

DESIGN, INSTALLATION and CHECK-OUT GUIDE MULCHING - 484

Mulching shall be planned and applied in accordance with the Standard detailed in the Field Office Technical Guide - Section IV - Conservation Practices subfolder. This document provides additional parameters, procedures, and requirements for site-specific plans and installation. To document this practice, use Form ND-CPA-484a for loose mulch materials and Form ND-CPA-484b for blanket or synthetic mulch material.

GENERAL INFORMATION

Cropland sites typically suited to Mulching:

- Fields subject to severe wind erosion after harvest of low-residue crops
- Areas where soil organic matter is severely depleted

Permanent vegetation planting sites typically suited to Mulching:

- Constructed/shaped sites such as dams, waterways, and blow-outs completed when conditions are not favorable for immediate growth of seeded vegetation
- Construction sites with slopes steeper than 3:1
- Unsheltered planting sites with Wind Erodibility Group 1, 2, or 3 soils
- Soils subject to serious sheet, rill, or concentrated flow erosion
- Expensive or difficult plantings where mulching reduces risk of failure
- Thin soil
- Saline/sodic soil, especially if alkali sacaton seeding is planned
- Sites from which sediment delivery could pose a safety hazard
- Sites from which sediment delivery could cause significant economic loss
- Tree/shrub plantings – new or established

DESIGN AND INSTALLATION

Site Investigation

Determine site conditions based on client interview, site visit, review of soils map, and/or review of topographic map, as needed. Determine severity of significant problems such as:

- Slope length and steepness
- Soil salinity (EM-38 readings)
- Topsoil and subsoil thickness
- Wind erosion hazard
- Soil compaction
- Risk of sediment damage to high-value property onsite or offsite
- Potential safety hazards from sediment delivery on-site or offsite
- Probable duration, frequency & velocity of flow events

Material Selection and Installation

Select Mulching materials based on the purpose(s), material characteristics, and site conditions. Mulch must be free of noxious weed seed and amounts of other seeds that will compete with desired vegetation. Mulching Purposes and Considerations are summarized in Table 1.

Table 1. Mulching Purposes and Considerations (page 1 of 2)

Type of mulch	Wind erosion control	Sheet/rill erosion control - minimum 70% ground cover required	Concentrated flow erosion control- 70% ground cover required	Weed suppression	Moisture conservation - minimum 60% ground cover required	Establish plant cover - 50% ground cover required	Improve soil condition and fertility
Small grain straw	Needs anchoring. Minimum 70% ground cover required.	Needs anchoring. Minimum 70% ground cover required.	Needs anchoring. Minimum 70% ground cover required.	Need 4" thick layer. May need anchoring.	Effective	Ground cover shall be 50-75% for herbaceous seeding.	Apply sufficient quantity to achieve Soil Condition Index of 0.5
Corn stalks	Suggested rate is 4-6 tons per acre.	NA	NA	Need 4-6" layer	Effective	NA	Apply sufficient quantity to achieve SCI of 0.5
Flax straw	Avoid on cropland. Needs anchoring on perm. veg sites.	Needs anchoring	Needs anchoring	Need 4" thick layer. Has longer endurance than small grain straw or hay. May need anchoring.	Effective	Ground cover shall be 50-75% for herbaceous seeding.	NA
Hay	Needs anchoring. Minimum 70% ground cover required.	Needs anchoring. Minimum 70% ground cover required.	Needs anchoring. Minimum 70% ground cover required.	Need 4" thick layer. May need anchoring.	Effective	Ground cover shall be 50-75% for herbaceous seeding. Maximum 25% legume-type.	Apply sufficient quantity to achieve SCI of 0.5 and in accordance with Nutrient Management - 590.
Manure	Need 70% ground cover applied in accordance with Nutrient Management - 590	NA	NA	NA	NA	Not acceptable due to risk of nutrient concentration toxicity and restricted emergence.	Apply sufficient quantity to achieve SCI of 0.5 and in accordance with Nutrient Management - 590.

Table 1. Mulching Purposes and Considerations (page 2 of 2)

Type of mulch	Wind erosion control	Sheet/rill erosion control - minimum 70% ground cover required	Concentrated flow erosion control- 70% ground cover required	Weed suppression	Moisture conservation - minimum 60% ground cover required	Establish plant cover - 50% ground cover required	Improve soil condition and fertility
Compost	Need 70% ground cover applied in accordance with Nutrient Management - 590	NA	NA	NA	NA	NA	Apply sufficient quantity to achieve SCl of 0.5 and in accordance with Nutrient Management - 590.
Soil retention blanket - excelsior wood fiber	Effective	Effective	Effective	NA	Secondary consideration only	Effective	NA
Synthetic mulch, including fabric	Secondary consideration only	Secondary consideration only	NA	Use around planted trees and shrubs only.	Use around planted trees and shrubs only.	NA	NA
Wood chips, chopped corn cobs	NA	NA	NA	Need 4" thick layer	Use around planted trees and shrubs only.	NA	NA
Hydro Seed wood cellulose mulch	Secondary consideration only	Secondary consideration only	NA	NA	NA	Effective	NA
Paper, cardboard, sawdust	NA	NA	NA	Need 1 or 2 layers of anchored cardboard, or 1" to 2" layer of sawdust.	Use around planted trees and shrubs only.	NA	NA

