

NATURAL RESOURCES CONSERVATION SERVICE  
MONTANA CONSERVATION PRACTICE SPECIFICATION**COVER CROP (ACRE)****CODE 340**

**SCOPE:** Cover Crops are grown to protect and improve the soil. Cover crops can control erosion, reduce weed populations, increase soil microbial activity, maintain or improve organic matter and soil health. They can reduce compaction, improve water infiltration and increase water-holding capacity, decrease leaching of water soluble nutrients and help manage soil moisture. Cover crops add, retain and recycle plant nutrients, especially nitrogen, increase biodiversity, and can provide habitat for wildlife, beneficial insects and pollinators. This specification provides guidelines for establishment and maintenance of cover crops.

There are many ways to use cover crops in a production cycle including:

- As an off-season crop grown to protect the soil during critical erosion periods.
- As an off-season legume crop grown to add nitrogen to the soil for subsequent crops.
- As an off-season crop grown to enhance soil health, improve soil nutrient cycling, increase organic matter and water-holding capacity for subsequent crops.
- As a crop to remove excess nutrients from the soil profile. Plants must have quick germination and a rooting depth sufficient to reach nutrients. A current soil test is necessary to determine where excess nutrients reside in soil profile.
- As a crop to minimize or break up soil compaction. Select deep-rooted crops such as radish and turnip to break up compaction layers in soil and increase infiltration. Crops selected must have roots that are able to grow through compaction layers. Planning must provide for adequate time for crops to develop a root system that is able to penetrate compaction layers.

Cover crops must be correctly selected and managed for the planned purpose. There are many possible cover crops, each differing in potential benefits and in adaptability to particular climates and rotational schemes. The most commonly used cover crops are **annual** grasses and legumes. Perennial species may be seeded but are required to be utilized as an annual, i.e., terminated during one growing season.

Consider soil moisture, cover crop and weed species maturity when terminating cover crops. Terminate cover crops early to conserve soil moisture for the subsequent crop. Cover crop species and weeds should be terminated prior to seed set to reduce potential for weed problems in following year's crop. Consider potential for cover crop species to become weeds in the crop rotation when selecting species. Many cover crop species such as hairy vetch and sweet clover have a high percent of hard seed (10-20%) which can germinate in the following year's crop. Hairy vetch, sweet clover, buckwheat, cereal rye, ryegrass and other species can become weed problems if proper management is not followed. For cover crop species with the potential to become weeds, options and procedures for control should be included in the operation and maintenance plan.

When managing for soil nutrient additions, the best time to terminate leguminous cover crops is the period just before or at full bloom. This ensures decomposition and nutrient release over a longer period of time (versus termination prior to bloom). To eliminate potential insect or disease infestations associated with growing green tissue (the green bridge) cover crops should be terminated at least two to three weeks prior to planting the next crop.

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Weeds are suppressed with cover crops during germination and establishment, while the cover is growing, and following desiccation and termination. Cover crops that germinate and emerge quickly before weeds grow will be the most effective. Choose single species or mixtures of crops based on lifecycle of weeds present and cover crop growth characteristics.

Consider type of cover crop species (warm season or cool season) when selecting individual species or "cocktail mixes". Plant cool season species in early spring and warm season species when soil and air temperatures are warmer. For example, buckwheat and teff are sensitive to frost and are killed by light frosts and should only be planted after danger of frost is past. Brassica species and spring grains are more frost tolerant and can grow under cooler temperatures. Warm season species can be planted in late spring to late summer, if adequate moisture and adequate growing season is available before killing frost. This will allow enough time to grow and take up nutrients; ensure biomass production, but not enough time to set seed.

To increase diversity in a rotation chose individual species or "cocktail mixes" that are different from the current rotation. If current rotation is small grains (cool season grass) consider adding cool season broadleaves such as peas or lentils or adding warm season broadleaves such as safflower or sunflower or adding warm season grasses such as corn or millet to the rotation. When planting "cocktail mixes" same season broadleaves or grasses can be mixed but mixing of cool season and warm season species in mixes is generally not recommended unless a mid-season planting is used. Mixtures should have enough diversity to ensure a variety of species/crop types with different above-ground growth, rooting depths and types, flowering and maturity ranges and residue types. Mixtures containing five to nine species representing different crop types will ensure adequate diversity. Some crops such as corn, soybeans, sugar beets and canola have been developed with resistance to the herbicide glyphosate and are marketed as "Roundup Ready<sup>®</sup>" crops. If these crops are used in a mix, care should be taken to ensure control of volunteer or "escape" plants, especially if glyphosate is used to control weeds in the rotation.

