

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD**

COVER CROP

(acre)

CODE 340

DEFINITION

Crops including grasses, legumes and forbs for seasonal cover and other conservation purposes.

PURPOSE

- 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.
- Suppress weeds.
- Provide supplemental forage.
- Manage soil moisture.
- Reduce particulate emissions into the atmosphere.
- Minimize and reduce soil compaction.

CONDITIONS WHERE PRACTICE APPLIES

On all lands requiring 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, fertility requirements, and planting methods will be consistent with approved local criteria and site conditions. Select appropriate species from Table 1.

The species selected will be compatible with other components of the cropping system including nutrient and pest management.

Seed must be clean and relatively free of weed seed and other contaminants and must comply with the Federal Seed Act and the Missouri State Seed Law. Do not plant seed that has become wet, moldy, or otherwise damaged.

Plant cover crop seeds at the proper depth for fast emergence based on Table 1. If the seed is applied by broadcast methods, roll or culti-pack the area immediately after spreading the seed on a prepared seedbed. If the seed is broadcast into 50 percent or more surface residue or into a growing crop, increase the broadcast seeding rate by 50 percent. Rolling or cultipacking will not be required.

Cover crops will be terminated by harvest (mechanical or grazing), frost, mowing, tillage, roller crimping, and/or herbicides in preparation for the following crop. The terminated cover crop must provide adequate surface protection to meet the desired purpose or purposes.

Herbicides used with cover crops will be compatible with the following crop in the rotation. Refer to Crop Replant and Rotation Guides in UMC Publication MP-575, "Weed Control Guide for Missouri Field Crops".

If tillage is used to terminate the cover crop, do not incorporate the cover crop residue more than two weeks prior to planting the next crop.

If the next crop is to be planted using no till planters or drills, control the cover crop with herbicide or roller crimpers to eliminate competition while maintaining the benefits of surface residue for runoff and erosion control.

Avoid using plants that are on Missouri's noxious (invasive) weed list.

Cover crop residue will not be burned.

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resource Conservation Service or download the standard from the electronic Field Office Technical Guide for Missouri.

**NRCS MOFOTG
March 2011**

Summer Cover Crops

Select species and seeding rates for the appropriate season from Table 1 of this standard. Select species that provide desired benefits as a nurse crop, temporary cover, and/or green manure crop.

Winter Cover Crops in Row Crop Production

If establishing the cover crop prior to the harvest of the growing crop, select an appropriate species or mixture and the seeding rate from Table 1. Broadcast the seed by a method that allows for good coverage of the field and does minimal crop damage to the standing crop. Recommended seeding dates are prior to leaf drop of the crop. No seedbed preparation is necessary.

If seeding the cover crop after the harvest of the primary crop, select cover crop species or mixtures, seeding rate, and planting method for the appropriate season. Seed may be planted either no till or broadcast into existing residue cover.

Cover Crops for Orchards, Vineyards, and Nurseries

Apply fertilizer and lime according to a current soil test to meet the needs of the cover crop. Incorporate the soil amendments to a minimum depth of three inches while preparing a suitable seedbed.

Plant winter rye, winter triticale, winter wheat, winter barley, or annual ryegrass. Select an appropriate planting date for the cover crop species.

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 periods for wind and water.

Plants selected for cover crops will have the physical characteristics necessary to provide adequate protection to the field.

The amount of surface and/or canopy cover needed from the cover crop shall be determined using current erosion prediction technology.

Additional Criteria to Increase Soil 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 NRCS Soil Conditioning Index (SCI) procedure will be used to determine the amount of biomass required to have a positive trend in the soil organic matter subfactor.

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 Excess Nutrients in the Soil Profile

Cover crops will be established and actively growing before the expected periods 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. If the objective is to best synchronize the use of cover crop as a green manure to cycle nutrients, factors such as the carbon/nitrogen ratios may be considered to kill early and have a faster mineralization of nutrients to match release of nutrient with uptake by following cash crop. A late kill may be used if the objectives are to use as a biocontrol and maximize the addition of organic matter. The right moment to kill the cover crop will depend on the specific rotation, weather and objectives.