For cropland needing wind erosion protection

Hay, Straw, Corn Stalks

When mulching with cereal grain straw or grass hay, at least 70% ground cover is required. Sufficient mulch shall be applied to help reduce wind erosion at or below a planned soil loss rate on the design soil. Actual pounds of mulch required per acre will vary, depending on design soil Wind Erodibility Group, stalk length, and burying effect of the anchoring implement used. The rate of mulch to apply shall be determined case by case. Apply a known amount of mulch on a representative trial area and anchor it. Then calculate the predicted erosion rate according to Field Office Technical Guide - Section I - Erosion Prediction procedure. If necessary, increase the application rate on a second trial area and recalculate the predicted erosion rate. Repeat the process until the necessary application rate is achieved. If the field has significantly different soil types, a different application rate may be determined for each area delineated.

Hay, straw, and cornstalks must be anchored. A variety of tools can be used such as plow packer, coil packer, press drill with packer wheels that have a v-shaped “footprint”, or a light disk adjusted to minimize cutting. Adjust implement settings, add weight, and adjust travel speed to find the combination that performs best by trial and error. Since moisture toughens straw, anchoring while there is heavy dew may reduce cutting. Where irrigation is available, wetting the soil and mulch material may improve the anchoring operation.

Manure or Compost

Apply sufficient material to attain 70% surface cover after dry-down, in accordance with Nutrient Management – 590 standard and specifications.

Maintenance Of Cropland Mulch

- Minimize fire hazard to the extent feasible. See conservation practice Firebreak – 394.
- Keep traffic off the site.

For cropland needing improved soil condition and fertility

Mulching for this purpose is typically needed on a spot basis. If applied on a whole field, a crop rotation & residue management to improve soil condition should also be planned.

Apply a sufficient quantity of manure, compost, or legume hay to achieve a 0.5 Soil Condition Index rating and in accordance with Nutrient Management -590 standard and specifications. The mulch material shall have a C:N ratio < 30:1. Mulch material applied in areas subject to concentrated flow shall have a C:N ratio between 20:1 and 30:1. Anchor hay mulch using techniques described in the above section on wind erosion protection.

Maintenance Of Cropland Mulch

- Minimize fire hazard to the extent feasible. See conservation practice Firebreak – 394.
- Keep traffic off the site.

For permanent herbaceous planting sites

The site must be free of rills and debris (clods, rocks, roots etc.). Mulch must be applied and anchored immediately after the planting operation. The following methods are acceptable:

Hay and Straw Mulches

- Perennial native or introduced (tame) grass hay. At least 50 percent of the herbage by weight shall be ten (10) inches or longer before being applied to the site. Seed hay may be used if the species is compatible with the purpose of the seeding and species planted; otherwise, hay should be free of seed. Leguminous plants shall not exceed 25% of the dry weight of the mulch applied on permanent vegetation planting sites.
- Small grain straw shall consist of wheat, oats, flax, barley or rye straw from which grain has been removed. At least 50 percent of the stems by weight shall exceed six (6) inches in length before being applied to the site if anchored by asphalt or netting. When anchored mechanically, 50% of the stems by weight shall exceed ten (10) inches.

Hay and small grain straw shall be free of visible mold or fungus, noxious weed seed and seed of other competitive plants.

Mulch shall be uniformly spread manually or mechanically, at the rates shown in Table 2. When spread by hand, the bales must be torn apart, “fluffed up” and spread uniformly over the area. For uniform distribution of hand-spread mulch, divide area into sections of approximately 1,000 square feet. At the rate shown in Table 2, place the mulch in each section for distribution. If excessive breakage of mulch occurs during spreading or anchoring, mulch will be “wet down” with sprinkler or other suitable means.

Suggested application rates for hay and straw mulches are shown in Table 2. Defer to requirements listed in Table 1.

Table 2. Suggested application rates for small grain straw, hay, or flax straw.			
Anchoring method	Mulch type	Mulch rate (pounds)	
		per acre	per 1,000 sq. ft.
Mulch tiller	small grain straw	4,000 to 5,000	90 to 115
	hay (native or tame)	3,000 to 4,000	70 to 90
	flax straw	3,000 to 5,000	70 to 115
Netting, manual anchor with spade, or peg & twine	small grain straw	3,000	70
	hay (native or tame)	3,000	70
	flax straw	3,000	70

Hay or straw mulches will be anchored using one of the following methods:

- Mechanical Mulch Anchoring

Tools - A heavy, straight-coulter machine such as the Imco Landscape Soil Erosion Mulch Tiller is preferred. ^{1/} The coulters should be one-fourth inch thick and be of sufficient diameter to prevent the frame from dragging the mulch. The edges should be dull so as not to cut the mulch during the anchoring operation. The edges may be serrated or smooth; if serrated, the scallops should not be more than 3 inches in length and 3/4 inch in depth. The rows or furrows made by the mulch tiller shall be spaced 6 to 12 inches apart. Penetration depth should be 2 to 3 inches. The mulch should not be covered with excessive amounts of soil. Limit to no more than 2 passes by the mulch tiller. All mulching operations will be done on the approximate contour.