The following tables have listings of cover crops for erosion control, soil health, deep-rooted species and their associated full production seeding rates.

**TABLE 1. COVER CROP FOR EROSION CONTROL <sup>1/</sup>**

<b>Cool Season Broadleaves</b>	<b>Warm Season Broadleaves</b>	<b>Cool Season Grasses</b>	<b>Warm Season Grasses</b>
beet,	buckwheat	barley, spring	corn
camelina	safflower <sup>2/</sup>	oats, spring	millet
canola, spring	soybeans	wheat, spring	sorghum
clover, spp.	sunflower	wheat, winter	sudangrass
flax		triticale, spring	sorghum/sudangrass hybrids
radishes, deep-rooted (forage or daikon)		triticale, winter	teff
sweetclover			
turnips			
vetch			

<sup>1/</sup> Cover crop species can have a wide range of seeding dates ranging from spring to fall depending on specific use and climatic conditions. Generally soil moisture must be apparent within the top two inches of soil to ensure planting success. This is not a complete list; consult the NRCS State Agronomist to plant other species.

<sup>2/</sup> Safflower should be planted as early as small grains but needs a full growing season for optimum seed production.

**TABLE 2. COVER CROPS FOR SOIL HEALTH <sup>1/2/</sup>**

Cool Season Broadleaves	Warm Season Broadleaves	Cool Season Grasses	Warm Season Grasses
alfalfa	beans, field	barley, spring	corn
beet	buckwheat	oats, spring	millet
camelina	chickpea	triticale, spring	sorghum
canola, spring	cowpea	triticale, winter	sudangrass
clover, spp.	soybeans	wheat, spring	sorghum/sudangrass crosses
flax	safflower <sup>3/</sup>	wheat, winter	teff
lentils	sunflower		
peas, field			
radishes, deep-rooted (forage or daikon)			
sweetclover			
turnips			
vetch			

<sup>1/</sup> Cover crop species can have a wide range of seeding dates ranging from spring to fall depending on specific use and climatic conditions. Generally soil moisture must be apparent within the top two inches of soil to ensure planting success. This is not a complete list; consult the NRCS State Agronomist to plant other species.

<sup>2/</sup> Addition of organic matter is essential for improved health.

<sup>3/</sup> Safflower should be planted as early as small grains but needs a full growing season for optimum seed production.

**TABLE 3. DEEP-ROOTED COVER CROPS TO BREAK UP COMPACTED SOILS <sup>1/</sup>**

Species	Crop Type	Crop Growth Cycle
Alfalfa	Cool season broadleaf	Perennial
Radish, deep-rooted (forage or daikon) <sup>2/</sup>	Cool season broadleaf	Annual
Safflower <sup>3/</sup>	Warm season broadleaf	Annual
Sunflower	Warm season broadleaf	Annual
Turnip	Cool season broadleaf	Biennial

<sup>1/</sup> This is not a complete list; consult the NRCS State Agronomist to plant other species.

<sup>2/</sup> Radish can “bolt” and produce seed (rather than deep roots) based on cool temperatures after emergence and radish type. Oilseed type radishes have shown a greater tendency to “bolt” than daikon or forage types that have been selected for root growth.

<sup>3/</sup> Safflower should be planted as early as small grains but needs a full growing season for optimum seed production.

