

NATURAL RESOURCES CONSERVATION SERVICE
MONTANA CONSERVATION PRACTICE SPECIFICATION

MULCHING (ACRE)

CODE 484

DEFINITION: Mulch is defined as the placement of 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; moderate soil temperature; provide erosion control; suppress weed growth; facilitate the establishment of vegetative cover; improve soil quality, 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, grass seeding, tree and shrub plantings, conservation buffer practices, grassed waterways, and other practices on a site-specific basis to address natural resource concerns and the producer's objectives. The major role of mulching is to conserve soil moisture and control erosion on sites devoid of cover protection. Mulching generally can improve overall germination and seedling establishment and protect the soil resource.

MULCHING PLANNING: 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 may not be necessary where soils are not highly erodible, adequate soil moisture and organic matter is present, weed control is unnecessary and high winds are not a problem.

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 map of managed fields.

When mulching is completed to reduce soil moisture evaporation on a grass planting, seeding must be completed prior to mulching. At least 60 percent cover is required to reduce potential evaporation. When mulching is completed to moderate soil temperature, 100 percent coverage over the area is required. When mulching is completed to protect against soil and water erosion or for establishing vegetation, at least 70 percent ground cover is required. If wood chips or bark will be used, a minimum 2-inch thickness is required. Plastic mulches may also be used for weed suppression. To suppress weeds, 100 percent ground cover is required. Thickness must be adequate enough to prevent emergence of targeted weeds.

PLANNING GUIDELINES: Straw mulches consisting of wheat, barley, and/or oats are the most common mulches. Application rates shall be determined using the current erosion prediction technology. Care must be taken to use certified weed-free straw to prevent the introduction of noxious weeds onto the site. Stems need to be as long as possible to increase its life expectancy as a mulch. Straw can be placed on the site by hand or with a blower for large areas. Straw mulch often needs to be anchored to prevent being blown away or washed away by overland water flow. The use of tackifiers, plastic, or biodegradable netting is an effective

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way to retain the straw on the site. Mechanical crimpers have also been used to push the straw into the soil surface on sites where the use of heavy equipment is feasible.

Mulch materials used to conserve soil moisture should be applied prior to moisture loss. 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 pounds to the acre and a tackifier can be used to help it stay on the slope. 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.

Perennial native or introduced grass should have at least 50 percent of the stems and leaves, by weight, 10 inches long or longer, before being applied to the site. Hay containing mature seed may be used if it is the same species and/or variety as the species used in planting. Native hay mulches often contain high levels of noxious weed seed or other non-desirable plant species. Great care must be exercised when using native hay; if the introduced species are desirable, then native hay can result in increased diversity of the resulting plant community. Therefore, native and introduced hay mulch should be free of noxious weed seed and mold.

Small grain straw shall consist of wheat, oats, barley, or rye straw from which the grain has been removed. At least 50 percent of the stems, by weight, should exceed 6 inches in length before being applied to the site if anchored by resin, netting, tackifiers, etc. When anchored mechanically, 50 percent of the stems, by weight, shall exceed 10 inches in length.

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.

Wood fiber mulch should be cut from green timber. The timber should be cut for maximum fiber length and at slight angle to the wood grain to promote splintering while weathering. As a guide, 50 percent of the fibers, by weight, need to be 6 inches in length.

Spread mulch uniformly by hand or mechanically at the rates shown in TABLE 1. When spread by hand, the bales of hay 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 at the rate shown in TABLE 1 in each section. Mechanically-applied mulches should not be applied when wind velocities exceed 15 miles per hour.

The use of pre-made erosion control mats is also effective for revegetation and rehabilitation projects. These mats come in a variety of types, sizes, and strengths and 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.

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.