Additional Criteria to Promote Biological Nitrogen Fixation

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

Inoculate the legume seed at the time of planting with the specific *Rhizobium* bacteria for that species. Select and apply the proper inoculant and amount recommended by the manufacturer for the species to be planted.

The inoculant will be mixed with the seed and applied during the planting operation. Use a binder or sticking agent to help the inoculant adhere to the seed. Acceptable binders are commercially available or use a solution of water and corn syrup or sugar in a 10 to 1 ratio.

Additional Criteria to Increase Biodiversity

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

Additional Criteria for Weed Suppression

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

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

For long-term weed suppression, reseeding annuals and/or biennial species can be used.

Additional Criteria to Provide Supplemental Forage

Species selected will 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.

Additional Criteria for Soil Moisture Management

Terminate growth of the 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 into the Atmosphere

Manage cover crops and their residues so that at least 80 percent ground cover is maintained during planting operations for 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.

CONSIDERATIONS

Plant cover crop in a timely matter 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 and moisture depletion.

Use deep-rooted species to maximize nutrient recovery.

Use grasses to utilize more soil nitrogen, and legumes utilize both nitrogen and phosphorus.

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

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.

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 dates.
- Establishment procedure.
- Planned rates 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 AND MAINTENANCE

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

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

Control soil moisture depletion by selecting water efficient plant species and terminating the cover crop before excessive transpiration.

REFERENCES

Bowman, G., C. Cramer, and C. Shirley. A. Clark (ed.). 1998. Managing cover crops profitably. 2nd ed. Sustainable Agriculture Network Handbook Series; bk 3. National Agriculture Library. Beltsville, MD.

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

Magdoff, F. and H. van Es. Cover Crops. 2000. p. 87-96 *In* Building soils for better crops. 2nd ed. Sustainable Agriculture Network Handbook Series; bk 4. National Agriculture Library. Beltsville, MD.

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.

Cover Crop Table 1 - Performance and Roles

<i>Species</i>	<i>Crop Type¹</i>	<i>Winter Hard-ness²</i>	<i>Total N (lbs/A)³</i>	<i>Dry Matter (lbs/A/yr)</i>	<i>N Scav-enger⁴</i>	<i>Soil Builder⁵</i>	<i>Erosion Fighter⁶</i>	<i>Weed Fighter</i>	<i>Good Graze⁷</i>	<i>Break Compact Layers⁸</i>
Non-Legumes										
Annual Ryegrass	CG	Statewide		2,000-9000	VG	VG	VG	VG	VG	G
Spring or Winter Barley	CG	Statewide		2,000-10,000	VG	VG	E	VG	VG	G
Spring Oats	CG	NFT		2,000-10,000	VG	G	VG	E	G	P
Spring or Winter Rye	CG	Statewide		3,000-10,000	E	E	E	E	G	F
Spring or Winter Wheat	CG	Statewide		3,000-8,000	VG	VG	VG	VG	VG	G
Spring or Winter Triticale	CG	Statewide		3,000-10,000	VG	VG	VG	E	G	G
Corn	WG	NFT		3,000-12,000	VG	G	G	F	G	G
Grain Sorghum	WG	NFT		6,000-10,000	VG	G	G	F	G	E
Sorghum-Sudangrass	WG	NFT		8,000-10,000	E	E	E	VG	VG	E
Pearl Millet	WG	NFT		4,000-8,000	VG	G	G	G	G	F
Proso Millet	WG	NFT		2,000-6,000	F	F	G	F	G	P
Safflower	CB	NFT		2,000-4,000	VG	G	F	F	P	F
Turnip	CB	NFT	30-120	3,000-6,000	G	G	F	F	G	G
Oilseed Radish	CB	NFT	50-200	4,000-7,000	E	VG	VG	E	G	E
Buckwheat	WB	NFT		2,000-4,000	P	G	F	E	P	P
Legumes (produces soil nitrogen when properly inoculated)										
Cowpeas	WB	NFT	100-150	2,500-4,500	F	G	E	E	G	G
Crimson Clover	WB	South MO only	100-200	3,500-5,500	G	VG	VG	VG	E	F
Soybean	WB	NFT	30-70	4,000-8,000	G	G	F	F	G	F
Sunnhemp	WB	NFT	60-120	2,000-6,000	G	VG	F	F	F	G
Hairy Vetch	CB	Statewide	90-200	2,300-5,000	F	VG	G	G	G	G
Alsike Clover	CB	Statewide	70-140	2,000-5,000	F	G	G	VG	VG	F
Red Clover	CB	Statewide	70-150	2,000-5,000	G	VG	G	VG	E	VG
Subterranean Clovers	CB	NFT	75-200	3,000-8,500	F	VG	VG	E	VG	P
Sweetclover	CB	Statewide	90-170	3,000-5,000	F	E	VG	VG	VG	E
White Clover	CB	Statewide	80-200	2,000-6,000	F	G	VG	VG	E	F
Woollypod Vetch	CB	NFT	100-250	4,000-8,000	G	E	G	E	G	VG
Field Pea	CB	NFT	90-150	4,000-5,000	F	G	VG	G	VG	F
Alfalfa	CB	Statewide	70-120	4,000-8,000	G	VG	G	G	E	G

