

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD**

Cover Crop

(Acre)

CODE 340

DEFINITION

Grasses, legumes, and forbs planted for seasonal vegetative cover.

PURPOSE

This practice is applied to support one or more of the following purposes:

- Reduce erosion from wind and water.
- Maintain or increase soil health and organic matter content.
- Reduce water quality degradation by utilizing excessive soil nutrients.
- Suppress excessive weed pressures and break pest cycles.
- Improve soil moisture use efficiency.
- Minimize soil compaction.

CONDITIONS WHERE PRACTICE APPLIES

All lands requiring seasonal vegetative cover for natural resource protection and or improvement.

CRITERIA

General Criteria Applicable To All Purposes

Plant species, seedbed preparation, seeding rates, seeding dates, seeding depths, and planting methods see will be consistent with, Michigan State University Extension (MSUE) recommendations in Extension Bulletin E-2646, Michigan Field Crop Ecology and other published MSUE bulletins etc.

Select species that are compatible with other components of the cropping system.

Ensure herbicides used with crops are compatible with cover cropping selections and purpose(s).

Cover crops may be established between successive production crops, or companion-planted or relay-planted into production crops. Select species and planting dates that will not compete with the production crop yield or harvest.

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 that follow MSUE recommendations. Aerial seeding of cover crops shall follow the requirements of the NRCS Michigan Agronomy Technical Note 52, *Aerial Seeding of Cover Crops*.

Do not burn cover crop residue.

Determine the method and timing of termination to meet the grower's objective and the current NRCS Cover Crop Termination Guidelines.

When a cover crop will be grazed or hayed ensure that crop selection(s) comply with pesticide label rotational crop restrictions and that the planned management will not compromise the selected conservation purpose(s).

Do not harvest cover crops for seed.

If the specific rhizobium bacteria for the selected legume are not present in the soil, treat the seed with appropriate inoculum at the time of planting.

Additional Criteria to Reduce Erosion from Wind and Water

Time cover crop establishment, in conjunction with other practices, to adequately protect the soil during the critical erosion period(s).

Select cover crops that have the physical characteristics necessary to provide adequate protection (see Table 1).

Use the latest Revised Universal Soil Loss Equation (RUSLE2) or Wind Erosion Prediction System (WEPS) models to determine the amount of surface and/or canopy cover needed from the cover crop to achieve the erosion objective. See Section I of the local NRCS Michigan FOTG for instructions on using these models.

Inter seed small grain cover crops in rows with row or vegetable crops to reduce wind erosion losses to the atmosphere and protect young seedlings from wind erosion saltation (abrasion) damage. For example this is a common practice on MI muck farms growing onions.

Additional Criteria to Maintain or Increase Soil Health and Organic Matter Content

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

The planned crop rotation including the cover crop and associated management activities will score a Soil Conditioning Index (SCI) value > 0 found in RUSLE2 2.5.2.11 as determined using the current approved NRCS Soil Conditioning Index (SCI) procedure *with appropriate adjustments for additions to and or subtractions from plant biomass*.

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

Additional Criteria Reduce Water Quality Degradation by Utilizing Excessive Soil Nutrients

Establish cover crops as soon as practical prior to or after harvest of the production crop. (I.e. before or after harvest).

Select cover crop species for their ability to effectively utilize nutrients.

Terminate the cover crop as late as practical to maximize plant biomass production and nutrient uptake. Practical considerations for termination date may include crop insurance criteria, the amount of time needed to prepare the field for planting the next crop, weather conditions, and cover crop effects on soil moisture and nutrient availability to the following crop.

If the cover crop will be harvested for feed (hay/balage/etc.), choose species that are suitable for the planned livestock and capable of removing the excessive nutrients present

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 Suppress Excessive Weed Pressures and Break Pest Cycles

Select cover crop species for their life cycles, growth habits, and other biological, chemical and or physical characteristics to provide one or more of the following:

- To suppress weeds or compete with weeds.
- Break pest cycles or suppress plant pests and pathogens.
- Provide food and habitat for natural enemies of pests.
- Release compounds such as glucosinolates that suppress soil borne pathogens or pests.