If soil crusting has occurred on the surface of the soil prior to seeding, the crust must be broken up and the application of a mulch and tackifier should be utilized. If rainfall has occurred on disturbed areas prior to seeding, crusting has probably occurred. Stockpiling the organic layer and topsoil while building roads or other activities for redistribution later is a very good idea. One of the biggest problems in poor revegetation success is the lack of organic matter and nutrients needed by the plants. Sampling soil pH, bulk densities, and nutrient levels present on and in the seedbed will provide information to help decide if soil amendments, mulches, fertilizers, or other cultural treatments are necessary. See TABLE 5 for various mulch types and descriptions, and considerations.

Anchoring

Hay, straw, or wood fiber mulches should be anchored using one of the following **hand methods**:

Using stake and twine anchor immediately after spreading mulch. Drive 8-10 inch wooden stakes to within 2 or 3 inches of the soil surface every 4 feet in all directions. Drive stakes before mulch is applied. Secure mulch to soil surface by stretching twine between pegs in a crisscross-within-a-square pattern. Secure twine around each peg with two or more round turns or a clove hitch.

When using mulch netting staple lightweight paper, jute, cotton, or plastic netting to the soil surface according to the manufacturer's recommendations. The mesh size of the fabric should not exceed 1-1/2 inches by 3 inches. The plastic netting should contain a carbon black additive for longer life durability.

When using silt anchoring use a square-pointed spade and cut mulch into the surface soil in contour rows 12 inches apart.

If mulch is **anchored mechanically** use the following methods:

The seedbed must be tilled to a minimum of 4 to 6 inches deep immediately before placing and anchoring mulch material. Use a heavy, straight, disk type mulch tiller. The disk should be 1/4-inch thick and of sufficient diameter to prevent the frame from dragging the mulch. The edges should be dull so as not to cut the mulched hay/straw during the anchoring process. The edges may be serrated or smooth. If serrated, the scallops will not be more than 3 inches in length and 3/4-inch in depth.

The rows of furrows made by the mulch tiller should be spaced not more than 9 inches apart. Penetration depth should be about 2 to 3 inches. The mulch will not be covered with excessive amounts of soil. Limit to no more than two passes by the disk. All mulching operations will be completed as close to the contour as possible.

A farm disk set straight may be used if weight is added to provide adequate penetration depths and if it tucks the material with cutting.

Travel speeds must be reduced to prevent excessive burial of seed and mulch material.

If **asphalt or asphalt emulsion tackifier** is used, use the following method:

See TABLE 2 for application rates.

Asphalt shall be liquid or cutback asphalt of grade RC-70 or equivalent and shall contain no water. Asphalt emulsion shall consist of liquid emulsion of water and natural bituminals of asphalt grade SS-1 or equivalent.

The asphalt shall be applied with a mechanical mulch blower equipped with an emulsion spray system that has a heating unit. Asphalt shall be applied continuously to the mulch as it passes through the nozzle end of the mulch blower and is broadcast upon the ground.

Do not apply asphalt to the surface of the mulch after it is spread on the ground. Do not apply asphalt when the air temperature is less than 50 degrees F.

If **resin emulsion mulch tackifier** is used, apply with the following method:

See TABLE 2 for application rates.

Resin emulsion shall consist of liquid emulsion of water and natural petroleum or acrylic resins prepared specifically for soil stabilization of a type and grade similar to Petroset SB, American Cyanamide, Aerospray 70, or Curosol AH.

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The resin is applied with a mechanical mulch blower equipped with an emulsion spray system. Resin should be applied continuously to the mulch as it passes through the nozzle end of the mulch blower and is broadcast upon the ground.

Do not apply asphalt to the surface of the mulch after it is spread on the ground. Do not apply asphalt when the air temperature is less than 50 degrees F.

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

TABLE 2. Rate of Application for Resin and Asphalt Mulches.

