

Cover Crop (Acre) 340

DEFINITION

Cover crops include grasses, legumes, and forbs, established for seasonal cover and other conservation purposes.

PURPOSES

- Reduce erosion from wind and water.
- Increase soil organic matter content
- Capture and recycle or redistribute nutrients in the soil profile
- Promote biological nitrogen fixation.
- Increase biodiversity.
- Weed suppression.
- Provide supplemental forage.
- Soil moisture management.
- Reduce particulate emissions into the atmosphere.
- Minimize and reduce soil compaction.
- Reduce pest pressure.
- Encourage Pollination

CONDITIONS WHERE PRACTICE APPLIES

On all lands requiring vegetative cover for natural resource protection and or improvement

This standard provides guidelines for the selection of cover crops to address single or multiple resource concerns. It supports the principals and recommendations found in Michigan State University (MSU)-Extension Bulletin E-2646, Michigan Field Crop Ecology and other recently published MSUE Bulletins, etc.

Also sowing cover crops in marginal areas could have many benefits see NRCS Michigan Agronomy Tech Note 49 Cover Crops on the edge and NRCS MI Agronomy Tech Note 54 Michigan Cover Crop Management.

CRITERIA

General Criteria Applicable To All Purposes

Plant species, seedbed preparation, seeding rates, seeding dates, seeding depths, and planting methods will be consistent with approved local criteria and site conditions (see Table 1 and 2 following row crops, vegetables, small grains, summer cover, and conservation use land.

Use weed-free and disease-free seed and establish cover crops by one of the following methods: over-seeding, frost seeding, aerial seeding, broadcast seeding, air-flow broadcasting, drilling or manure slurry seeding following MSUE recommendations. Aerial seeding of cover crops shall follow the requirements of the NRCS Michigan Agronomy Technical Note 52, Aerial Seeding of Cover Crops.

The species selected will be compatible with other components of the cropping system.

Cover crops will be terminated by harvest, frost, mowing, tillage, crimping, and/or herbicides in preparation for the following crop.

Herbicides used with cover crops will be compatible with the following crop.

Avoid using plants that are on the state's noxious weed or invasive species lists.

Cover crop residue will not be burned.

For legume cover mixtures; use the appropriate inoculant or pre-inoculated seed if that particular legume has not been grown on the site within the last 5 years.

Avoid cover crop species that harbor or carryover potentially damaging diseases or insects.

Do not recommend brassicas on the same field for more than two years in a row. Oil seed radish may be susceptible to club root disease or cabbage root maggot and shall not be used in a rotation with vegetable crops susceptible to these pests.

Additional Criteria to Reduce Erosion from Wind and Water

Cover crop establishment, in conjunction with other practices, will be timed so that the soil will be adequately protected during the critical erosion period(s).

Plants selected for cover crops will have the physical characteristics necessary to provide adequate protection (see Table 1).

The amount of surface and/or canopy cover needed from the cover crop shall be determined using current erosion prediction technology. See Section I of the local NRCS Michigan eFOTG for instructions.

Inter seed small grains in rows with row crops or vegetables to reduce wind erosion losses to the atmosphere and protect young seedlings from wind erosion Saltation (abrasion) damage.

Additional Criteria to Increase Soil Organic Matter Content

Cover crop species will be selected on the basis of producing high volumes of organic material to maintain or improve soil organic matter.

The NRCS Soil Conditioning Index (SCI) procedure found in the latest NRCS Revised Universal Soil Loss Equation (RUSLE2) Model shall be used to determine the amount of biomass to have a positive trend in the soil organic matter sub factor.

The cover crop will be terminated as late as feasible to maximize plant biomass production, considering the time needed to prepare the field for planting the next crop and soil moisture depletion.

Additional Criteria to Capture and Recycle or Redistribute Excess Nutrients in the Soil Profile

Cover crops will be established and actively growing before expected period(s) of nutrient leaching.

Cover crop species will be selected for their ability to take up large amounts of nutrients from the rooting profile of the soil.

When used to redistribute nutrients from deeper in the profile up to the surface layer, the cover crop will be killed in relation to the planting date of the following crop.