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 and Potato Production Using Compost and Pacific Gold Oriental Mustard Cover Crop.

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

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 Improve Soil Moisture Use and Efficiency

In areas of limited soil moisture, 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 Minimize Soil Compaction

Select and manage cover crop species that have the ability to root deeply and the capacity to penetrate or prevent compacted layers.

There are many benefits to using cover crops as bio-till 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*.

CONSIDERATIONS

Plant cover crops in a timely matter and when there is adequate moisture to establish a good stand.

When applicable, ensure cover crops are managed and are compatible with the client's crop insurance criteria.

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

Select cover crops that are compatible with the production system, well adapted to the region's climate and soils, and resistant to prevalent pests, weeds, and diseases. Avoid cover crop species that harbor or carry over potentially damaging diseases or insects.

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

When cover crops are used for grazing, select species that will have desired forage traits, be palatable to livestock, and not interfere with the production of the subsequent crop.

Use plant species that enhance forage opportunities for pollinators by using diverse legumes and other forbs.

Cover crops may be selected to provide food or habitat for natural enemies of production crop pests.

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

Seed a higher density cover crop stand to promote rapid canopy closure and greater weed suppression. Increased seeding rates (1.5 to 2 times normal) can improve weed-competitiveness.

Cover crops may be selected that release biofumigation compounds that inhibit soil-borne plant pests and pathogens.

Species can be selected to serve as trap crops to divert pests from production crops.

Select a mixture of two or more cover crop species from different plant families to achieve one or more of the following: (1) species mix with different maturity dates, (2) attract beneficial insects, (3) attract pollinators, (4) increase soil biological diversity, (5) serve as a trap crop for insect pests, or (6) provide food and cover for wildlife habitat management.

Plant legumes or mixtures of legumes with grasses, crucifers, and/or other forbs to achieve biological nitrogen fixation. Select cover crop species or mixture, and timing and method of termination that will maximize efficiency of nitrogen utilization by the following crop, considering soil type and conditions, season and weather conditions, cropping system, C:N ratio of the cover crop at termination, and anticipated nitrogen needs of the subsequent crop. Use MSUE recommended nitrogen credits from the legume and reduce nitrogen applications to the subsequent crop accordingly. “If the specific rhizobium bacteria for the selected legume are not present in the soil, treat the seed with the appropriate inoculum at the time of planting.

Time the termination of cover crops to meet nutrient release goals. Termination at early vegetative stages may cause a more rapid release compared to termination at a more mature stage.

Both residue decomposition rates and soil fertility can affect nutrient availability following termination of cover crops

Allelopathic effects to the subsequent crop should be evaluated when selecting the appropriate cover crop.

Legumes add the most plant-available N if terminated when about 30% of the crop is in bloom.

Additional Considerations to Reduce Erosion by Wind or Water

To reduce erosion, best results are achieved when the combined canopy and surface residue cover attains 90 percent or greater during the period of potentially erosive wind or rainfall.

Additional Considerations to Reduce Water Quality Degradation by Utilizing Excessive Soil Nutrients

Use deep-rooted species to maximize nutrient recovery.

When appropriate for the crop production system, mowing certain grass cover crops (e.g., sorghum-sudangrass, pearl millet) prior to heading and allowing the cover crop to regrow can enhance rooting depth and density, thereby increasing their subsoiling and nutrient-recycling efficacy.

Additional Considerations to Increase Soil Health and Organic Matter Content

Increase the diversity of cover crops (e.g., mixtures of several plant species) to promote a wider diversity of soil organisms, and thereby promote increased soil organic matter.

Plant legumes or mixtures of legumes with grasses, crucifers, and/or other forbs to provide nitrogen through biological nitrogen fixation.

Legumes add the most plant-available N if terminated when about 30% of the crop is in bloom.

PLANS AND SPECIFICATIONS

Prepare plans and specifications for each field or treatment unit according to the planning criteria and operation and maintenance requirements of this standard. Specifications shall describe the requirements to apply the practice to achieve the intended purpose for the practice site. Plans for the establishment of cover crops shall, as a minimum, include the following specification components in an approved Cover Crop, 340, Implementation Requirements based on Michigan Seeding Tables as of September 2015, Cover Crops 340, Tables 1 or 4 or the latest Michigan Cover Crop Seeding Calculator for cover crop mixtures of 2 or more.