Table 1 Performance and Roles (Continued)

Species	Quick Growth	Lasting Residue ⁹	Duration ¹⁰	Harvest Values ¹¹		Cash Crop Interseed ¹²	Comments
				F*	S*		
Non-Legumes							
Annual Ryegrass	VG	VG	VG	G	F	E	Heavy N & water use; likes wet soils.
Spring or Winter Barley	VG	E	F	VG	F	VG	Tolerates moderately alkaline conditions but does poorly in acid soil pH<6.0.
Spring Oats	E	G	F	G	G	E	Prone to lodging in N-rich soil.
Spring or Winter Rye	E	E	VG	F	F	VG	Tolerates triazine herbicides; may be allelopathic to corn.
Spring or Winter Wheat	VG	VG	VG	G	VG	F	Heavy N and water user in spring.
Spring or Winter Triticale	VG	VG	VG	F	G	F	
Corn	VG	E	VG	VG	VG	P	
Grain Sorghum	G	VG	VG	G	G	P	
Sorghum-Sudangrass	E	VG	E	E	P	P	Mid-season cutting increases yield and root penetration.
Pearl Millet	VG	VG	VG	F	G	P	
Proso Millet	F	F	F	G	F	P	Heavy seed producer for later competition.
Safflower	F	F	F	P	F	P	
Turnip	VG	F	G	G	F	P	
Oilseed Radish	VG	F	G	VG	F	F	Good N scavenging and weed control; N released rapidly; does not like acid soils.
Buckwheat	E	P	F	P	VG	VG	Summer smother crop; breaks down quickly.
Legumes							
Cowpeas	VG	F	E	G	G	G	Season length, habit varies by cultivar.
Crimson Clover	G	G	F	E	VG	E	Establish easily, grows quickly if planted early in fall; matures early in spring; does not like wet soils.
Soybean	G	P	G	P	VG	G	
Sunn hemp	G	G	VG	G	P	P	Will not set seed in Missouri.
Hairy Vetch	F	F	VG	F	VG	G	Bi-culture with small grain expands seasonal adaptability.
Alsike Clover	F	F	G	G	F	F	Suited to poor fertility soils, more tolerant of acid soils.
Red Clover	F	F	G	E	VG	E	Excellent forage, easily established; widely adapted.
Subterranean Clover	G	VG	VG	VG	P	E	Strong seedlings, quick to nodulate.
Sweetclovers	G	VG	VG	VG	G	G	Tall stalks, deep roots in second year.
White Clover	F	F	E	VG	G	VG	Persistent after first year.
Woollypod Vetch	VG	F	VG	F	VG	G	Reseeds poorly if mowed within 2 months of seeddrop; overgrazing can be toxic.
Field Pea	F	F	G	G	P	F	Needs small grain crop for climbing vines.
Alfalfa	F	F	VG	VG	F	E	Perennial cover for longer cover.

