apply herbicides according to labeled directions. See references.

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

Note: Haying a cover crop removes some of the nutrients.



OPERATION & MAINTENANCE

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

REFERENCES

Midwest Cover Crop Council - Cover Crop Decision Tool - Cover Crop Selector for Iowa Counties
www.mccc.msu.edu/SelectorTool/2011CCSelectorTool.pdf

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. www.sare.org/publications/

Iowa Agronomy Technical Note Cover Crops 1: **Cover Crop Management**

Cover Crops Recommendations by Resource Concern

Resource Concern	Species	Pure Stand Rate lbs./ac. of PLS ¹	Winter Hardy?	Seeding Dates
SUMMER COVER				
Erosion Control	Spring Oats	60	No	4/1 - 6/15
	Annual Ryegrass	20	Sometimes	4/1 - 6/15
	³ Sudangrass and Sorghum/Sudangrass	25	No	5/15 - 8/1
	Buckwheat	50	No	6/1 - 8/15
	Millet	25	No	5/15 - 8/1
Compaction	Oil Seed Radish	8 drilled - 12 broadcasted	No	4/1 - 5/15
	Rape/Turnips/Canola	4 drilled - 8 broadcasted	No	4/1 - 5/15
Nitrogen Fixing	Alfalfa	15 drilled - 20 broadcasted	Yes	4/1 - 6/1
	Red Clover	8 drilled - 12 broadcasted	Yes	4/1 - 6/1
	Soybean	50	No	5/1 - 7/1
	Cow Peas	50	No	5/15 - 8/1
Herbicide Concern ⁴	Sorghum/Sudangrass	25	No	5/15 - 8/1
FALL/WINTER COVER				
Soil Building/N Scavenge	Annual Ryegrass	20	Sometimes	8/1 - 10/1
	Cereal Rye	75	Yes	8/1 - 10/15
	Winter Wheat ²	75	Yes	FFD - 10/15
	Spring Oats	60	No	7/15 - 9/15
	Winter Triticale	75	Yes	8/1 - 10/15
Nitrogen Fixing	Hairy Vetch	15	Yes	8/1 - 10/1
	Winter Peas	50	No	8/1 - 10/1
	Crimson Clover	10 drilled - 15 broadcasted	No	8/1 - 9/15
	Alfalfa	15 drilled - 20 broadcasted	Yes	4/1 - 6/1
	Red Clover	8 drilled - 12 broadcasted	Yes	4/1 - 6/1
	Soybean	50	No	5/1 - 7/1
Erosion Control	Cereal Rye	75	Yes	8/1 - 10/15
	Winter Wheat	75	Yes	FFD - 10/15
	Winter Triticale	75	Yes	8/1 - 10/15
	Annual Ryegrass	20	Sometimes	8/1 - 10/1
Grazing/Compaction	Cereal Rye	75	Yes	8/1 - 10/15
	Winter Wheat	75	Yes	FFD - 10/15
	Winter Triticale	75	Yes	8/1 - 10/15
	Annual Ryegrass	20	Sometimes	8/1 - 10/1
	Turnips	4 drilled - 8 broadcasted	No	8/1 - 10/1
	Forage Radish	8 drilled - 12 broadcasted	No	8/1 - 10/1

¹Pure Live Seed (PLS) ²Not to be planted prior to Fly Free Date (FFD) ³Concern with grazing after frost

⁴Sorghum/Sudangrass is the most tolerant to amine herbicides.

This is not an all-inclusive list of species. See Midwest Cover Crop Council-Cover Crop Decision Tool – Cover Crop Selector for Iowa Counties.

It is recommended that you plant diverse cover crop mixes. The rates listed are for pure stand seedings. When developing a cover crop mix, take the percent desired by the pure stand rate to determine seeding rate by species. (Example 60% Cereal Rye 40% radish would have a seeding rate of .6 X 75 = 45 lbs. cereal rye and .4 X 8 = 3.2 lbs. radish)

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Examples of Diverse Cover Crop Mixes

See Midwest Cover Crop Council-Cover Crop Decision Tool – Cover Crop Selector for Iowa Counties for an all-include species list.

Resource Concern	Species Mix	% of Pure Stand Rate	lbs./ac. of PLS	Seeding Dates
SUMMER COVER				
Erosion Control Mix	Annual Ryegrass	20	4	5/15 - 8/1
	Sorghum/Sudangrass	15	4	
	Oats	15	9	
	Buckwheat	15	8	
	Oil Seed Radish ¹	20	2	
	Cow Peas	15	8	
Compaction Mix	Oil Seed Radish ¹	20	2	4/1 - 5/15
	Turnips ¹	20	2	
	Rape/Canola ¹	30	2	
	Millet (Pearl or Japanese)	30	8	
Nitrogen Fixing Mix 1	Alfalfa	50	8	4/1 - 6/1
	Red Clover	50	5	
Nitrogen Fixing Mix 2	Cow Peas	30	15	7/1 - 8/1
	Crimson Clover	40	6	
	Hairy Vetch	30	5	
Grazing/Compaction Mix	Cow Peas	20	10	5/15 - 8/1
	Millet (Pearl or Japanese)	20	5	
	Sorghum/Sudangrass	20	5	
	Turnip ¹	20	2	
	Forage Radish ¹	20	2	
FALL/WINTER COVER				
Soil Building/N Scavenge Mix	Cereal Grain (Cereal Rye, Winter Wheat, Winter Triticale)	50	38	8/1 - 10/15
	Oil Seed Radish	50	5	
Erosion Control Mix	Cereal Grain (Cereal Rye, Winter Wheat, Winter Triticale)	60	45	8/1 - 10/15
	Hairy Vetch	40	6	
Nitrogen Fixing Mix	Cereal Rye	40	30	8/1 - 10/1
	Winter Peas	30	15	
	Hairy Vetch	30	5	
Grazing/Compaction Mix	Cereal Grain (Cereal Rye, Winter Wheat, Winter Triticale)	50	38	8/1 - 10/1
	Oil Seed Radish	25	3	
	Turnip	25	3	

¹Brassicas will bolt when seeded in the spring, and will produce seed.