- Field number and acres.
- Species of plant(s) to be established.
- Seeding rates.

- Seeding dates.
- Establishment procedure.
- Rates, timing, and forms of nutrient application (if needed).
- Dates and method to terminate the cover crop.
- Other information pertinent to establishing and managing the cover crop e.g., if haying or grazing is planned specify the planned management for haying or grazing.

OPERATION AND MAINTENANCE

Evaluate the cover crop to determine if the cover crop is meeting the planned purpose(s). If the cover crop is not meeting the purpose(s) adjust the management, change the species of cover crop, or choose a different technology.

REFERENCES

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Hargrove, W.L., ed. Cover crops for clean water. SWCS, 1991.

Harrigan, T. M., D.R. Mutch, S.S. Snapp. 2005. Manure Slurry-Enriched Micro-Site Seeding of Biosuppressive Cover Crops. ASAE Meeting Presentation. Paper Number 051059.

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Mutch D., K. D. Thelen, 2003. No-till Drilling Cover Crops after Wheat Harvest and Their Influence on Next Season's Corn. MSU/KBS Michigan State University-Extension bulletin E-2897.

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Ngouajio, M. and D. R. Mutch, 2004. Oilseed Radish: A New Cover Crop for Michigan. E-2907. MSU Extension, East Lansing, MI

NRCS Conservation Information Sheet, 1998. Conservation Buffers and Beneficial Insects, Mites, and Spiders.

NRCS Agronomy Tech Notes:

45- Cover Crops for Orchards

46- Buckwheat a Phosphorus Pump

47- Squeezing More Value from Manure with Cover Crops

48- Using Cover Crops to Convert to No-till

- 49- Cover Crops on the Edge
- 50- Oil Seed Radish Cover Crop
- 51- Radishes- A New Cover Option
- 52- Aerial Seeding of Cover Crops
- 53- Soil Quality Enhancement for Tree Fruit and Potato Production Using Compost & Pacific Gold Oriental Mustard Cover Crops
- 54- Michigan Cover Crop Management.

Rust S.R., H.D. Ritchie, O. B. Hesterman, and J.J. Kells, 1988. Annual Summer Forage Production in Michigan, Michigan State University-Extension Bulletin E-2126, 8 pp.

Reeves, D.W. 1994. Cover crops and erosion. p. 125-172 in J.L. Hatfield and B.A. Stewart (eds.) Crops Residue Management. CRC Press, Boca Raton, FL

Snapp S., K. Date, K. Cichy and K.O'Neil 2006. Mustards a Brassica Cover Crop for Michigan.

Snapp, S., and D.R. Mutch, 2003. Cover Crop Choices for Michigan Vegetables. Michigan State University Extension Bulletin E-2896.

Stringer, J. W., W. Clatterbuck, and J. Seifert. Site Preparation and Competition Control Guidelines for Hardwood Tree Plantings, the University of Tennessee Extension Bulletin PB1783.

Warncke, D.D., D.R. Christensen, and M.L Vitosh., 1985. Fertilizer Recommendations: Vegetable and Field Crops. Michigan State University-Extension Bulletin E-550B, 34 pp.

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)

[http://www.covercrops.msu.edu/pdffiles/extension_bulletin E-2907.pdf](http://www.covercrops.msu.edu/pdffiles/extension_bulletin_E-2907.pdf). (Verified March 31, 2010)

<http://www.sare.org/publications/covercrops.htm>. (Verified 24 March 2010)

<http://web2.msue.msu.edu/bulletins/Bulletin/pdf/E-2956.pdf>. (Verified March 31, 2010)

See the following Web site for a list of Aerial Applicators or National Agricultural Aviation Association (NAAA) to aerial seed cover crops:

<http://agaviation.org/>

| Attachment: NRCS Cover Crop Termination Guidelines - Non-Irrigated Cropland |



Cover crops on a field in Black Hawk County, Iowa

Photo: Lynn Betts, NRCS

Background:

To ensure that USDA policies are coordinated and up-to-date with evolving cover crop practices, the administrators of NRCS, Risk Management Agency and Farm Service Agency organized an interagency workgroup to develop consistent, simple and flexible policy across the three agencies. National and local experts, along with multiple stakeholders, were involved in the process. Research literature, plant growth and soil hydrology models, and input from national/local experts in cover crop management provided the basis for developing termination cover crops guidelines to achieve their conservation benefit while minimizing risk of reducing yield to the following crop due to soil water use.