Cover crops to capture nutrients have many benefits. See the NRCS MI Agronomy Technical Note 46` Buckwheat a Phosphorus Pump, Agronomy Tech Note 47 Squeezing More Value from Manure with Cover Crops and Agronomy Tech Note 50 Oilseed Radish Cover Crop.

Additional Criteria to Promote Biological Nitrogen Fixation

Only legumes or legume grass mixtures will be established as cover crops.

The specific Rhizobia bacteria will either be present in the soil or the seed will be inoculated at the time of planting legumes.

Additional Criteria to Increase Biodiversity

Cover crop species shall be selected that have different maturity dates, attract beneficial insects, serve as a trap crop from damaging insects, and/or provide food and cover for wildlife habitat management. See NRCS Michigan Agronomy Conservation Sheet, Conservation Buffers and Beneficial Insects, Mites, and Spiders.

Additional Criteria for Weed Suppression

Species for cover crops will be selected for their chemical or physical characteristics to suppress or compete with weeds.

Cover crop residues will be left on the soil surface to maximize allelopathic (chemical) and mulching (physical) effects.

For long-term weed suppression, including on sites to be planted to trees and /or shrubs, perennials and/or biennial species can be used.

Cover crops for forest tree/tree shrub establishment sites shall be one of the following: white clover, redbud, Virginia Wildrye, Canada Wildrye (on upland landscapes), or Riverbank Wildrye (on floodplain or other lowland sites). The three Wildrye species are native to Michigan and are preferred for forest restoration plantings.

Cover crops for tree/shrub establishment shall control weeds in the areas between trees; however, cover crops are not a substitute for proper weed control in the areas adjacent to the trees and shrubs. Maintain at least an 18" radius zone around each seedling that is vegetation free. See the NRCS MI

Tree/Shrub Establishment (612) and Tree/Shrub site preparation practice (490) standards for more information.

Additional Criteria to Provide Supplemental Forage

Species selected shall have desired forage traits, be palatable to livestock, and not interfere with the production of the subsequent crop.

Forage provided by the cover crop may be hayed or grazed as long as sufficient biomass is left for resource protection. *See MSU-Extension Bulletin E-2126, Annual Summer Forage Production in Michigan, and MSU/KBS cover crop fact sheets for species and management recommendations.*

Additional Criteria for Soil Moisture Management

Terminate growth of cover crop sufficiently early to conserve soil moisture for the subsequent crop. Cover crops established for moisture conservation shall be left on the soil surface.

In areas of potential excess soil moisture, allow the cover crop to grow as long as possible to maximize soil moisture removal.

Additional Criteria to Reduce Particulate Emissions to the Atmosphere

Manage cover crops and their residues so that at least 80% ground cover is maintained during the planting operations to the following crop.

Additional Criteria to Minimize and Reduce Soil Compaction

Select and manage cover crop species that will produce deep roots and large amounts of surface or root biomass to increase soil organic matter, improve soil structure and increase soil moisture through better infiltration.

There are many benefits to using cover crops to reduce soil compaction before adopting a no till farming system. See the NRCS MI Agronomy Tech Note 48 Using Cover Crops to Convert to No Till, Agronomy Tech Note 50 Oilseed Radish Cover Crop, and Agronomy Tech Note 51 Radishes: A New Cover Crop Option.

Additional Criteria to Reduce Pest Pressure

To reduce sugar beet cyst nematode pressure, seed a fall seeding of oil seed radish after small grain. Use only Adagio or Colonel Oilseed radish varieties for this purpose.

Cover crop species shall be selected that have different maturity dates, attract beneficial insects, serve as a trap crop for damaging insects, and/or provide food and cover for wildlife habitat management.

Pacific Gold Oriental Mustard cover crop can reduce damage of herbivore nematodes in orchards and potatoes. See the NRCS MI Agronomy Technical Note 45 Cover Crops for Orchards and NRCS MI Agronomy Technical Note 53, Soil Quality Enhancement for Tree Fruit Production and Potatoes Using Compost and Pacific Gold Oriental Mustard.

Additional Criteria to Encourage Pollination

Use a mixture or strip planting of different clover species next to field edges and meadows where pollinators are foraging. All of the flowering clovers and alfalfa are good for pollinators. Buckwheat is a good choice for mid to late summer pollen source. Annually sow Crimson Clover in blueberry alleys to attract bees and provide an additional pollen source. (Mutch, D. 2008. MSUE research trials unpublished data)

CONSIDERATIONS

Sow cover crops in a timely manner to establish a good stand.

