NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

VEGETATIVE BARRIER

(Ft.)

CODE 601

Switchgrass (*Panicum virgatum*) vegetative barrier study at Jamie L. Whitten Plant Materials Center, Coffeeville, MS.

DEFINITION

Permanent strips of stiff, dense vegetation established along the general contour of slopes or across concentrated flow areas.

PURPOSE

- Reduce sheet and rill erosion.
- Reduce ephemeral gully erosion.
- Manage water flow.
- Stabilize steep slopes.
- Trap sediment.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all land uses where sheet and rill and/or concentrated flow erosions are resource concerns.

This practice is not well-suited to soils that are shallow to rock or other restrictive layers and where tillage is used on the cropped strips.

The "benching" process that occurs on slopes where barriers are installed (tillage erosion moves soil from the upper part of the cropped strip, which then accumulates in the lower part of the cropped strip) can expose soil material unfavorable for crop growth.

CRITERIA

General Criteria Applicable to All Purposes

Physical Characteristics of Plants.

Stiffness Index. Vegetation used in vegetative barriers need to have the minimum Vegetation Stiffness Index (VSI) designated in Table 1 measured at a point 6 inches above the ground.

Density. By the end of the first growing season, gaps between plants need to be ≤ 3 inches.

Species Selection. Species must be adapted to local soil and climate conditions, be easily

Table 1. Stem Diameter and Minimum Stem Density Values for Vegetation Stiffness Index (VSI) Values of 0.05 and 0.10.

Stem Diameter	Concentrated Flow Areas (VSI = 0.1)	Other Purposes (VSI = 0.05)
--Inch--	----------Stem density/ sq ft----------	
0.10	1000	500
0.15	200	100
0.20	60	30
0.25	30	15
0.50	20	10
≥ 1.00	1.0	1.0

established, long-lived, manageable, and tolerant to herbicides used in the cropped field.

Select species which exhibit characteristics that are required for adequate function. Desirable characteristics include the ability to emerge though several inches of sediment or resume growth from buried stem nodes, have a rhizomatous or stoloniferous growth habit, and have stems that remain intact and erect year round. Examples of grass species that might be used in Florida include switchgrass (*Panicum virgatum*), eastern gamagrass (*Tripsacum dactyloides*), and coastal panicgrass (*P. amarum* var. *amarulum*).

Do not plant any species found on the Florida Dep. of Agriculture and Consumer Services or the Florida Dep. of Environmental Protection noxious or prohibited weed lists. Additionally, do not plant any species listed as a Category 1 invasive species by the Florida Exotic Pest Plant Council (see FOTG Section I [f] [4]).

Consult the Florida Plant List for Conservation Alternatives [FOTG II (G)] for approved herbaceous and woody species for use in Florida. Other plant material not found on the list may be suitable, but they need to be approved by the Plant Materials Specialist before use.

Establishment. Barriers may be established vegetatively or from seed.

Use seeding dates, depths, and rates appropriate for the species selected and the conditions of the site. Plant seeds to insure good seed-to-soil contact, and pack area after planting.

Plant vegetatively established barriers in a single row at a dense enough spacing to insure a functional barrier by no longer than the end of the second growing season. For most herbaceous species, this will require a in row spacing of no more than 6 inches for bare-root seedlings, cuttings, sod chunks, plugs, rhizomes, or divisions consisting of no less than 5 viable stems. Use a maximum spacing of 12 inches between plants within the row when planting suckering shrubs or herbaceous species in 6-inch (gallon) pots or equivalent container.

Use whatever site preparation and planting date is necessary to ensure seed germination or proper rooting conditions for vegetated material establishment. If transplants are used, plant in a manner that produces good root-to-soil contact and pack around plants after planting.

See Florida Conservation Practice Standards Tree/Shrub Establishment, Code 612, and Critical Area Planting, Code 342, and their accompanying guidance for more information on site preparation and planting dates.

Temporary measures, such as erosion control blankets, silt barriers or mulches, can be used if needed during the establishment period.