The guidelines apply to non-irrigated cropland, including systems that contain a fallow period, and to cover crops actively growing at the time of termination.

Zone	Cover Crop Termination Period Guidance	
Zone 1	For Late Spring to Fall Seeded Crops Terminate cover crops 35 days or earlier prior to planting the crop.	For Early Spring Seeded Crops Terminate cover crops as soon as practical prior to planting the crop. [Additional Cover Crop Termination Considerations 4 and 8.]
Zone 2	For Late Spring to Fall Seeded Crops Terminate cover crops 15 days or earlier prior to planting the crop.	For Early Spring Seeded Crops Terminate cover crops as soon as practical prior to planting the crop. [Additional Cover Crop Termination Considerations 4 and 8.]
Zone 3	Terminate cover crop at or before the planting of the crop.	
Zone 4	Terminate cover crop at or within 5 days after planting, but before crop emergence.	

Additional Cover Crop Termination Considerations:

1. If the season is drier than normal nearing cover crop termination time, consider an earlier termination to conserve soil moisture.
2. If the spring season is wetter than normal at cover crop termination time, consider a later termination to use excess soil moisture and improve seedbed condition.
3. If the cover crop is part of a no-till system, termination can be delayed up to 7 days from the above termination period guideline, but terminated prior to crop emergence.

Additional Cover Crop Termination Considerations (Continued):

4. In zones 1 and 2, fall seeded cover crops will have limited growth in the spring prior to “early” spring seeded crops (e.g., spring wheat, sugar beets, corn), and therefore the cover crop may be terminated at or just prior to planting.
5. Cover crop termination zones 1 and 2, in the largely mountainous regions in the Western U.S. (from Montana south to New Mexico and west to California), were refined by NRCS and other local university experts to identify proper cover crop management due to wide variability in climate and cropping systems in those areas.
6. Early vs. Later Spring Seeded Crops - Crops planted as early as possible after the spring thaw are considered early spring crops (e.g., spring wheat, spring barley, sugar beets, corn). Later spring crops include such crops as dry beans and soybeans.
7. New Technology - Where new technology has at least 3 years of satisfactory performance (achieves historical yield) based on farm records and the written approval of two “agricultural experts” as defined by RMA, the cover crop may be terminated closer to planting, if recommended by the experts.
8. Cover Crop Grazing - Cover crops may be grazed as long as the planned amount of biomass is available at the time of termination. Cover crops that winterkill may be grazed to a level that meets their conservation purpose.
9. Irrigated Crops – Termination of cover crops utilized in an irrigated cropping system are not restricted to a given cover crop termination zone. The cover crop should be terminated based on the crop system and conservation purpose, but before the planted crop emerges.
10. Herbaceous Wind Barriers - There are specific cropping situations when seasonal cover is needed to protect young seedlings from wind erosion abrasion. The typical seasonal covers may include such crops as wheat, rye, or oats that are planted in rows, e.g., 20 feet apart (single or double row of small grain). These seasonal covers fall under the [NRCS Conservation Practice Code 603 – Herbaceous Wind Barriers](#).
11. Short Season Cover Crops – There are specific cropping situations where the producer will plant the intended crop, plus a short term seasonal cover crop ([NRCS Conservation Practice Code 340 – Cover Crop](#)) prior to or at the same time as planting the main or insured crop. In this case the seasonal cover emerges first and provides short term wind erosion protection until the main crop becomes established and provides its own protection from wind erosion. These seasonal cover crops are terminated by cultivation, frost /winterkill, or herbicides once the main crop is established. The seasonal covers used for the purpose of early crop establishment must be appropriate species for the area and the planned purpose.