MULCH	SOIL TYPE	RATE			
		CUPS/YARD ²		GALLON/ACRE	
		MATERIAL	WATER	MATERIAL	WATER
<u>RESIN EMULSIONS</u>^{1/}					
Petroset SB	Loamy sand	5/8	6	200	1,800
Aerospray 70		5/8	6	200	1,800
Curosol AH	Sandy loam	1/8	6-1/2	50	1,950
Petroset SB	Loam	5/8	4-1/2	200	1,300
Aerospray 70		5/8	4-1/2	200	1,300
Curosol AH		1/8	4-1/2	50	1,450
<u>ASPHALT EMULSIONS</u>					
SS-1	all soils except	4	----	1,200	----
CSS-1	silty clay and clay				
<u>CUT-BACK ASPHALT</u>					
RC-70	all soils	4	----	1,200	----

When a resin emulsion or asphalt emulsion is used to temporarily stabilize soil surfaces for wind erosion control, use the following method:

Resin emulsions and asphalt emulsions form a crust on the soil surface that will protect the soil against wind erosion for a period of time until other organic mulches can be applied. The crust will also significantly **increase** surface runoff from rainfall. Do not use where the potential for surface runoff exists during the period soil is to be protected. If these conditions exist, use an organic mulch to protect the site.

The crust will also **hinder** emergence of seedlings. Therefore, do not seed before applying resin emulsion or asphalt emulsion.

When a soil retention blanket is used, use the following method:

A soil retention blanket is made of a uniform web of interlocking wood fiber that has a backing of mulchnet fiber on one side only. The fibers should be made from aspen wood and should be 0.021 inch by 0.042 inch plus or minus 25 percent and a minimum of 4 inches in length. The top side is covered with extruded plastic netting. Maximum mesh size shall not exceed 2 inches by 1 inch.

For longer life and durability, netting with carbon black additive is recommended. Thickness of the blanket shall not be less than 1/4-inch before installation.

Roll weight shall average 0.8 pounds per square yard plus or minus 10 percent at the time of manufacturing. This information will be stenciled on the roll wrapper or attached tag. Staples used to anchor retention blankets should be U-shaped, 11 gauge or heavier wire, approximately 2 inches wide at the throat, and a minimum of 8 inches in length.

Place blanket with the netting on top and the fibers in contact with the soil over the entire area to be covered. The blanket should be unrolled approximately along the contour of the slope. Begin at the bottom of the slope. Lap each subsequent roll approximately 4 inches over the adjoining roll.

When used in water overflow areas, the blanket should be unrolled in the direction of flow and lapped 4 inches over the adjoining downstream roll. When using two or more blankets side by side in a ditch, do not put the seam (lapped edges of the adjoining blankets) in the center of the water flow. Offset seam 6 to 12 inches. In drainages, blanket shall be placed to cover design flow depths.

Blanket must be stapled at joints, corners, and approximately 5-foot intervals along the sides and lapped edges. Exterior ends and edges shall be buried to prevent undercutting by water or wind.

Other Mulches

Wood chips or Bark: Wood chips or bark are well suited for mulching of woody plantings. Use bark chips from fir, pine, larch, hemlock, or western red cedar that has a maximum dimension of 3 inches or shredded particles from the bark. A layer of bark or chips greater than 1 inch may affect seedling emergence.

Cover the entire area when making mass shrub or tree plantings. For single plant seeding, spread chips or bark around the base and extend outward 18 inches from the main stem or trunk. Applying a depth of 2-4 inches will assist in controlling weed competition.

Do not use in water flow areas.

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.

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TABLE 3. 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 4. 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

Guidelines for Operation and Maintenance

- Review the nutrient management component of the conservation plan annually and make adjustments when needed.
- Calibrate application equipment to ensure uniform distribution and accurate application rates.
- Protect nutrient storage areas from weather to minimize runoff and leakage.
- Avoid unnecessary exposure to fertilizer and organic waste, and wear protective clothing when necessary.
- Observe setbacks required for nutrient applications adjacent to water bodies, drainageways, and other sensitive areas.
- Maintain records of nutrient application as required by state and local regulations.
- Clean up residual material from equipment and dispose of properly.

TABLE 5. Mulch Types ^{1/}

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

^{1/} Taken in part from the USDA–Forest Service, Region 1, Native Plant Handbook.