Barrier Width. Barrier widths need to be at least 3-feet wide or 0.75 times the design vertical interval, whichever is larger. Broadcast or drilled seed need to be sown in a strip at least 3-feet wide. When a row planter is used, a minimum of 2 rows needs to be sown.

Comply with applicable federal, state and local laws and regulations during the installation, operation, and maintenance of this practice.

Impact to cultural resources, wetlands, and Federal and State protected species shall be evaluated and avoided or minimized to the extent practical during planning, design and implementation of this conservation practice in accordance with established National and Florida NRCS policy, General Manual (GM) Title 420-Part 401, Title 450-Part 401, and Title 190-Parts 410.22 and 410.26; National

Planning Procedures Handbook (NPPH) FL Supplements to Parts 600.1 and 600.6; National Cultural Resources Procedures Handbook (NCRPH); and The National Environmental Compliance Handbook (NECH).

Additional Criteria for Reducing Sheet and Rill Erosion

Gradient. Gradients along the barrier need to be between 0.2 and 1.0 percent, except where the vegetative barrier crosses concentrated flow areas. Gradients entering a concentrated flow area may up to 1.5 percent for 100 feet in order to get better row alignment.

Perform all tillage and equipment operations in the interval between barriers parallel to the vegetative barrier.

A berm and/or a channel immediately upslope edge of the barrier is required to redirect flow along the vegetative barrier. Minimum berm height/channel depth needs to be 3 inches. Water flowing along the vegetative barrier/channel must be delivered to a stable outlet

Spacing. Base horizontal spacing between the vegetative barriers on the lesser of:

- the horizontal distance that creates a vertical interval of no more than 6 feet, or
- the RUSLE2 “L” that achieves the allowable soil loss for the field, considering the planned practices in the conservation management system. See Florida NRCS Conservation Practice Standard Terrace, Code 600, for more information.

Plan crop strip width on the multiples of widths from planting, tillage, spraying and harvest equipment. This spacing may be adjusted up to 10 percent between the barriers.

Vegetation. Use species that will provide the designated minimum stem density with the designated stem diameter and have a minimum vegetation stiffness index (VSI) of 0.05. See Table 1.

Additional Criteria for Reducing Concentrated Flow (Gully) Erosion

Alignment. Vegetative barriers may be installed across concentrated flow areas perpendicular to the direction of water flow.

Width and Length. For this purpose, vegetative barriers need to be a minimum of 2 rows wide. Each strip will be long enough to ensure the ends of the strip are at least 1.5 feet higher than the center of the flow (see Fig. 1.) When the concentrated flow area has a pre-existing headcut, place one row of a barrier at the bottom of the headcut and the other row at the top.

Spacing. Spacing between the vegetative barriers needs to be based on a vertical interval of 1.5 feet for conditions where no tillage is performed between the barriers. For all other conditions where sediment deposition and bench development is anticipated, vertical interval needs to be 3 feet.

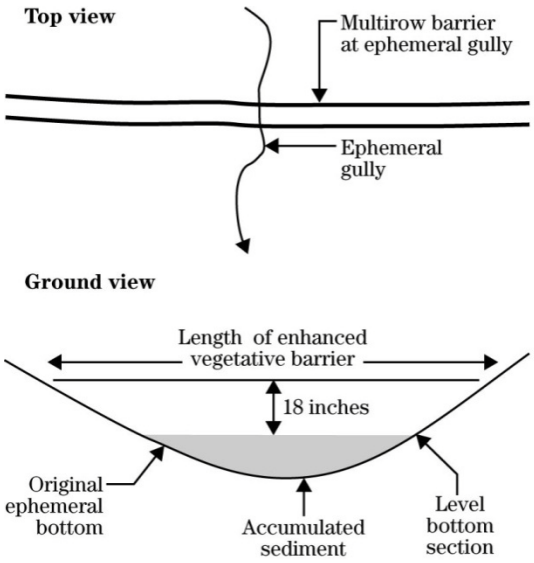
Crop strip width needs to be based on multiples of widths of planting, tillage, spraying, and harvesting equipment. Adjustments of ±10 percent in the width of the crop strip between the barriers is allowed for equipment operations.

