

NATURAL RESOURCES CONSERVATION SERVICE  
MONTANA CONSERVATION PRACTICE SPECIFICATION

**MULCHING (ACRE)**

**CODE 484**

**DEFINITION**

Applying plant residues or other suitable materials that are produced off-site to the land surface.

**PURPOSE**

To conserve soil moisture; reduce energy use associated with irrigation; provide erosion control; facilitate the establishment of vegetative cover; improve soil health and reduce airborne particulates.

**CONSERVATION MANAGEMENT SYSTEMS**

Mulching may be a component of a conservation management system. It is used in conjunction with critical area planting, conservation plantings, tree and shrub plantings and other practices on a site-specific basis to address natural resource concerns and the producer's objectives.

**PRACTICE SPECIFICATIONS**

The need for mulching is based on conserving soil moisture, facilitating establishment of vegetation or other cover, suppressing weeds, providing erosion control and the potential benefits mulch can provide toward meeting producer goals. Mulching after seeding can improve the success of the revegetation by keeping the seed in contact with soil, moderating temperatures, and reducing water loss necessary for the seed to germinate. Mulching around planted seedlings can also improve water availability and provide protection from the environment. Mulching applies to all lands where mulches are needed and can be used alone or in combination with other practices.

**MULCH TYPES AND METHODS**

Perennial native or introduced grass hay should consist of long stems that create loft and porosity which conserve moisture for the germinating seedlings. Hay containing mature seed may be used if it is the same species and/or variety as the species used in planting or is a desirable species. If the species are desirable, hay can result in increased diversity of the resulting plant community. Hay used for mulching should be certified weed free to prevent spread of noxious weed seed or other non-desirable plant species.

Small grain straw shall consist of mostly long stems of wheat, oats or barley straw from which the grain has been removed. Straw used for mulching should be certified weed free to prevent spread of noxious weed seed or other non-desirable plant species. Straw can be spread by hand for small areas or with a straw blower for large areas. Wind can move the straw, so crimping, rolling or other mechanical means should be used to anchor the straw. Tackifiers can be applied over the straw to prevent movement; follow manufacture's application rates and methods.

When spread by hand, the bales of hay or straw must be torn apart, "fluffed up" and spread uniformly over the area. For uniform distribution of hand spread mulch, divide the area into 1,000-square foot sections and spread the mulch one section at a time.

Woodchips, sawdust, and bark can also be used as mulch. These can be quite inexpensive if local sources are present. Wood residues are very long lasting compared to other mulches. However, nutrients like nitrogen can get tied up and immobilized in the wood during the decay process. The addition of fertilizer can help offset nitrogen deficiencies during decomposition.

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Wood fiber mulches such as shredded small diameter trees are an effective mulch if available. Shredded wood is heavier than straw or hay and generally does not need to be crimped into the soil to keep it from blowing. Care must be taken to ensure seed of undesirable species are not present in the shredded wood fiber.

Plant based mulches or compost should be of suitable quality and quantity to add organic matter, increase soil microbial activity, protect the soil surface and improve soil structure. Adjust application rates according to specific site conditions, compost C:N ratios and nutrient levels in the soil and compost.

Hydromulching with wood fiber or paper in a water slurry is another form of mulching. This requires the use of a machine called a hydromulcher or hydroseeder and equipment access to the site. Wood fiber mulches are usually more effective than paper mulches because the longer wood fibers adhere to the soil and are more resistant to wind and water erosion. Hydromulch is often applied at average rates of 1,500 to 2,000 lbs./ac acre and a tackifier can be used to help the mulch stay in place. Incorporation of seed and fertilizer in the mix is not a good idea because much of the seed will not be in contact with the soil and can be lost to desiccation. Fertilizer in the slurry can create a high salt concentration that can reduce water adsorption and kill the seed.

Erosion control mats are also effective for revegetation and rehabilitation projects. These mats come in a variety of types, sizes, and strengths and but can be expensive. Mats made from straw and/or coconut fiber with biodegradable netting are rolled onto the site and secured with metal staples. Stronger mats, either pure coconut fiber or synthetic fibers need to be used on sites with high erosion hazards, high velocity overland flow rates, or steep slopes.

**Table 1 below is for application rates of hay, straw and wood fiber mulch and emulsifiers. Tables 2 and 3 are for straw mulch application rates on irrigated land. Table 4 is for information on application rates, methods and consideration for different mulches.**

**Table 1. Application Rates for Hay, Straw, and Wood Fiber Mulch Anchored with Anchoring Tools or Other Methods.**

METHOD OF ANCHORING AND MULCH	RATE FOR MULCH (POUNDS)		RATE FOR ASPHALT OR RESIN EMULSION (GAL)	
	PER ACRE	PER 1,000 FT <sup>2</sup>	PER ACRE	PER 1,000 FT <sup>2</sup>
<b><u>ANCHORED WITH DISK</u></b>				
Native or tame hay	5,000	118		
Small grain straw	4,000/5,000*	140		
Wood fiber	4,000	93		
<b><u>ANCHORED W/ ASPHALT OR RESIN EMULSIONS</u></b>				
Native or tame hay	3,000	70	300	7
Small grain straw	3,000	70	300	7
Wood fiber	3,000	70	300	7
<b><u>ANCHORED W/ MULCH NETTING OR STAKE AND TWINE OR SHOVEL (SILT)</u></b>				
Native or tame hay	3,000	70		
Small grain straw	3,000	70		

\*North Slopes = 4,000 pounds per acre

\*South Slopes = 5,000 pounds per acre

**Straw Mulching on Irrigated Land**

Straw may be applied in furrows under either furrow or sprinkler irrigation at the minimum rates shown in Tables 3 and 4.