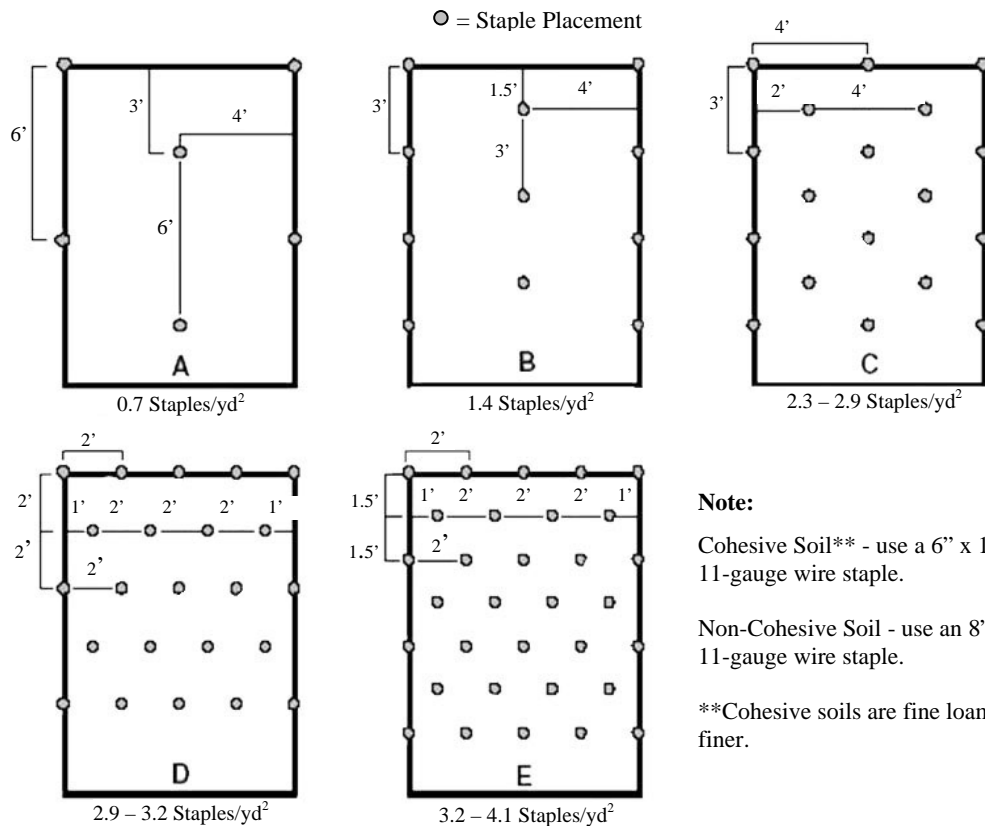
^{1/} A farm disk set straight may be used if weight is added to provide for penetration depths, providing it tucks the material without cutting. Travel speeds must be reduced to prevent excessive burial of seed and mulch material.

Site Preparation - When using a mulch anchoring implement, the seedbed must be loosened to a minimum depth of 3 inches prior to placing and anchoring mulch material. This is necessary for the 2 or 3 inch penetration required for mulch anchorage. (Drill or seeding equipment used at this time must be equipped with depth bands since the ability to obtain a firm seedbed is improbable)

- Manual Anchoring - With a square-bottom spade, punch the mulch into the surface soil in contour rows 12 inches apart.
- Mulch Netting - Mesh size shall not exceed 1 ½ inches by 3 inches. After mulch material is uniformly applied, staple paper, cotton, or plastic netting to the soil surface. Install the netting according to the manufacturer's recommendations or by following the instructions below, whichever is more secure;
 - On long slopes - unroll netting from top of slope to bottom. Bury at least eight inches of the top edge in a trench and firmly pack backfill. Netting shall be slightly taut but not stretched. Overlap adjacent netting at least 3 inches. Lap at least 3 inches of upslope netting segments over down-slope segments. Drive staples into the ground vertically, starting at the center of the top segment and working laterally outward. See Figure 1 - Recommended Staple Patterns - for stapling pattern and staple specifications. Staples at overlap points must span at least one thread of both segments.
 - On short slopes - mulch netting may be installed across the slope.
 - In Channels - Use the same method described for long slopes with the following adjustments:
 - Center the first roll with the middle of the channel.
 - Install adjacent netting with 4 inches lapping over the first roll.
 - Install sufficient netting to cover at least one foot beyond the maximum design flow width. See Figure 1 - Recommended Staple Patterns - for stapling pattern and staple specifications.

