

**NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION PRACTICE STANDARD**

**MULCHING  
(Ac)  
CODE 484**

**DEFINITION**

Applying plant residues, by-products or other suitable materials produced off site, to the land surface.

**PURPOSE**

- Conserve soil moisture
- Moderate soil temperature
- Provide erosion control
- Suppress weed growth
- Facilitate the establishment of vegetative cover
- Improve soil condition
- Reduce airborne particulates

**CONDITIONS WHERE PRACTICE APPLIES**

This practice applies to all lands where mulches are needed. It may be used alone or in combination with other practices.

**CRITERIA**

**General Criteria Applicable to All Purposes**

The selection of mulching materials will depend primarily on site conditions and the material's availability. Mulch shall consist of natural and/or artificial materials that are environmentally safe such as plant residue, wood bark, chips or wood fiber by-products, gravel, plastic, fabric, rice hulls, or other equivalent materials of sufficient dimension (depth or thickness) and durability to achieve the intended effect for the required time period.

Mulching shall be performed as soon as possible after grading and soil surface preparations are complete. Prior to mulching, the soil surface shall be prepared in order to achieve desired purpose and to ensure optimum contact between the soil and mulch.

The mulch material shall be evenly applied by hand or machine at the specified rate and, if necessary, anchored to the soil. Anchoring method will be selected from Table 2. Tackifiers, emulsions,

pinning, netting, crimping or other acceptable methods of anchoring will be used to maintain mulch in place for specified time periods.

Inadvertent movement of mulching or any mulching operation materials (including degraded or decomposed materials) by wind, surface or subsurface water, or mechanical means must not pose a direct or indirect cumulative environmental or safety hazard.

As a minimum, manufactured mulches shall be applied according to the manufacturer's specifications

Mulching operations shall comply with federal, state and local laws and regulations during the installation, operation and maintenance of this practice.

Mulch material shall be relatively free of disease, noxious weed seeds, and other pest and pathogens.

Mulch material, quality, rate and depth of application will be selected from Table 1.

**Additional Criteria to Conserve Soil Moisture**

Mulch materials applied to the soil surface shall provide at least 60 percent cover to reduce potential evaporation.

**Additional Criteria to Moderate Soil Temperature**

Mulch materials shall be selected and applied to obtain 100 percent coverage over the area treated. . The material shall be of sufficient thickness to persist for the period of time required for the temperature modification.

**Additional Criteria to Provide Erosion Control**

When mulching with cereal grain straw or grass hay, apply at a rate to achieve a minimum 70 percent ground cover. Mulch rate shall be determined using current erosion prediction technology to reach the soil erosion objective.

NRCS-Minnesota  
September 2008

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the MN Natural Resources Conservation Service in your area, or download it from the electronic Field Office Technical Guide for Minnesota.

When mulching with other wood products such as wood chips, bark, shavings or other wood materials, apply a minimum 2 inch thickness if the soil is not well-drained and to a 3-4 inch thickness if the soil is well drained..

When mulching with gravel or other inorganic material apply a minimum 2 inches thickness, and shall consist of pieces 0.75 to 2 inches in diameter.

#### **Additional Criteria to Suppress Weed Growth**

The thickness of mulch will be determined by the size of the plant being mulched. Mulches shall be kept clear of the stems of plants where disease is likely to occur. Mulches applied around growing plants or prior to weed seedling development shall have 100 percent ground cover. Thickness of the mulch shall be adequate to prevent emergence of targeted weeds. Plastic mulches may be used.

#### **Additional Criteria to Establish Vegetative Cover**

Mulch shall be applied at a rate that achieves a minimum of 70 percent ground cover to provide protection from erosion and runoff and yet allow adequate light and air penetration to the seedbed to ensure proper germination and emergence.

#### **Additional Criteria to Improve Soil Condition**

Apply mulch materials with a carbon to nitrogen ratio less than 30 to 1 so that soil nitrogen is not immobilized by soil biota. Do not apply mulch with C:N less than 20:1 to an area of designed flow in watercourses.

Use the Soil Conditioning Index to assess soil quality impacts and to determine the type and rate of the mulching material.

#### **CONSIDERATIONS**

Evaluate the effects of mulching on evaporation, infiltration and runoff. Mulch material may affect microbial activity in the soil surface, increase infiltration, and decrease runoff, erosion and evaporation. Increased infiltration increase nutrient and chemical transport below the root zone. The temperature of the surface runoff may also be lowered.