Table 1 Performance and Roles (Continued)

Species	Tolerances					Habit ¹³	pH (Pref.)	Establishment Periods ¹⁴	Min. Germ. Temp.
	Heat	Drought	Shade	Flood	Low Fert				
Non-Legumes									
Annual Ryegrass	F	F	VG	VG	F	U	6.0-7.0	March, Aug-Sept	40°F
Spring and Winter Barley	VG	VG	G	F	VG	U	6.0-8.5	Mar-May, Aug-Oct	38°F
Spring Oats	F	F	F	G	G	U	4.5-7.5	March-April, August-mid Sept.	38°F
Spring and Winter Rye	G	VG	VG	G	E	U	5.0-7.0	March-May, August-mid Nov.	34°F
Spring and Winter Wheat	G	G	G	P	G	U	6.0-7.5	March-May, October-November	38°F
Spring and Winter Triticale	G	G	G	F	G	U	5.0-7.0	March-April August-October	38°F
Corn	VG	F	P	P	F	U	5.6-7.5	April-July	55°F
Grain Sorghum	VG	G	P	F	G	U	5.6-7.5	May-July	65°F
Sorghum-Sudangrass	E	E	G	G	G	U	6.0-7.0	May-July	65°F
Pearl Millet	VG	F	F	P	G	U	5.0-7.0	June-July	65°F
Proso Millet	G	P	P	P	G	U	5.6-7.5	June-August	65°F
Safflower	F	F	F	P	F	U	6.5-7.5	Mar-May, Aug-Sept	40°F
Turnip	G	F	G	F	F	U	6.0-7.5	March-May, August	45°F
Oilseed Radish	G	F	G	F	F	U	6.0-7.5	March-May, August	45°F
Buckwheat	G	P	F	F	F	U/SU	5.0-7.0	March-August	50°F
Legumes									
Cowpeas	E	VG	G	F	E	SU/C	5.5-6.5	July-August	58°F
Crimson Clover	G	F	VG	F	G	U/SU	5.5-7.0	July-August	60°F
Soybean	VG	F	F	F	G	U	6.0-7.0	May-August	60°F
Sunnhemp	E	G	F	F	VG	U	6.0-7.0	May-August	60°F
Hairy Vetch	F	G	G	G	F	C	5.5-7.5	August-September	60°F
Alsike Clover	F	P	F	P	G	SU	6.0-7.5	March, August	38°F
Red Clover	F	F	VG	G	F	U	6.2-7.0	Mar-Apr, Aug-Sept	41°F
Subterranean Clover	G	VG	VG	G	E	P/SP	5.5-7.0	August	38°F
Sweetclover	VG	E	F	F	E	U	6.5-7.5	March-August	42°F
White Clover	G	G	VG	VG	G	P/SU	6.0-7.0	Feb-May, Aug-Sept	40°F
Woollypod Vetch	VG	VG	G	G	VG	SP/C	6.0-8.0	August-September	40°F
Field Pea	F	P	F	F	G	C	5.5-6.5	Mar-Apr, Aug-Sept	40°F
Alfalfa	G	F	F	P	G	U	6.0-7.5	April-September	40°F

Table 1 Performance and Roles (Continued)

Species	Planting Depth (Inches)	SeedingRate			Inoculant Type	Reseeds
		Drilled (lbs/A)	Broadcast (lbs/A)	Drilled Middles (lbs/A)		
Non-Legumes						
Annual Ryegrass	0-½	9	14	3	NA	Usually
Spring or Winter Barley	¾-2	60	80	20	NA	Sometimes
Spring Oats	½-1½	35	50	12	NA	Sometimes
Spring or Winter Rye	¾-2	45	65	15	NA	Usually
Spring or Winter Wheat	½-1½	60	80	20	NA	Sometimes
Spring or Winter Triticale	½-1½	50	75	15	NA	Reliably
Corn	¾-1½	20	30		NA	Usually
Grain Sorghum	½-1½	25	34		NA	Usually
Sorghum-Sudangrass	½-1½	25	34		NA	Sometimes
Pearl Millet	½-1	10	15		NA	Sometimes
Proso Millet	½-1	10	15		NA	Usually
Safflower	1-1½	20	30		NA	Sometimes
Turnip	¼-½	4	6		NA	Usually
Oilseed Radish	¼-½	5	8		NA	Sometimes
Buckwheat	½-1	45	60		NA	Sometimes
Legumes						
Cowpeas	1-1½	40	60		Cowpea, Lespedeza	Sometimes
Crimson Clover	¼-½	12	18	4	Crimson, Berseem	Usually
Soybean	1-1½	45	60		Soybean	Usually
Sunnhemp		40	55		Cowpea	No
Hairy Vetch	½-1½	15	20		Pea, Vetch	Sometimes
Alsike Clover	¼-½	3	5	1	Red Clover, White Clover	Usually
Red Clover	¼-½	6	9	2	Red clover, White clover	Sometimes
Subterranean Clover	¼-½	20	30	7	Clovers, sub, rose	Usually
Sweetclovers	¼-1	6	9	2	Alfalfa, Sweetclover	Usually
White Clover	¼-½	3	5	1	Red clover, White clover	Reliably
Woollypod Vetch	½-1	30	40		Pea, Vetch	Sometimes
Field Pea	1½-3	50	70		Pea, Vetch	Usually
Alfalfa	¼-½	8	12	3	Alfalfa	Sometimes