Minimum Level Bottom Section Length. The minimum level bottom section length (in feet) needs to be numerically equal to the peak discharge (in cubic feet second [cfs]) for a 2-year, 24-hour design storm from the total watershed upslope of the lowest barrier. This equates to a specific discharge of 1 cfs/ft of vegetative barrier. Level bottom section is defined as the bottom width of a trapezoidal waterway. This can be shaped during construction or formed by sediment deposition (see Fig. 1.) Use methods in Chapter 2, of the Engineering Field Handbook to estimate peak discharge for local soil, climate, and management conditions.

If the channel does not have a level bottom section, design barriers so that the peak discharge through the barriers for a 2-year, 24-hour storm does not exceed allowable velocities for the soil, vegetation, and slope conditions as determined using Chapter 7 of the Engineering Field Handbook.

Vegetation. Use species that will provide the designated minimum stem density with the designated stem diameter and have a VSI of 0.10. See Table 1.

Figure 1. Barriers in concentrated flow areas must extend far enough up the hillslope to avoid bypass around the ends during peak flows.



Additional Criteria for Managing Water Flow

Gradient. In order to divert flow, gradients along the barrier need to be between 0.2 and 1.0 percent, except where the vegetative barrier crosses a concentrated flow area. Gradients entering a concentrated flow area may be up to 1.5 percent for 100 feet in order to get better row alignment.

In order to redirect flow, a berm and/or a channel on the upslope edge of the barrier is necessary to redirect flow and reduce slope length. Minimum berm height/channel depth needs to be 3 inches. Water flowing along the barrier must be delivered to a stable outlet.

Width and Length. Vegetative barriers can consist of 1 or 2 rows, but can be wider to adjust for planter and/or sprayer width, or for improved contour alignment. Vegetative barrier length will vary depending on the topography. At a minimum, each strip needs to be long enough to ensure that the ends of the strip are at least 1.5 feet higher than the center of the flow (see Fig. 1.)

Spacing. Base horizontal spacing between the vegetative barriers on the lesser of:

- the horizontal distance that creates a vertical interval of no more than 4 feet, or
- the RUSLE2 “L” that achieves the allowable soil loss for the field, considering the planned practices in the conservation management system. See Florida NRCS Conservation Practice Standard Terrace, Code 600, for more information.

For barriers intended to retard and spread run-off, the maximum vertical interval needs to be 1 foot.

Plan crop strip width in multiples of widths of planting, tillage, spraying, and harvest equipment. This spacing may be adjusted up to 10 percent between the barriers.

Maximum Watershed. The total watershed in a vegetative barrier system needs to be the smaller of the size that will:

- provide runoff to impound 1 foot of water upslope of the lowest barrier in the system, or
- generate maximum allowable velocity on bare soil for the soil texture in the concentrated flow area as determined in Chapter 7 in the Engineering Field Handbook.

Vegetation. Use species that will provide the designated minimum stem density with the designated stem diameter and have a VSI of 0.05 for areas diverting runoff and VSI of 0.1 for areas retarding and ponding runoff. See Table 1 for guidance.

Additional Criteria for Stabilizing Steep Slopes

No concentrated flow channels may exist on slopes face where vegetative barriers are to be used. Any concentrated flow must be dispersed using other means prior to installation of the vegetative barriers.

Barrier Row Grade. Maximum grade of the barrier rows shall not exceed:

- one-half of the up-and-down slope percent used for conservation planning, or
- 2 percent,

whichever is less.

Spacing. For this purpose, the maximum vertical interval is:

- 6 feet when barriers are designed so that runoff water flows along the barrier, not through it (i.e., barrier functions as a terrace.),

- but no more than 4 feet when overland flow occurs between barriers.

Vegetation. Use deeply rooted species that establishes easily and grows rapidly.

The vegetation stiffness needs to provide the designated minimum stem density with the designated stem diameter and VSI of 0.05 based on Table 1.

Additional Criteria for Trapping Sediment at the Bottom of Fields and/or the Ends of Furrows

Alignment. As close as possible, align barriers perpendicular to the flow coming off of the field(s) or out the ends of furrows.