Mulched soil retains moisture, requires less watering and reduces the chance of water stress on plant materials. Mulch also minimizes evaporation from

the soil surface and hence reduces losses from bare soil areas. Mulch material used to conserve soil moisture should be applied prior to moisture loss. Prior to mulching, ensure soil under shallow rooted crops is moist, as these crops require a constant supply of moisture.

Mulch materials with a high water holding capacity and/or high impermeability to water droplets may adversely affect the water needs of plants.

Fine textured mulches (e.g. rice hulls) which allow less oxygen penetration than coarser materials should be no thicker than 1 or 2 inches.

Organic materials with C:N ratios of less than 20:1 will release nitrate-nitrogen which could cause water quality impairments.

Mulching may also provide habitat for beneficial insects and provide pest suppression.

Clear and infra-red transmissions (IRT) plastics have the greatest warming potential. They are transparent to incoming radiation and trap the longer wavelengths radiating from the soil. Black mulches are limited to warming soils by conduction only and are less effective.

Clear mulches allow profuse weed growth and may negate the benefits of soil warming. Black mulches provide effective weed control. Wavelength selective (IRT) plastic blends the soil warming characteristics of clear mulch with the weed control ability of black mulch.

Low permeability mulches (e.g. Plastic) may increase concentrated flow and erosion on un-mulched areas.

Consider potential toxic allelopathic effects that mulch material may have on other organisms... Animal and plant pest species may be incompatible with the site.

Consider the potential for increased pathogenic activity within the applied mulch material.

Keep mulches 3 to 6 inches away from plant stems and crowns to prevent disease and pest problems. Additional weed control may be needed around the plant base area.

Deep mulch provides nesting habitat for ground-burrowing rodents that can chew extensively on bark on tree trunk and/or tree roots. Light mulch applied

after the first cold weather may prevent rodents from nesting.

Installation of this practice with any others proposed, should not negatively impact any federal or state listed Rare, Threatened or Endangered species or their habitat.

Organic fiber mats composed of wood fiber or straw covered with biodegradable polypropylene netting are effective on critical sites including areas of concentrated water flow. Other mat type materials manufactured from paper or similar materials are suitable to provide erosion control while vegetation grows through the mat.

Weed seed (in particular, noxious weeds) may be found in the mulch material. Weed growth should not interfere with the intended purpose or escape through the mulch material. The use of certified weed free mulch may be considered.

Some mulch material may adversely affect aquatic environments through changes in water chemistry or as waterborne debris. Consider placing mulch in locations that minimizes these risks.

## PLANS AND SPECIFICATIONS

Plans and specifications shall be prepared for each site and purpose and recorded using approved specification sheets, job sheets, technical notes, narrative statements in the conservation plan, or other acceptable documentation.

Documentation shall include:

- Purpose of the Mulch
- Type of mulch material used
- The percent cover and/or thickness of mulch material
- Timing of application
- Site preparation
- Listing of netting, tackifiers, or method of anchoring
- Operation and maintenance

## OPERATION AND MAINTENANCE

Mulched areas will be periodically inspected, and mulch shall be reinstalled or repaired as needed to accomplish the intended purpose.

Removal or incorporation of mulch materials shall be consistent with the intended purpose and site conditions.

Operation of equipment near and on the site shall not compromise the intended purpose of the mulch.

Prevent or repair any fire damage to the mulch material.

Properly collect and dispose of artificial mulch material after intended use.

Monitor and control undesirable weeds in mulched areas.

## REFERENCES

Renard, K.G., G.R. Foster, G.A. Weesies, D.K. McCool, and D.C. Yoder, 1997. Predicting Soil Erosion by Water: A Guide to Conservation Planning with the Revised Universal Soil Loss Equation (RUSLE). U.S. Department of Agriculture, Agriculture Handbook No. 703, pp. 175, 177-179.

Toy, Terence J., and George R. Foster, Co-editors, 1998, Guidelines for the Use of the Revised Universal Soil Loss Equation (RUSLE) Version 1.06 on Mined Lands, Construction Sites, and Reclaimed Lands. U.S. Department of the Interior, Office of Surface Mining and Reclamation.

Wischmeier, W.H., and D.D. Smith. 1978, Predicting Rainfall Erosion Losses-A guide to Conservation Planning. U.S. Department of Agriculture, Agriculture Handbook No 537. Pp. 19, 26, 31, 50.

Wischmeier, W.H. 1974, New Developments in Estimating Water Erosion. In: Proceedings of the 29<sup>th</sup> Annual meeting of the Soil Conservation Society of America. Syracuse, New York

**Agriculture and Agri-Food Canada. 2000. Plastic mulches for commercial vegetable production. Canada-Saskatchewan Irrigation Diversification Centre. Outlook, Saskatchewan.**

**Shaffer, M.J., and W.E. Larson (ed.). 1987. NTRM, a soil-crop simulation model for nitrogen, tillage and crop residue management. USDA Conserv. Res. Rep. 34-1. USDA-ARS.**

USDA, NRCS. 2002. National Agronomy Manual. 190-V. Washington, D.C.