FIGURE 1. Staple Pattern Guide *

Slope	≤ 4:1	≤ 3:1	≤ 2:1	> 2:1 ≤ 1:1	Low Flow Channel	High Flow Channel
Staple Pattern	A	B	C	D	D	E



Note:

Cohesive Soil** - use a 6" x 1" x 6" 11-gauge wire staple.

Non-Cohesive Soil - use an 8" x 2" x 8" 11-gauge wire staple.

**Cohesive soils are fine loamy texture or finer.

* Staple pattern guide is adapted from Curlex® Staple Pattern Guide, courtesy of American Excelsior Company, 850 Avenue H East, P.O. Box 5067, Arlington, Texas 76007. No product endorsement by NRCS is intended or implied.

- Peg and Twine - Drive 8 to 10 inch wooden pegs to within 2 or 3 inches of the soil surface every 4 feet in all directions. Secure mulch to soil surface by stretching twine between pegs in a criss-cross within a square pattern. Secure twine around each peg with two or more round turns or a clove hitch.

Soil Retention Blankets

Soil retention blankets can be used to mulch small, critical areas.

- Excelsior soil retention blanket shall consist of a machine-produced mat of curled wood excelsior of 80 percent 6-inch or longer fiber length with consistent thickness and the fiber evenly distributed over the entire area of the blanket. The top side of each blanket shall be covered with a 2" X 1" biodegradable mesh. The blanket shall be smolder-resistant.

- When the blanket is unrolled, the netting shall be on top and the fibers in contact with the soil over the entire area. Install the blankets according to the procedures outlined for mulch netting.

Soil retention blankets may be comprised of materials other than excelsior. Contact the NRCS State Resource Conservationist in advance for approval to use other materials.

Wood Cellulose Fiber Mulch (Hydro-Mulching)

- Wood cellulose fiber mulch shall consist of wood cellulose fiber pulp which shall contain no germination- or growth-inhibiting factors. This mulch shall be free of contamination from noxious weed seed, seed from other competitive plants, mold, or fungus. It shall be dyed an appropriate color to allow visual metering of its application, and shall have the property of becoming dispersed and suspended when agitated in water. When sprayed uniformly on the surface of the soil, the fibers shall form a blotter-like ground cover that readily absorbs water and allows infiltration to the underlying soil.
- Weight specifications from suppliers, and for all applications, shall refer only to air-dry weight of the fiber, a standard equivalent to ten percent moisture. Each package of the cellulose fiber shall be marked by the manufacturer to show the air-dry weight content. Suppliers shall certify, upon request of the engineer, that laboratory and field testing of their product has been accomplished and that it meets the foregoing requirements and intent. Sampling and testing for moisture content will be in accordance with ASTM D 2016, Oven Drying Method.
- Wood cellulose fiber mulch shall be applied with hydraulic spray equipment at the rate of 1,500 to 2,000 pounds per acre. The fiber shall be added to the water slurry in a hydraulic seeder along with the proportionate quantities of seed, fertilizer, and other approved materials. All ingredients shall be mixed to form a homogenous slurry. Using the color of the mulch material as a metering agent, one shall uniformly spray the slurry mixture on the prepared seed bed.
- A non-toxic, organic soil stabilizer may be included or added to the wood cellulose fiber where there is a high probability of wind or water erosion. Application rates of such soil stabilizers will be at the manufacturer's recommended rates.
- Since this method is basically a broadcast (surface) application of seed, the mulched area will be kept moist, by sprinkler or other means, for a period of thirty (30) days.
- High winds may cause "peeling" of hydromulch, which usually requires reseeding and reapplication of mulch. Hydromulch peeling may be prevented by irrigating before and during wind storms. The mulch also is subject to washing away under intense or prolonged rains. These factors should be considered in selecting this method of mulching.

Asphalt, Asphalt Emulsion, and Resin Emulsion

The cost of these materials and their application is high. The specialized equipment needed for application is rarely available in rural areas. Since high winds may cause these mulches to peel and require reseeding and reapplication of mulch, it is not recommended for wind-exposed areas.

- Asphalt shall be liquid or cut back asphalt of grade RC-1 or equivalent and shall contain no water.

- Asphalt emulsion shall consist of liquid emulsions of water and natural bituminals of asphalt grade SS-1 or equivalent.
- Resin emulsion shall consist of liquid emulsion of water and natural petroleum or acrylic resins prepared specifically for soil stabilization. These materials include such products as Phillips Petroleum, Petroset SB; American Cyanamid, Aero-spray 70; and Curosol AH.