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**TABLE 4. SEEDING RATES FOR COVER CROPS BASED ON MAXIMUM CROP PRODUCTION <sup>1/2/</sup>**

SPECIES	DRILLED SEEDING RATES (lb./ac. PLS)	
	Dryland	Irrigated
alfalfa	5	6
barley, spring	45-60	60-75
beet, sugar <sup>3/</sup>	Not recommended	45,000 (# seeds/ac)
buckwheat	40-50	40-50
camelina	3-5	5-7
canola spring	5-8	5-8
chickpea (desi)	80-100	80-100
chickpea (kabuli)	125-150	125-150
clover berseem	8	9
Clover spp	3-6	3-6
corn <sup>3/</sup>	10-15,000 (# seeds/ac)	32-40,000 (# seeds/ac)
Flax	25-30	30-35
Cowpeas	20-30	30-40
lentils (IndianHead-22,000sds/lb)	40-70	40-70
millet, Foxtail	4-12	4-12
Millet, Pearl	10-20	10-20
millet, Proso	15-30	15-30
Oats	50-60	60-70
peas field	70-150	70-150
radishes, deep-rooted (forage or daikon)	8	10
Safflower	15-30	15-30
Sorghum	5-8	8-10
sorghum / Sudangrass crosses	5-8	8-10
Soybeans	25-40	35-45
sudangrass	25-30	25-30
sunflower <sup>3/</sup>	14-21,000 (# seeds/ac)	20-25,000 (# seeds/ac)
sweetclover	4	3-6
teff	4-5	5-6
triticale spring	50-60	60-70
triticale winter	45-55	55-65
turnips	8	8
vetch, chickling	60	60
vetch, hairy	25-30	25-30
wheat spring	50-60	60-80
wheat winter	40-60	50-70

<sup>1/</sup> Cover crop species can have a wide range of seeding dates ranging from spring to fall depending on specific use and climatic conditions. Generally soil moisture must be apparent within the top two inches of soil to ensure planting success. This is not a complete list; consult the NRCS State Agronomist to plant other species.

<sup>2/</sup> Seeding rates are for a single species planted for maximum crop production; adjust rates for mixtures based on desired percent composition of species.

<sup>3/</sup> Seed size can vary widely; consider planting by number of seeds per square feet or acre to ensure adequate stands. Recommended seed rates for corn, sugar beet and sunflower are based on seeds per square foot.

**PLANTING METHODS:** Each field should be evaluated for weed populations to ensure good stands. Seeding on fields with significant weed or volunteer plant populations will be delayed until weeds are controlled by mechanical tillage, organic methods or chemically with labeled herbicides prior to planting. Check residual effect of previously applied herbicides prior to planting cover crops. Any potential carryover problems must be addressed by delaying seeding, or changing species to prevent planting failures. Ensure adequate moisture is available and good seed to soil contact for germination and seedling growth. Base fertilizer recommendations on current soil test analysis which at the minimum shall include 0-6" analysis for Nitrate (NO<sub>3</sub>), Phosphorus-Olsen method (P), Potassium (K), Organic Matter (OM), pH, and Electro Conductivity (EC) and a 6-24" sample for NO<sub>3</sub>. Plant at recommended seeding rates and depths, when planting cocktail mixes with different species adjust rates based on desired species percent composition. When small seeded species such as turnip and radish are in the mix plant approximately one-half to one inch in depth. Deeper planting depths may reduce germination of these species. Use a current seed analysis with germination, purity and noxious seed percent and calculate seeding rates based on a Pure Live Seed (PLS) basis.

Establish stand of vegetation according to recommended seeding rates (see Table 3). Control pests according to the Field Office Technical Guide (FOTG), Section IV, Practice Standard for Integrated Pest Management (Code 595). If nutrients are applied, guidelines will follow the FOTG, Section IV, Practice Standard for Nutrient Management (Code 590).

**OPERATION AND MAINTENANCE:** Perform all seedbed preparation and planting operations in a manner that will minimize erosion until cover establishment. Control weeds in the cover crop by herbicide application or terminate cover crop before seed set of weeds and cover crop species. Annually terminate cover crop as late as possible in summer or fall to maximize plant growth while retaining adequate soil moisture for the subsequent crop. To avoid potential insect or disease infestations associated with green tissue, terminate cover crop at least two to three weeks prior to planting the next crop. If the cover crop is to be grazed, a site-specific inventory of cover crop production and guidance for the estimated number of AUMS of grazing should be provided for each field. Fields should be monitored to ensure adequate residue levels and soil quality objectives are met. Test for nitrate levels or Prussic acid if sorghum, sudangrass or sorghum sudangrass hybrids are present in the mix prior to grazing. Be careful if livestock are moved from dry pasture or range onto lush green cover crops. Monitor animals to ensure animals are healthy.