**Table 2. Straw Mulch Application on Irrigated Land**

SLOPE	MULCH RATE lbs./100 feet of ROW
0-2	2.00
2-3	4.00
3-4	6.00
>4	8.00

**Table 3. Straw Weight for Irrigated Row Widths**

ROW SPACING (DEPTH)	POUNDS OF STRAW PER 100' OF ROW				
	1"	2"	3"	4"	8"
22	240	480	720	960	1,920
30	175	350	525	700	1,400
36	145	290	435	580	1,160
44	120	240	360	480	960

**Table 4. Mulch Types <sup>1/</sup>**

TYPE	DESCRIPTION	REQUIRED EQUIPMENT	APPLICATION RATE	CONSIDERATIONS	LIFE
Straw	Certified Straw	Hand Application, Blown on or Applied by Helicopter	4,000 lbs./ac (4") on North slopes; 5,000 lbs./ac (5") on South side	Tough to put on extremely steep slopes except by helicopter. Inexpensive, effective.	2 years
Hydro Seed Wood Cellulose Mulch	Hydro Mulch with Wood Cellulose Mulch	Applies with a Hydro Seeding Machine	2,000 lbs./ac	Hydro Seeders are expensive to move in and are in short supply in the fall. Seeding cannot be kept current with construction. Very effective.	1 Year
Hydro Seed Paper Mulch	Hydro Mulch with Paper Mulch	Applied with a Hydro Seeding Machine	2,000 lbs./ac	SAME AS ABOVE.	1 Year
Blankets (SOME COME IMPREGNATED WITH SEED)	Various Types of Pre-made Erosion Control Blankets	Rolled Out and Staked or Pinned Down	By the Square Foot	Effective, netting decomposes at a different rate than mulch. Expensive.	2 Years
Netting	Various Types of Biodegradable and Non-degradable Netting	Rolled Out and Staked or Pinned Down, Over Mulch	By the Square Foot	Can trap animals, decomposes slowly; used over mulch; Biodegradable types are available.	2 Years
Channel Liners	Various Width Heavy Duty Blankets	Rolled Out and Staked or Pinned Down	By the Square Foot	Effective, usually left in place. Very expensive.	3 Years
Tackifiers	Sprayed on Material Used to Hold Soil in Place	Sprayed on, usually with a Truck Mounted Sprayer	By the Square Foot	Short Term.	1 Year
Sodding	Grass Sod	Rolled Out and Pinned Down	By the Square Foot	Used when instant plant establishment is important.	Indefinite

<sup>1/</sup> Taken in part from the USDA–Forest Service, Region 1, Native Plant Handbook.

## **Specification MT484-4**

### **GENERAL CRITERIA APPLICABLE TO ALL PRACTICE PURPOSES**

The selection of mulching materials will depend primarily on the purpose(s) of the application, site conditions and availability of the material. 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. 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.

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

### **CRITERIA APPLICABLE TO SPECIFIC PRACTICE PURPOSES**

#### **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.

#### **Provide Erosion Control and to Reduce Airborne Particulates**

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 for wind by Wind Erosion Prediction System (WEPS) and water by Revised Universal Soil Loss Equation (RUSLE2).

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.

#### **Establish Vegetative Cover**

Mulch shall provide 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.

#### **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 water courses.

Soil conditioning Index (SCI) must be zero or higher using either WEPS or RUSLE2. Entering the WEPS wind erosion soil loss value into RUSLE2 or the RUSLE2 water soil loss value into WEPS is required to get accurate SCI values from both programs. In RUSLE2, the soil conditioning index folder must be opened and the WEPS average 'annual gross soil loss' must be entered into the 'wind & water induced ero' input cell. In WEPS, the RUSLE2 'soil loss for cons. plan t/ac/yr' value must be entered into WEPS 'water erosion' input cell.

## CONSIDERATIONS

Evaluate the effects of mulching on evaporation, infiltration, runoff, soil temperature, C:N ratio and microbial activity.

Apply mulch to conserve soil moisture prior to moisture loss.

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

Crop residues that have a C:N ratio greater than 30 can tie up soil N and necessitate supplemental N applications on crops.

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

Select mulching materials and methods that are compatible with the crop and site.

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.

Select mulching materials, methods and application rates that are compatible with the crop and site and do not contribute to pest problems. Mulching may provide habitat for beneficial insect and provide pest suppression.

Use the Web Soil Survey at: <http://websoilsurvey.nrcs.usda.gov/app/> to consider potential effects of mulching on soil physical and chemical properties.

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

## PLANS AND SPECIFICATIONS

Mulch components of the conservation plan will include the following information:

- Purpose of the mulch
- Type of mulch material used
- Percent cover and/or thickness of mulch material
- Timing of application
- Site preparation
- Listing of netting, tackifiers, methods of anchoring
- Operation and maintenance
- **Plan and soil maps of fields.**

## OPERATION AND MAINTENANCE

Inspect mulch periodically and reinstall or repair as needed to accomplish the intended purpose.

## **Specification MT484-6**

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.

## **REFERENCES**

*Roadside Vegetation – An Integrated Approach to Establishing Native Plants*. Technology Deployment Program, Western Federal Lands Highway Division, Federal Highway Administration, Vancouver, WA. August 2008.

*Shredding Small Trees to Create Mulch for Erosion Control*, Engineering Tech Tips, USDA Forest Service Technology & Development Program, Groenier and Showers. September 2004.

*Northern Region Native Plant Handbook- Mulching and Erosion Control*, pages 55-59. USDA Forest Service, March 1995.

*Revegetation Guidelines for Western Montana: Considering Invasive Weeds*, Kim Goodwin and Roger Sheley. February 2003.