Resin emulsion, asphalt emulsion and cut back asphalt shall be applied with an emulsion spray system having a heating unit. See Table 3 for application rates. Table 3. -- Rate of Application of Resins and Asphalt Mulches					
Mulch	Soil Type	Rate			
		Cups ^{1/} -Per Sq. Yd.		Gallons Per Acre	
		Material	Water	Material	Water
<i>Resin Emulsions</i> ^{2/}					
Petroset SB	Loamy Sand and Sandy Loam	5/8	6	200	1800
Aerospray 70		5/8	6	200	1800
Curosol AH		1/8	6-1/2	50	1950
Petroset SB	Loams	5/8	4-1/2	200	1300
Aerospray 70		5/8	4-1/2	200	1300
Curosol AH		1/8	4-1/2	50	1450
<i>Asphalt Emulsion</i>					
SS-1	All soils except silty clays and clays	4	None	1200	None
<i>Cutback Asphalt</i>					
RC-1	All soils	4	None	1200	None

^{1/} Conversion of Cups to Gallons: 16 cups = 1 gallon
^{2/} Not recommended for use on clays.

Maintenance of Mulch on Permanent Herbaceous Plantings

- Minimize fire hazard to the extent feasible. See conservation practice Firebreak – 394.
- Keep traffic off the site. See conservation practice Use Exclusion – 472 and Fence - 382.
- Inspect site after events that could damage or displace mulch. Use hand tools to the extent possible to do repairs.
- Fill rills and gullies and level dunes as needed.
- Remove sediment deposits if it will improve chance of seeding recovery.
- Redistribute or replace mulch following spot seeding, as needed.
- If hydromulch is used, keep it sufficiently moist to withstand dry, windy periods.

For tree/shrub stock plantings or established woody plantings

Organic Mulches For Weed Control Around Trees

Organic mulches may include straw, wood chips, sawdust, chopped corncobs, grass clippings, or other organic byproducts. Mulches are most effective when maintained to the drip line of the tree or beyond. For newly planted stock, place mulch in a 3-4 foot diameter circle around each plant to a thickness of 4 inches (4-6" for corn stalks). When mulching shrub rows, mulch can be applied in a contiguous 4-foot wide band (2 feet each side of the plants).

In high moisture situations, mulch contacting the trunk may enable mold or fungus growth that injures the bark or kills the tree. In situations of higher precipitation, frequent irrigation, or on fine-textured, wetter soils, the hazard might be avoided by maintaining a 4-6 inch mulch-free circle around each trunk.

Mulches shall be free of seeds and/or grain to avoid attracting rodents and to prevent seed germination resulting in a mat of competing weeds.

Lighter and finer mulches are prone to blowing away and should be firmly tamped down with water jets or feet. On exposed sites with strong winds, this will not be adequate. On sites subject to strong wind, use mulches with large-sized chips or a high proportion of long (10-16") twigs to tie mulch together and resist blowing.

Consider maintaining standing small grain stubble or growing a crop adjacent to the weed-free zone to help prevent mulch blowout.

Consider planting herbaceous wind barriers between newly established tree/shrub rows to reduce risk of mulch blowout, reduce transpiration, and to harvest snow moisture.

Maintenance Of Organic Mulch On Tree Plantings:

- Minimize fire hazard to the extent feasible. See conservation practice Firebreak – 394.
- Keep traffic off the site. See conservation practice Use Exclusion – 472 and Fence - 382.
- Inspect site after events that could damage or displace mulch. Use hand tools to the extent possible to do repairs.
- Fill rills and gullies and level dunes as needed.
- Remove debris and sediment as necessary.
- Redistribute or replace mulch following debris removal and/or replanting trees, as needed.

Synthetic Mulch For Trees (also known as barrier) Synthetic mulch or barrier may be solid polyethylene, woven polypropylene, or pin-punched plastic. It must prevent plant shoots from pushing through from below.

The minimum width for continuous rolls of barrier applied by machine will be 6 feet, i.e., nominal 4-foot weed control band after installation. Individual squares may be as small as 4 feet by 4 feet since the full width, when stapled or pinned, effectively prevents weed growth.

In certain planting designs a profusion of root suckers is desired. For such shrub species, barrier is not recommended. If limited suckering is acceptable, 4-foot wide rolls of barrier - yielding a nominal 2-foot weed-free zone - (1- foot each side) may be appropriate. Where narrower barrier is applied, shrubs such as chokecherry that sucker close to the trunk might not produce a significant number of suckers.

Consider searing fabric edges on home-cut individual squares of woven fabric to prevent fabric edges/fibers from running or snagging on maintenance equipment.

Barrier Materials:

- Polyethylene (black plastic sheet) - Compared to woven polypropylene fabric, polyethylene sheet is less durable and much lower cost.
 - Polyethylene shall be black to resist photo-decomposition.
 - Polyethylene shall have a minimum 2.7 mil thickness.
- Polypropylene Fabric – Consists of polypropylene fibers woven into a fabric that permits air and water to pass through while prohibiting weed shoot penetration. (It does not stop root penetration from plants growing in debris or soil on top of the fabric.) Polypropylene fabric is very durable and requires careful maintenance to avoid damage to tree trunks.
 - Polypropylene fabric shall be of such quality that the manufacturer warrants complete weed control for at least five years.
 - Polypropylene fabric must be black and capable of preventing underlying plant growth.
 - Polypropylene fabric must be capable of withstanding deer hoof action without tearing or puncturing.
- Pin-punched plastic - Tiny holes are punched in plastic to allow water and air infiltration, yet the holes are small enough to prevent weeds from emerging through them. The punching process stretches the plastic to form a tiny funnel at each hole.
 - Pin-punched plastic must be applied so the cones point downward to resist weed emergence.
 - Pin-punched plastic must be black to resist photo-decomposition.
 - Minimum thickness of pin-punched plastic shall be 2.7 mil.