Width. Vegetative barriers need to be a minimum of 3 feet wide.

CONSIDERATIONS

General Considerations

When designing the conservation management system on cropland, management practices such as Florida Conservation Practice Standard Crop Rotation, Code 328, and tillage management practices (Codes 329, 345, and 346) must be considered.

Associated structural practices such as water and sediment control basins, subsurface drainage, and underground outlets may be needed to adequately handle surface and subsurface water.

This practice may improve the efficiency of other practices such as stripcropping, filter strips, riparian forest buffers, grassed waterways, diversions, and terraces.

On tilled fields, consider if the soil profile has sufficient depth to retain productivity when benches develop as soil is moved down gradient by tillage. Soil upslope of barriers will gradually build up while soil will be removed down slope of the barrier. This effect needs to be considered with respect to soil depth, subsoil characteristics, and response to amendments.

Established vegetative barrier systems can pond water behind the barriers. Subsurface drains may need to be installed across the slope parallel to the barrier or through the ponded areas above barriers that are installed across concentrated flow areas.

Increasing the minimum width of the barrier and choosing species with greater above- and below-ground biomass will increase the potential for carbon sequestration.

Considerations to Enhance the Functioning of Other Practices

Filter Strips. Vegetative barriers incorporated into the upslope portion of filter strips will increase filter strip longevity by promoting sediment deposition above the filter strip.

Field Borders. Vegetative barriers incorporated into the upslope portion of field borders at the bottom of slopes will increase field border longevity by promoting sediment deposition above the field border.

Riparian Forest Buffers. Vegetative barriers can reduce sediment delivery to riparian buffers when located just upslope of the buffer. Locate barriers used in association with riparian forest buffers immediately upslope of zone two or zone three of the buffer (see Florida Conservation Practice Standard Forest Riparian Buffer, Code 391). Shading effects on vegetative barrier growth should be considered when selecting species.

PLANS AND SPECIFICATIONS

Plans and specifications need to include:

1. Field map with location of vegetative barriers.
2. Width of crop strip.
3. Vegetative barrier and crop strip orientation.
4. Width of barrier.
5. Vegetative species and cultivar.
6. Vegetation establishment date, establishment method, and seeding rate or vegetation spacing.
7. Site stabilization, if needed to ensure establishment.

OPERATION AND MAINTENANCE

Carry out the following actions to insure that this practice functions as intended. These actions include normal activities in the

application and use of the practice and repair and maintenance of the practice.

1. Reseed or replant establishment failures immediately; short gaps in seeded barriers may be reestablished more effectively and immediately with transplanted plant material.
2. Mowing of herbaceous barriers may be used as a management practice to encourage the development of a dense stand and prevent shading of crops in adjacent fields. Do not mow closer than 15 inches or the recommended height for the species, whichever is taller.
3. Mow barriers in concentrated flow areas during their dormant period to avoid lowering VSI.
4. Burning of herbaceous barriers may be used as a management practice, if the species used in the barrier will tolerate fire. Perform burning in the spring when the vegetation is dormant. A controlled burn plan is required. Refer to Florida NRCS Conservation Practice Standard Prescribed Burning, Code 338, for more information.
5. Control any plant on the Federal or State noxious weed list. Control other weeds as necessary to ensure a dense stand within the barrier.
6. Perform crop tillage and planting operations parallel with the vegetative barrier.
7. Pest control in adjacent fields needs to be performed with techniques and pesticides that will not damage the vegetative barrier. Refer to Florida NRCS Conservation Practice Standard Pest Management, Code 595, for more information.
8. Fill and replant washouts or rills immediately. Reestablish short gaps in established barriers with transplanted plant material.
9. Do not use vegetative barriers as a field road or turn row. Do not cross vegetative barriers in concentrated flow areas with machinery.
10. Do not cross vegetative barriers with water furrow plows or similar implements to cut drainage ditches to allow the passage of surface and subsurface water. If necessary, drain water with underground outlets installed up gradient of the barrier.

REFERENCES

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