



Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

MULCHING

CODE 484

(ac)

DEFINITION

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

PURPOSE

This practice is used to accomplish one or more of the following purposes:

- Conserve soil moisture – Resource concern (INSUFFICIENT WATER – Inefficient moisture management)
- Reduce energy use associated with irrigation – Resource concern (INEFFICIENT ENERGY USE – Farming/ranching practices and field operations and INSUFFICIENT WATER – Inefficient moisture management)
- Provide erosion control – Resource concern (SOIL EROSION – Excessive bank erosion from streams shorelines or water conveyance channels, and/or SOIL EROSION – Concentrated flow erosion, and/or SOIL EROSION - Sheet, rill, & wind erosion)
- Facilitate the establishment of vegetative cover – Resource concern (DEGRADED PLANT CONDITION – Undesirable plant productivity and health)
- Improve soil health – Resource concern (SOIL QUALITY DEGRADATION – Organic matter depletion)
- Reduce airborne particulates – Resource concern (AIR QUALITY IMPACTS - Emissions of Particulate Matter - PM - and PM Precursors)

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all lands where mulches are needed. This practice 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 the purpose(s) for the mulch application site conditions and the material's availability. Mulch materials shall consist of natural and/or artificial materials that are of sufficient dimension (depth or thickness) and durability to achieve the intended purpose for the required time period.

Prior to mulching, the soil surface shall be prepared in order to achieve the desired purpose.

The mulch material shall be evenly applied 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 if needed to hold the mulch in place for specified periods.

In cases where excessive furrow erosion may occur due to concentrated flows from plastic mulches, appropriate measures will be taken to protect the furrows.

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

Mulch material needs to be of a quality to meet the intended purpose.

Additional Criteria to Conserve Soil Moisture and/or Reduce Energy Use Associated with Irrigation

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

Additional Criteria to Provide Erosion Control and to Reduce Airborne

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 conservation objective.

When mulching with wood products such as wood chips, bark, or shavings or other wood materials, apply a minimum 2-inch thickness comprised of particles that remain in place during heavy rainfall and/or strong wind events.

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

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 Health

Use plant-based mulching materials of suitable quantity and quality to add organic matter, provide food and shelter for soil biota, and protect the soil surface from raindrop impact and crusting, while allowing for adequate soil aeration.

Apply mulch materials with a carbon to nitrogen ratio (C:N) 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.

An evaluation of the system using the current approved soil conditioning index (SCI) procedure results in zero or higher.

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. The temperature of the surface runoff may also be lowered.

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 2 inches.

Avoid excessively thick or tightly packed mulches that can result in soggy, anaerobic conditions at the soil surface during wet weather; or prevent rainfall or overhead irrigation from reaching the soil during times of moisture deficit

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

Finely-divided plant residues (e.g., sawdust) and those rich in soluble carbohydrates (e.g., fresh green-chopped sorghum-sudangrass, corn, or other grasses) that have a C:N ratio greater than 30 can tie up soil N and necessitate supplemental N applications on crops. Coarser materials such as grain straw and chipped brush usually do not reduce crop-available soil N levels unless and until they are incorporated into the soil by tillage or cultivation.

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

Use mulch of sufficient ground cover, and suitable thickness and texture to provide habitat for ground beetles, spiders, and other predators of weed seeds and crop pests. Select crops to be mulched, mulching materials, and rates of application that do not contribute to pest problems. Avoid excessively thick or tightly-packed mulches, which can interfere with the movement of ground beetles and other beneficial organisms, and may increase the incidence of crop pests and diseases.

During the period when weed seed predation is desired and predators are most active, avoid pesticide applications or pesticide exposures that could adversely affect weed seed consumers.

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

Light-reflecting mulches such as white or aluminized plastic film or bright straw can repel some pests.

Select mulching materials and methods that are compatible with the crop and site. Consider potential beneficial or detrimental effects of mulching materials on the biotic community surrounding the crop, including beneficial soil micro- and macro-organisms, as well as plant pathogens and plant pests. These effects are specific to site, mulch, and crop, and may include enhanced soil microbial activity, increased or reduced levels of crop diseases, and toxic (allelopathic) activity against the crop, weeds, or other beneficial or pest organisms.

Keep mulch 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 tree trunks and/or tree roots. Light mulch applied after the first cold weather may prevent rodents from nesting.

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.

Consider potential effects of soil physical and chemical properties. Refer to soil survey data as a preliminary planning tool for assessment of areas. Consult the Web Soil Survey at: <http://websoilsurvey.nrcs.usda.gov/app/> to obtain Soil Properties and Qualities information.

For all organic or transitioning to organic operations, follow all National Organic Program (NOP) rules.

PLANS AND SPECIFICATIONS

Specifications shall be prepared for each site and purpose and recorded in the approved 484 implementation requirements 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, and
- 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.

Evaluate the effectiveness of the mulch (application, amount of cover provided, durability, etc.) and adjust the management or type of mulch to better meet the intended purpose(s).

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

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

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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.

Toy, T.J., and G.R. Foster. (Ed.) 1998. Guidelines for the use of the Revised Universal Soil Loss Equation (RUSLE) Version 1.06 on mined lands, construction sites, and reclaimed lands. USDI, OSMR.

USDA, NRCS. 2011. National Agronomy Manual. 190-V, 4th Ed. Washington, D.C.

TABLE 1 - GUIDE¹ TO MULCH MATERIALS, RATES, AND USES

Mulch Material	Quality Standards	Applicable Rate	Depth of Application	Remarks
Organic Mulches				
Grass Hay or Cereal Grain Straw ²	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 Hyromulch	Natural wood fiber with green dye and dispersing agent added	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 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	<p>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".</p> <p>Resistant to blowing. Requires 30-35 lbs. N/ton to prevent nitrogen deficiency during decay. Rate based on weight of 24-lbs.</p> <p>/cubic foot. Anchoring not required.</p>

Mulch Material	Quality Standards	Applicable Rate	Depth of Application	Remarks
Wood Chips or Bark, Shavings	Green or air dried; free of weed seeds, trash and coarse Material	10 – 20 tons / acre	2 – 7 inches	<p>Chips or shavings from hardwood species are preferred to avoid possible toxicity from pitch or resins contained in conifers. Has same use and application as sawdust.</p> <p>Requires 20 – 25 lbs. N/ton to prevent nitrogen deficiency during decay. Resistant to blowing. Decomposes slowly. Anchoring not required.</p>
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		<p>May create a problem with weeds. Excellent moisture conserver. Resistant to</p> <p>wind blowing. Do not use manure for water erosion control because surface water may be contaminated. Anchoring is required.</p>
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.
Non-Organic Mulches				

Mulch Material	Quality Standards	Applicable Rate	Depth of Application	Remarks
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.
<ol style="list-style-type: none"> 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

Anchoring Method or Material	Kind of Mulch to be Anchored	How to Apply
<u>Mechanical</u>		
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.
<u>Manual</u>		

Anchoring Method or Material	Kind of Mulch to be Anchored	How to Apply
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. ¹
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. ¹
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. ¹
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 twin 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.

Anchoring Method or Material	Kind of Mulch to be Anchored	How to Apply
		<ol style="list-style-type: none"> <li data-bbox="248 172 1451 583">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. <li data-bbox="248 592 1451 806">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.

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