Barrier Installation

Excessive vegetation/residue shall be removed from the area where barrier will be placed, to reduce rodent habitat and to allow barrier to lie flat against the soil surface.

Barrier not flush to the ground around the tree can provide a runway for rodents and accumulate excessive heat that damages or kills the trees. Prior to barrier installation, tree planting sites shall be firmed and leveled so no ridges or furrows are left by the planting operation that could cause the barrier to bridge above the soil surface. After installation, barrier must entirely contact the soil surface. (Sites should be firmed to barely show an adult foot print, prior to planting.) See Figure 1.

Figure 1 - Improper & Proper Barrier Installation



Improper Barrier Installation:

- Tree planter furrow is left
- Barrier bridged over furrow creates an "oven"
- Trees can be killed by heat

Proper Barrier Installation:

- + Barrier fully contacts level ground surface
- + All limbs are above barrier
- + Soil around tree is relatively cool and moist

Solid polyethylene and pin-punched plastic are vulnerable to punctures that will allow weed growth. All weeds, stubble, residue, or other matter that can cause punctures or tears shall be removed before installing either of these two barrier types.

Solid polyethylene and pin-punched plastic are easily stretched. Stretched areas are weak and vulnerable to punctures or tearing. Avoid stretching these barrier types and apply only on a firm site.

Openings for trees or shrubs shall be cut with a sharp instrument to avoid excessive tearing of barrier or "running" of individual fabric fibers.

Openings shall be X, C, L or J-shaped. Length of slit should not exceed 12 inches. Do not use I-shaped (straight) slits as abrasion of tree bark can occur.

When barrier is placed over plants before openings are made, avoid cutting the plant when cutting the tree/shrub opening in the barrier. Trees and shrubs must be pulled through the openings within minutes after installation to avoid mortality from an oven effect beneath the barrier.

Ensure barrier edges are firmly anchored. Six inches of barrier should be buried vertically on fine-textured soils. On sands, twelve inches should be buried vertically. Immediately after installation, pack the soil at the buried edge by driving on it with tractor tires, or other effective means.

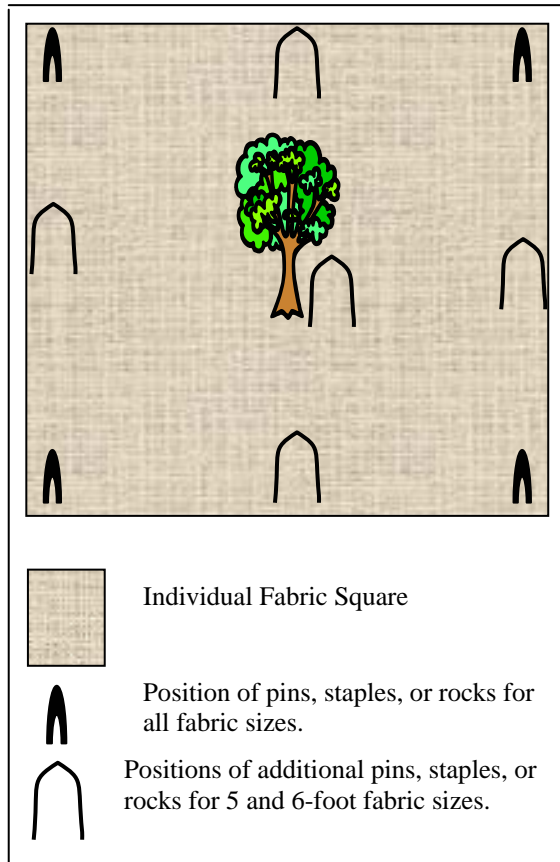
Barrier is not recommended within flood plains. One flood event could cover the barrier with silt and cancel its effectiveness. Flood flows could tear out the barrier.

Do not cover fabric or pin-punched plastic barrier with organic mulches or gravel. These materials provide a medium in which weeds can grow and compete with the trees. Organic mulches and gravel delay the breakdown of the barrier or plastic, which extends the risk of tree trunk growth being impaired by fabric contact.

Installation of Individual Barrier Pieces

Individual barrier pieces shall be at least 4 feet by 4 feet square or 4-foot diameter.

Figure 2 - Positions of Pins, Staples, or Rocks for Individual Barrier Squares



Use landscape fabric staples, pins, or rocks to anchor fabric and pin-punched barrier. Do not use soil to anchor individual fabric or pin-punched pieces. Individual rocks should weigh at least 5 pounds to resist being moved by wind or water. Place rocks with care to avoid tearing or puncturing pin-punched plastic and solid polyethylene barrier.