Maintain an actively growing cover crop as late as feasible to maximize plant growth, allowing time to prepare the field for the next crop.

Use deep-rooted species to maximize nutrient recovery.

For most purposes for which cover crops are established, the combined canopy and surface cover is at nearly 90 percent or greater, and the above ground (dry weight) biomass production is at least 4,000 lbs/acre.

Cover crops may be used to improve site conditions for establishment of perennial species.

Use plant species that enhance bio-fuels opportunities.

Use plant species that enhance forage opportunities for pollinators.

Rye, oats, or barley cover crops are recommended for organic soils.

Oats are recommended where the field will not be tilled in the spring and direct seeding is planned.

PLANS AND SPECIFICATIONS

Plans and Specifications will be prepared for the practice site. Plans for the establishment of cover crops shall include:

- Species or species of plants to be established
- Seeding rates
- Recommended seeding date
- Establishment procedure
- Planned rate and timing of nutrient application
- Planned dates for destroying cover crop.
- Other information pertinent to establishing and managing the cover crop.

Plans and specifications for the establishment and management of cover crops may be recorded in narrative form, on job sheets or on other forms.

OPERATION, MANAGEMENT, AND MAINTAINENCE

Control growth of the cover crops to reduce competition from volunteer plants and shading.

Control weeds in cover crops by mowing or by using other pest management techniques.

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- Warncke, D.D., J. Dahl, L. Jacobs, and C. Laboski, 2004. Nutrient Recommendations for Field Crops in Michigan. Michigan State University-Extension Bulletin E-2904, 30 pp.
- For free copies of MSU bulletins and other references see the pdf files at the following Web sites:
- [Web2.msue.msu.edu/bulletins/Bulletin/PDF/E-2897.pdf](http://web2.msue.msu.edu/bulletins/Bulletin/PDF/E-2897.pdf)
- [Web2.msue.msu.edu/bulletins/Bulletin/PDF/E-2896.pdf](http://web2.msue.msu.edu/bulletins/Bulletin/PDF/E-2896.pdf)
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TABLE 1 - COVER CROP SPECIES

Purpose BD - Bio Diversity EC - Erosion Control EN - Excessive Nutrients NF - Nitrogen Fixation OM - Organic Matter SF - Supplemental Forage SM - Soil Moisture Mgt. WS - Weed or Pest Suppression	Cover Crop Species	Life Cycle	Nitrogen Value (lb/Ac)	Seeding Rate (lb/Ac)	Seeding Depth (inches)	Frost Seed March - mid-April*	Direct Drill or Broadcast and Shallow Till	Overseed Corn @ Vegetative Stage V4 - V8	Overseed Corn by Air or Highboy	Overseed Corn by Air or Highboy	Overseed at Leaf Drop	Seed Post-Harvest	Seed Post-Harvest
							May 1 - mid-June	Early June - early July	Early August - mid-Sept.	Late/mid-Sept. - mid-Oct.	Mid-August - mid-Sept.	Mid-July - Sept. 1.	
B E E N O S S D C N F M F M W	Legumes												
x	Annual medic	SA	40 - 100	10 - 39	¼ - ½			X			NR		
x	Berseem clover	SA	60 - 90	9 - 20	¼ - ½			X			NR	X	
x	Crimson clover	SA	50 - 60	12 - 20	¼ - ½						X	X	
x	Field peas	SA	30 - 100	70 - 150	1 - 2								
x	Hairy vetch	WA	60 - 180	25 - 40	½ - 2	X		X	X		X	X	9/1-11/1
x	Mammoth red clover	B	60 - 70	8 - 15	¼ - ½			X	X		X	X	
x	Sweetclover	B	70 - 90	8 - 15	¼ - ½			X	X		X	X	
x	Alfalfa	P	50 - 150	9 - 25	¼ - ½								
x	White clover	P	60 - 100	5 - 7	¼ - ½			X	X		X	X	
	Medium red clover	P	60 - 70	10 - 15	¼ - ½	X		X	X		X	X	
	Alsike clover	B/P	60 - 70	4 - 10	¼ - ½								
	Birdsfoot trefoil	P	40 - 100	5 - 10	¼ - ½								
x	60/40 mix (RC/SC)	B/P	60 - 90	8 - 15	¼ - ½	X		X	X		X		
	Soybeans	SA	0 - 40	1 Bu	1 - 2		X					X	
x	Crownvetch	P	50 - 100	3 - 10	¼		X						
	Non-Legumes												
x	Buckwheat	SA	NA	36 - 60	¼ - ½			X	X		NR	NR	
	Corn	SA	NA	1 Bu	1½		X						
	Field Bromegrass	SA	NA	10	¼		X	X					
	Forage turnips	SA	NA	3 - 5	¼ - ½							X	
x	Oats	SA	NA	34 - 68	1 - 2				X		X	X	
	Oilseed radish	SA	NA	15 - 25	¼ - ½				X		X	X	
	Rape	SA	NA	3 - 8	¼ - ½						X	X	
	Sudan Grass	SA	NA	20 - 25	½ - 1		X					X	
	Annual ryegrass	AW	NA	15 - 25	¼ - ½			X	X			X	
	Barley	AW	NA	48 - 96	1 - 2					X		X	9/10-9/30
x	Cereal Rye	AW	NA	28 - 112	½ - 1					X	X	X	9/1-11/1
x	Triticale	AW	NA	60 - 120	½ - 1					X	X	X	9/10-10/15
x	Wheat	AW	NA	60 - 120	½ - 1					X	X	X	9/13-10/20
	Re Forest Areas												8/1-30 UP
	Redtop		NA	2-6	¼-1/2				x				
	Canada Wildrye		NA	3-6	¼-1	X			x				
	Virginia Wildrye		NA	3-6	¼-1	X			x				
	Riverbank Wildrye		NA	3-6	¼-1	x			x				