Tillage turnips used as a cover crop.

Photo: Justin Fritsher, NRCS



Cover crops in an orchard reduce soil erosion.

Photo: Gary Kramer

Additional Cover Crop Termination Considerations (Continued):

12. Early Crop Planting – When earlier than normal planting occurs due to favorable weather or soil conditions, cover crop termination will naturally occur closer to planting. For example, in zone 2, if planting occurs 2 weeks earlier than normal, the cover crop termination period may be 2 weeks closer to planting.
13. Multiple Climates Within a County – Some counties may have multiple climate areas. In these situations, producers may request a different cover crop termination zone due to unique geographical and topographical features that reflect a different climate. Producers should contact either Extension or the local NRCS for management guidance. If the guidance includes practices other than indicated by the zones in this document, the producer must inform FSA and their crop insurance agent, as appropriate, and provide copies of the recommended management practice.

Definitions:

1. Over-Seeding/Interseeding – Both terms can be defined as planting one or more cover crop species into an existing or established crop. Common uses that involve over-seeding or interseeding include: (1) over-seeding a grass and/or legume cover crop into an existing stand of small grain at an appropriate time for the cover and germination, or (2) seeding a cover crop into an existing crop of corn or soybeans about the time of physiological maturity (leaves beginning to yellow) to get the cover crop started a few weeks earlier. Neither of these examples of over-seeding/interseeding would interfere with harvest of the main crop.
2. Interplanted – This involves multiple crop species grown together, with no distinct row pattern and does not permit separate agronomic maintenance or management. For RMA purposes, this means if a cover crop and cash crop are planted in a way that does not permit separate agronomic maintenance or management, then RMA will not insure the cash crop. This would also apply to cover crops if interplanted into the main crop and the cover crop interfered with the agronomic management and harvest of the main crop.
3. Relay Cropping – The practice of interseeding a second crop into the first crop well before it is harvested. The relay cropping strategy is used to enable production of a second crop in areas where time for seeding the second crop following harvest of the first is considered inadequate for double cropping. This is not considered a cover cropping practice, but a method of double cropping and may fall under the RMA 1st / 2nd crop rules.
4. Double-Cropping – RMA and NRCS term: Harvesting at least 2 crops from the same land in the same year. This does not include cover crops.
5. Harvested Cover – If an annual “cover” crop is harvested (e.g., as hay or silage) then that annual “cover” crop is considered a “crop”.
6. Good Farming Practice – RMA term - The production methods utilized to produce the insured crop and allow it to make normal progress toward maturity and produce at least the yield used to determine the production guarantee or amount of insurance, including any adjustments for late planted acreage, which are: (1) for conventional or sustainable farming practices, those generally recognized by agricultural experts for the area; or (2) for organic farming practices, those generally recognized by organic agricultural experts for the area or contained in the organic plan.
7. Late Planting Period – RMA term - The period of time following the date considered as the latest planting date for an insured crop. The late planting period may vary from a week up to a few weeks.
8. Prevented Planting – RMA term - Failure to plant the insured crop by the final planting date designated in the Special Provisions for the insured crop in the county, or within any applicable late planting period, due to an insured cause of loss that is general to the surrounding area and that prevents other producers from planting acreage with similar characteristics.

Zone 1 - See Map	Zone 2 - See Map	Zone 3 - See Map	Zone 4 - See Map
Cover Crop Termination Period Guidance:			
<p>For Late Spring to Fall Seeded Crops - Terminate cover crops 35 days or earlier prior to planting the crop.</p> <p>Early Spring Seeded Crops - Terminate cover crops as soon as practical prior to planting the crop. (Additional Cover Crop Termination Considerations 4 and 8)</p>	<p>For Late Spring to Fall Seeded Crops - Terminate cover crops 15 days or earlier prior to planting the crop.</p> <p>Early Spring Seeded Crops - Terminate cover crops as soon as practical prior to planting the crop. (Additional Cover Crop Termination Considerations 4 and 8)</p>	<p>Terminate cover crop at or before planting the crop.</p>	<p>Terminate cover crop at planting or within 5 days after planting, but before crop emergence.</p>

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Cover Crop Termination Zones