- ¹**Crop type** – Cool-Season grass (**CG**), Warm-Season Grass (**WG**), Cool-Season Broadleaf (**CB**), and Warm-Season Broadleaf (**WB**).
- ²**Winter Hardiness** – Either adapted to climate **statewide, south MO only, or not frost tolerant (NFT)**. Winter hardiness is often dependent on snow cover during intense cold periods.
- ³**Total N** – Total N benefit from entire plant. Grasses not considered N source.
- ⁴**N Scavenger** – Ability to take up and store excess nitrogen.
- ⁵**Soil Builder** – Organic matter yield and soil structure improvement.
- ⁶**Erosion Fighter** – Soil armoring ability of roots and total plant.
- ⁷**Good Graze** – Production, nutritional quality and palatability. Feeding pure legumes can cause bloat problems.
- ⁸**Break Compact Layers** – Ability to reduce compaction in soil profile.
P=Poor **F=**Fair **G=**Good **VG=**Very Good **E=**Excellent
- ⁹**Lasting Residue** – Comparative rating of how long the killed residue remains on the surface.
- ¹⁰**Duration** – Length of vegetative stage.
- ¹¹**Harvest Value** – Economic value as forage (F), as seed (S), or as grain.
- ¹²**Cash Crop Interseed** – Rates how the cover crop will perform with an appropriate companion crop.
P=Poor **F=**Fair **G=**Good **VG=**Very Good **E=**Excellent
- ¹³**Habit** - **C=**Climbing; **U=**Upright, **P=**Prostrate; **SP=**Semi-prostrate; **SU=**Semi-upright.
- ¹⁴**Establishment period** - Listed by month or range of months; seed cover crops in high tunnels up to 1 month prior to a spring month or 1 month after for a fall month.
P=Poor **F=**Fair **G=**Good **VG=**Very Good **E=**Excellent

Other symbols used:

NA – Not applicable to this species.

Table 2 Varieties Adapted to Missouri

Species	Variety
Annual Ryegrass	King, Bounty, Saddle pro, Marshall, Saddle Butte, Soil Builder
Spring or Winter Barley	NR
Spring Oats	Bates, Webster
Spring or Winter Rye	Aroostock (winter variety)
Spring or Winter Wheat	NR
Spring or Winter Triticale	NR
Corn	NR
Grain Sorghum	NR
Sorghum-Sudangrass	Piper
Pearl Millet	Tifleaf I, Tifleaf II, Tifleaf III, Mil Hy-300, Sunny State
Proso Millet	NR
Safflower	NR
Turnip	NR
Oilseed Radish	Adios, Arena
Buckwheat	Mancan, Manor
Cowpeas	NR
Crimson Clover	AU Robbins, AU Sunrise, Dixie
Soybean	NR
Sunnhemp	NR

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Hairy Vetch	Groff, Madison, Winter, Pennington, Kaup
Alsike Clover	NR
Red Clover	Kenland, Kenstar
Subterranean Clover	NR
Sweetclover	Dentra, Polara, Madrid, Goldtop, Yukon
White Clover	Large Leaf, Piligram, Merit, Rega, Tillman
Woollypod Vetch	NR
Field Pea	NR
Alfalfa	NR

NR – No Recommendation