Table 2 Cover Crop Seeding Rates Alone and in Seed Mixtures

Crop	Life Cycle	Seeds Per Pound (in thousands)	Seeding Rate Pounds per Acre	Seeding Rate Pounds per Acre	Approximate Days for normal Germination
			Alone	Mixtures	
LEGUMES					
Alfalfa	p	220	12-20	6-10	7
Alsike Clover	b/p	680	6-8	2-4	7
Annual Medic	a	300	10-15		
Berseem Clover	sa	200	9-20	6-10	
Birdsfoot Trefoil	p	375	4-8	3-5	12
Crimson Clover	sa	140	12	6-10	7
Field Peas	a	3	70-150	20-30	
Hairy Vetch	p	20	30-40		10-14
Ladino Clover	p	800	2-6	½-2	7
Red Clover	p	280	10-12	3-8	7
Soybeans	a	5	45-60		
Sweet Clover	b	260	12-15	5-10	7
White Clover	p	800	2-6	1-3	7
60/40 or 80/20 mix	ab	270	10-15	5-10	7
NON-LEGUMES					
Annual Ryegrass	a	227	15-25	4-10	10
Barley	a	14	48-96	36-72	
Buckwheat	a	20	36-60	-	
Cereal Rye	a	18	28-112	44-84	
Field Brome	a	280	15-30	10	
Forage Turnips/Rape	a	157	3-5	1-2	
Oats	a	13	34-68	32-48	
Oilseed Radish	a		15-25	2-5	
Pacific Gold Mustard	a	157	3-5	-	
Sudan Grass	a	55	20-25	-	
Triticale	a	13	60-120	44-84	
Wheat	a	12	60-120	44-84	

Source: Modern Fruit Science Table 1, Pg. 109, MUSE Bulletin 2107 and Northrup King FS 828-1

Note: The purpose of this table is to accommodate custom cover crop seed mixtures and provide guidance of published Seeding rates recommended for seed mixtures. It is suggested to keep an individual seed within the recommended range.

Table 3 Recommended Seed Mixtures (Seed Cocktails)

Seed Mixture	Species	Seeding Rate (lbs/ac)
SM 1	Austrian Winter Pea	20-30
	Oilseed Radish	2-5
SM 2	Hairy Vetch	25-30
	Cereal Rye	56-75
SM 3	Triticale	44-84
	Austrian Winter Peas	40-60