Solid polyethylene barrier may be anchored with loose soil free of sharp matter that could cut the plastic.

Four-foot barrier squares shall have each corner anchored. Five- and six-foot squares shall have each corner and the midpoint of each side anchored, as well as an anchor point near the tree or shrub. See Figure 2

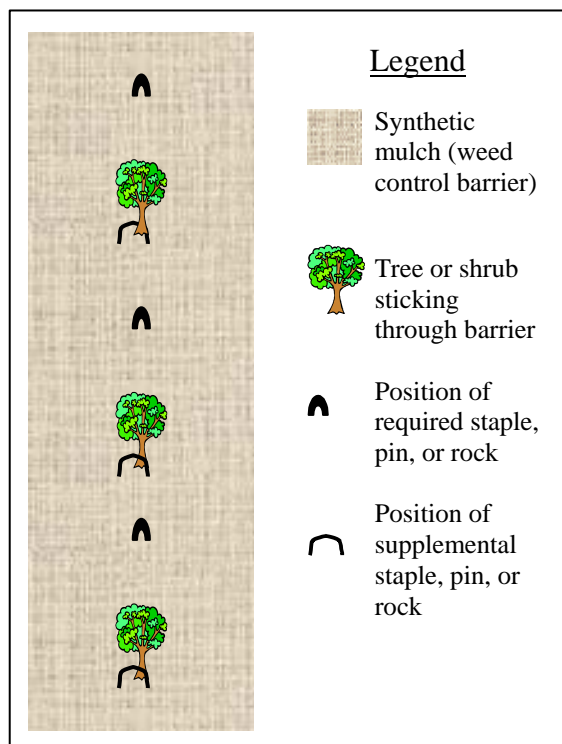
Installation of Continuous Barrier Strips

A strip at least 10 feet wide shall be prepared to enable anchoring the barrier edge firmly.

Barrier strip splices shall be anchored with staples, pins, or rocks. Staples and pins shall be of a length recommended by the manufacturer for the particular soil texture. Rocks must weigh at least 5 pounds. Do not anchor splices with soil. When splices are made with field-cut barrier ends, tuck at least two inches of the cut end under itself to reduce the risk of snagging the barrier with maintenance equipment.

About every 10 feet, or between each tree, whichever is greater, anchor the barrier with pins, staples, or rocks. In lighter soils, or in high wind areas, an additional pin, staple, or rock may be needed near each opening in the barrier. See Figure 3.

Figure 3: Positions of staples, pins, or rocks for continuous barrier strips.



Machines must be adjusted to ensure 10 - 12 inches of barrier edge are firmly anchored in the soil. See Figure 1. After installation, it is often necessary to run a tractor wheel over the edge of the barrier to get a firm seal.

Check-dams across the furrow or slight grading of the site may be necessary on sloping land to prevent water from running along the barrier edge and uncovering it.

Where barrier crosses larger waterways or areas of concentrated flows, the barrier shall be spliced on either side of the waterway. This is to prevent heavy runoff events from washing out an entire strip of barrier and potentially damaging 300-500 feet of tree row. The smaller spliced section may still wash out, but only a small amount will have to be repaired or replaced.

Pins or staples, instead of soil, may be used to anchor barrier edges. The barrier must lay flat against the soil and the pins or staples must be placed every 3 feet along the barrier edge. On sites exposed to extremely high winds or on loose soil, pins or staples may need to be closer than 3 feet.

When installing barrier on curves, use extra care to ensure that 10 -12 inches along each edge gets covered and packed with soil. Ensure the barrier is not so tight that temperature changes pull the barrier loose. Use pins, staples, or rocks to tack large "puckers" to prevent wind damage.

Where barrier is desired on a curved planting with a short radius, it may be better to break the curve into short, straighter segments to ensure better quality and easier barrier installation.

Operation and Maintenance of Synthetic Barrier Following Installation

Seeding non-aggressive, warm-season grasses such as buffalograss, blue grama, or side-oats grama according to NRCS specifications along barrier edge to help anchor it and to inhibit weed growth is recommended. Maintain the grass by mowing, being careful not to snag or rip barrier.

The maintenance requirements listed below will vary in frequency needed, depending on site-specific conditions. Inspections and corrective actions must be performed in a timely manner to achieve success.

- At least every two years, ensure barrier is not damaging tree trunks. Continue inspections until trees are done growing or until barrier is entirely removed. (Barrier under any tension will halt bark/trunk growth along the contact edge, permanently weakening or killing the tree; loose barrier flaps contacting the trunk are harmless.) Enlarge or add a slit as needed to provide at least 4 inches of clearance between taut barrier and tree trunk. A linoleum knife or a utility knife on a long handle is suggested.