**SPECIFICATIONS****TABLE 1 – GUIDE<sup>1</sup> TO MULCH MATERIALS, RATES AND USES**

<b>Mulch Material</b>	<b>Quality Standards</b>	<b>Applicable Rate</b>	<b>Depth of Application</b>	<b>Remarks</b>
<b>Organic Mulches</b>				
Grass Hay or Cereal Grain Straw <sup>2</sup>	Air dried; free of undesirable seeds, coarse material and moldy chunks	1.5 – 2 tons / acre	Lightly cover 75 – 90% of surface	Use where mulch effect is to be maintained for more than three months. Subject to blowing unless kept moist or anchored.
Wood Fiber Hydromulch	Natural wood fiber with green dye and dispersing agent added	0.75 – 1 ton / acre	Lightly cover 100% of the surface	Apply with hydromulcher. Use material with tacking agent for anchoring. Use Maximum rate on critical areas.
Wood Fiber / Paper Blend hydromulch	Blend of natural wood fiber and paper	0.75 – 1 ton / acre	Lightly cover 100% of the surface	Apply with hydromulcher, on 0-2% slopes. Use material with tacking agent for anchoring.
Wood Long-Fiber Excelsior	Air dried burred wood fibers, 4" or longer	1 – 2 tons / acre		Effective for erosion control. Anchoring usually not required except on critical areas or sites subject to high winds.
Sawdust and ground corn cobs	Green or composted, free from weed seeds, trash and coarse materials.	5 tons / acre	2 – 7 inches	Sawdust from hardwood species is preferred to avoid possible toxicity from pitch or resins contained in conifers. Most effective as mulch around ornamentals, small fruits and other nursery stock. Special application rates: fruit trees 5-7"; blueberries – 6", vegetables and flowers, 2-3", blackberries and raspberries 4-7"; strawberries – 3". Resistant to blowing. Requires 30-35 lbs. N/ton to prevent nitrogen deficiency during decay. Rate based on weight of 24-lbs. /cubic foot. Anchoring not required.
Wood Chips or Bark, Shavings	Green or air dried; free of weed seeds, trash and coarse	10 – 20 tons / acre	2 – 7 inches	Chips or shavings from hardwood species are preferred to avoid

	Material			possible toxicity from pitch or resins contained in conifers. Has same use and application as sawdust. Requires 20 – 25 lbs. N/ton to prevent nitrogen deficiency during decay. Resistant to blowing. Decomposes slowly. Anchoring not required.
Cornstalks, shredded or chopped	Air dried; shredded into 8” to 12” lengths	4 – 6 tons/ acre		Effective for erosion control. Slow to decompose. Excellent mulch for field crops. Resistant to wind blowing. Anchoring not required.
Manure	Well shredded, free of coarse materials	8 – 10 tons / acre		May create a problem with weeds. Excellent moisture conserver. Resistant to wind blowing. Do not use manure for water erosion control because surface water may be contaminated. Anchoring is required.
Compost	Commonly made from yard waste (leaves, branches, etc.) or manure	Cover 100% of the ground	2 inches	Applied with a blower truck. Anchoring is not required. Excellent for water infiltration and moisture conservation.
<b>Non-Organic Mulches</b>				
Gravel, crushed stone or slag	Washed	90% ground cover	2-3 inches	Use for permanent erosion control; on short slopes; around woody plants and ornamentals.
Plastic	2-4 mils	Apply according to manufacturer’s specifications	Thickness of one layer.	Use black for weed control and white for seedling establishment without organic mulch. Release plastic after seeding is established. Effective moisture conservation and weed control for small fruits. Large areas should have holes or slits cut to let rainfall percolate. Anchoring is required.

1. This table is not all-inclusive. There may be additional mulch materials or variations of the materials listed here that would be equivalent to achieve the intended effect.
2. Mulch used on native seedings should not consist of pasture hay containing introduced species. Use grain straw mulches only.