- Ensure all barrier edges are firmly anchored.
- Remove weeds, soil, or clippings that have accumulated on the barrier before it provides a rooting medium for weeds. This must be done frequently to prevent weed germination and subsequent root growth that punctures the barrier. This is not as critical on solid polyethylene barrier with no tears or punctures.
- Minimize fire hazard. See conservation practice Firebreak – 394.
- If tilling between barrier pieces, do not hook or rip barrier. Damage to trees and/or barrier may result. Re-anchor any torn or damaged barrier.
- Control erosion in tilled areas to prevent soil deposition on barrier. Consider applying Cover Crop – 340 or Herbaceous Wind Barriers -603.
- Control strongly rhizomatous grasses, such as brome grass, quackgrass, or reed canarygrass growing along the barrier perimeter with herbicides or frequent, close mowing. If not controlled, their extensive root systems will rob the moisture and nutrients under the barrier and suppress tree growth.

Check Out

Check out - general

For cropland erosion control, follow procedure in National Agronomy Manual Subparts 503.43 and 503.44 to measure mulch cover. Obtain producer signature verifying mulch material does not contain noxious weed seed or other seed quantity that will compete with desired vegetation.

For non-cropland sites, traverse the site in an approximate loop, visually inspecting the entire area. Examine mulch material and anchoring at random, representative points across the site.

Size of site	Minimum number of points to check mulch material and # of transects needed to check % ground cover, if applicable
0.1 to 0.5 acre	5
0.5 to 1 acre	9
more than 1.0 acre	9 + (number of acres)

Record on a map or sketch the locations of the points and/or transects checked. If deficiencies are found, check more points as needed to ascertain if a significant problem exists and record findings. Record check out data on Form ND-CPA-484 Notes section, or attach the data.

Record Mulching area to the nearest 0.1 acre. For tree plantings, record actual mulched area only - not the entire site acreage.

Check out – all purposes except weed suppression

Hay, Straw, or Cornstalks

Material - For hay or straw, pick a representative handful at each check point and combine it into one sample. Separate the material by length and determine what percent of the material, by weight, exceeds 10 inches or longer. Record the findings.

Measure the applied mulch rate according to the procedure detailed in NRCS National Agronomy Manual Subpart 503E. Record separate counts of mulch pieces that are anchored and those that are not anchored, i.e., subject to washing or blowing away.

Anchoring

Mechanical Anchoring - Record description of implement used to anchor residue.

Mulch Netting - Attach manufacturer's specifications and installation directions. Compare and record the actual installation details.

Peg and Twine - Measure and record peg length, depth to which they are driven, average distance to linked pegs, and whether or not the twine is sufficiently taut to hold the mulch material in place during a severe wind storm. Record findings.

Soil Retention Blanket

Material - Attach manufacturer's specifications. Visually examine the material and record whether or not the mulch blanket appears to meet NRCS specifications. Record staple leg length, crown width, and wire diameter.

Installation - Record whether or not the blanket is installed with netting side facing upward, and if it is oriented properly in relation to concentrated flow direction or slope, as applicable. Record whether or not the staple pattern matches the pattern shown in the Design & Installation Guide or if it exceeds it. Record the average and maximum distances from the selected staple points to adjacent staples.

Hydro-mulching

Material - Attach a copy of manufacturer's specifications. If possible, verify that the material does not inhibit germination or growth of the planted species. Attach applicator's certification of actual pounds of mulch applied per acre.

Installation - Determine percent of ground covered by mulch, using cropland transect technique. Estimate or measure mulch thickness to the nearest 1/16th inch on representative points actually covered by mulch, and record findings. Record whether the mulch material is moist or dry.

Check out – Mulch applied for weed suppression

Hay, Straw, Chopped Corn Cobs, Wood Chips

- Record the type of material used and thickness of mulch layer.
- For trees/shrubs individually mulched, record the diameter of mulch areas and the number of trees/shrubs treated. For rows entirely mulched, record the total length of rows treated and mulch band width.
- Record whether or not wind or water flow appears to be a threat to displace the mulch.
- Record any actions taken to protect mulch such as planting herbaceous wind barriers or mulch netting applied.

Synthetic Mulch

Material - Attach copy of manufacturer's warranty and product specifications or record the data in Notes.

Installation of Synthetic Mulch or "Barrier" - Record the area covered by barrier to nearest 0.1 acre. If barrier was installed by a consistently successful crew and no problems are seen while traversing the site, a statement to that effect may be placed in Notes in lieu of full details. For other cases, record the following;

Staples: Record soil texture and manufacturer's recommended length and gage. Record the average distance between staples and the pattern used, e.g., one staple between trees spaced 12' apart and one staple near each opening.

Rocks: If used, record whether or not rock size and distribution is sufficient to hold barrier.

Barrier: Record whether or not barrier is sufficiently taut and anchored to resist wind whipping it loose, paying particular attention to curves, side slopes, and splices.

Record whether or not the barrier sufficiently contacts the soil surface to prevent wind whipping, prevent heat stress on trees, and leaves no runway for rodents.

Record the closest distance between taut fabric and trees/shrubs. (the nearest point that could cause abrasion or girdling when trunk growth reaches it.