**TABLE 2 – GUIDE TO MULCH ANCHORING MATERIALS**

<b>Anchoring Method or Material</b>	<b>Kind of Mulch to be Anchored</b>	<b>How to Apply</b>
<b><u>Mechanical</u></b>		
Mulch Anchoring Tool or Disk	Grass hay, straw or manure	Apply mulch and pull the mulch anchoring tool or disk over mulch. Use equipment with serrated straight disks spaced 6-10" apart or other suitable equipment. Operate as close to the contour as possible. Mulch material should be tucked into the soil surface 2-3 inches. Use on areas of concentrated flow when velocity is less than approximately 4 feet per second.
Tackifier or Binder	Grass hay, straw, Hydromulch materials	Method and rate of application shall be according to manufacturers' recommendation. Use on areas without concentrated flow. Usually applied with a hydromulcher after seeding has been completed.
Wood Hydromulch Fibers	Grass, hay, straw	Use on areas without concentrated flow. Apply with hydromulcher immediately after seeding. Use 3000 lbs. Of mulch material and apply 750 lbs. of wood fiber with tacking agent per acre.
Asphalt Spray (Emulsion)	Grass hay, straw, compost, wood chips, wood shavings	Apply with suitable equipment to spray asphalt into the mulch as it is applied. Materials shall conform to the requirements of ASTM Specifications D 977. Application rate is 0.05 gallons per square yard (242 gallons per acres). Material shall be non-toxic to plant life. Use on areas without concentrated flow.

<b><u>Manual</u></b>	<b>Kind of Mulch to be Anchored</b>	<b>How to Apply</b>
Polypropylene plastic netting	Grass hay, straw, compost, wood shavings, wood long-fiber excelsior.	Apply plastic netting over mulch immediately after mulching and staple with 11 gauge or heavier wire staples. Installation is the same as for fiber

		blankets, mats and netting. Use when concentrated flow velocity is less than 4 feet per second. <sup>1</sup>
Wood Excelsior Fiber Blanket: interlocking web of excelsior fibers with netting on one or both sides. 80% of fibers are 8 inches or longer.	Use without additional mulch.	Anchor per manufacturer's specifications. Effective for erosion control on steep slopes and areas of concentrated flow. <sup>1</sup>
Chopped straw or straw and coconut fiber blanket: Uniform agricultural wheat straw or straw and coconut fiber between photodegradable or biodegradable netting.	Use without additional mulch.	Anchor per manufacturer's specifications. Effective for erosion control on moderate to steep slopes and low flow channels. <sup>1</sup>
Peg and twine	Grass hay, straw, wood shavings, wood long-fiber excelsior	After mulching, divide the area into blocks approximately 1 square yard in size. Drive 4-6 pegs per block to within 2-3" of soil surface. Anchor mulch by stretching twine between pegs in a criss-cross pattern on each block. Secure twine around each peg with two or more turns. Where mowing is planned, drive pegs flush with the soil surface.
Spade	Grass hay, straw, wood shavings, wood long-fiber excelsior	Cut mulch into soil surface with square edge spade. Make cuts in contour rows spaced 18" apart.
Soil and Stones	Plastic	Bury edge of plastic in a trench 6" deep. Firm soil over plastic. Use stones to hold plastic down in other places as needed.

1. Placing and anchoring Blankets, Mats and Netting: In areas of concentrated flow, lay the mat parallel to the direction of water flow, with netting on top. Spread blankets evenly without stretching so fibers are in direct contact with the soil. Adjacent strip edges shall be overlapped 2-4 inches. Strip ends shall overlap a minimum of 10 inches with the upgrade strip on top. The upgrade end of each blanket shall be buried at least 6 inches in a vertical slot with the soil pressed firmly against the embedded mat. Additional check slots at 50-foot intervals may be desirable on steep grades or long flow patterns. Strip ends and end overlaps shall be stapled with not more than 12 inches between staples. All other joints and edges shall be stapled at 4 foot intervals. Additional staples shall be placed down the center of each blanket in a diamond pattern at a maximum of 4-foot intervals. Where velocities exceed 5 cfs, place edge and center staples at 2-foot intervals. All staples shall be inserted flush with the ground surface. Staples shall be 11 gauge or heavier U shaped with a 1-2 inch crown. Staple length shall be determined by soil conditions as follows: Highly compacted soils – 6 inch; Friable soils – 8 inches; Loose or sandy soils – 10 inch.
2. In areas of broad sheet flow, mats may be placed either parallel or perpendicular to slope direction. Spread blankets evenly without stretching so fibers are in direct contact with the soil. Adjacent strip edges shall be overlapped 2-4 inches with upgrade strip on top. Ends of each mat shall be stapled with not more than 12 inches between staples. All other edges and mat centers shall be stapled to hold the mat in place with not more than 4-6 feet between staples. All staples shall be inserted flush with the ground surface. Staples shall be 11 gauge or heavier, U shaped with a 1-2 inch crown. Staple length shall be determined by soil condition as listed above.