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Selecting, Planting, and Managing Grasses for Vegetative Barriers

Acknowledgements

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Plant Materials Technical Note 6 was prepared by: Jon K. Allison, Farm Foreman, Jamie L. Whitten Plant Materials Center, Coffeeville, MS; Joel Douglas, Plant Materials Specialist, Central National Technology Support Center, Fort Worth, TX; Heather Dial, Plant Materials Specialist, West National Technology Support Center, Portland, OR; Steve Woodruff, Agronomist, East National Technology Support Center, Greensboro, NC; and John Englert, National Program Leader-Plant Materials, Washington, D.C.

Plant Materials Centers (PMC) contributing to the development of Plant Materials Technical Note No. 6: Jimmy Carter PMC, Americus, GA; Lockeford PMC, Lockeford, CA; Hoolehua PMC, Hoolehua, HI; Aberdeen PMC, Aberdeen, ID; Manhattan PMC, Manhattan, KS; Norman A. Berg National PMC, Beltsville, MD; Elsberry PMC, Elsberry, MO; Bismarck PMC, Bismarck, ND; Cape May PMC, Cape May Court House, NJ; E. “Kika” de la Garza PMC, Kingsville, TX; and Pullman PMC, Pullman, WA.

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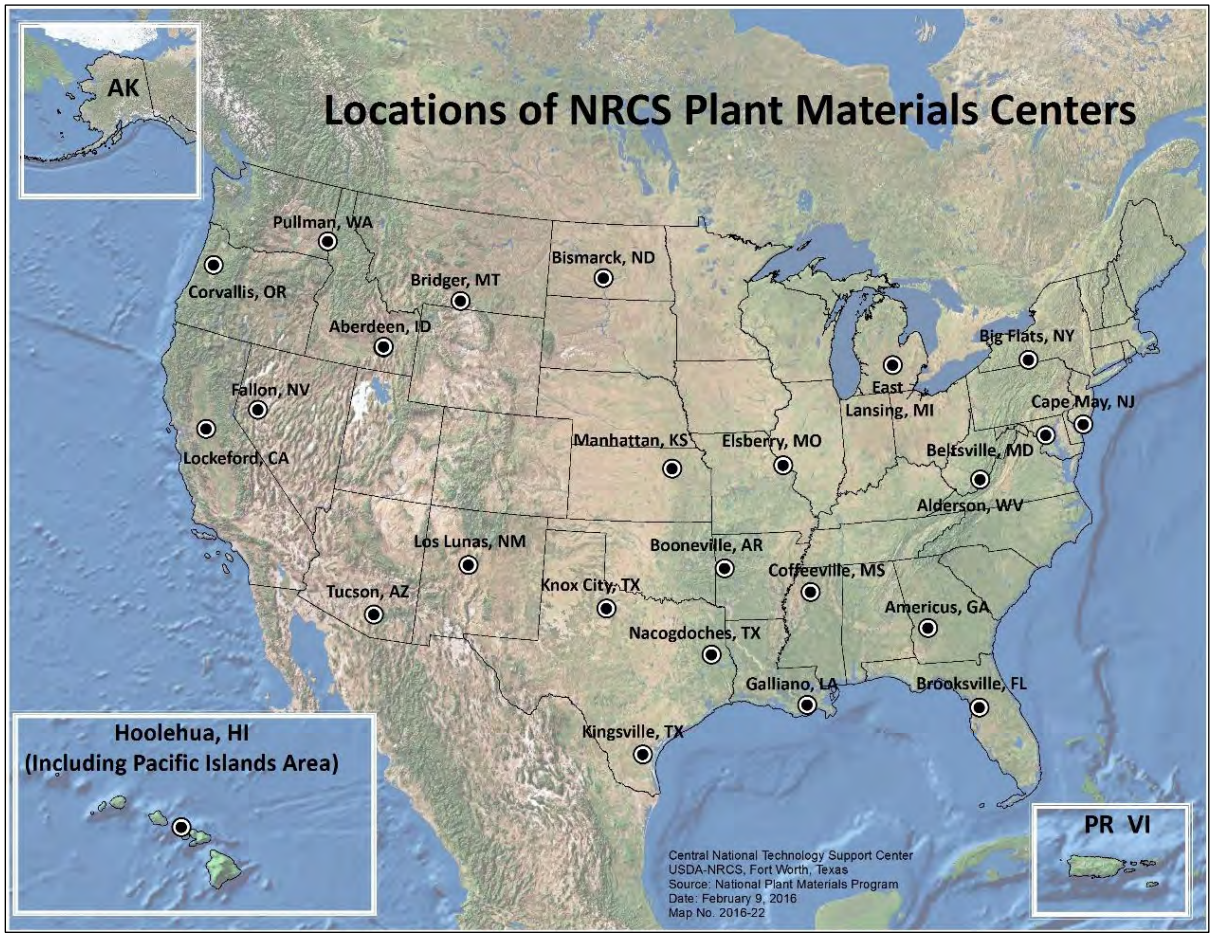
Preface

The U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Plant Materials Program has been involved in the evaluation of conservation plants and planting technology for more than 80 years. The Plant Materials Program releases plant material for use in conservation applications. This technical note provides information on perennial warm and cool season grasses that meet requirements for the installation of NRCS Conservation Practice Standard Vegetative Barrier (VB) (Code 601) or those suitable for improving the efficiency of other conservation buffers such as filter strips, field borders, riparian forest buffers, and contour buffer strips. Species not meeting the VB standard are listed in Appendix A of this technical note for reference.

For additional information on specific species of plants mentioned in this publication, please see the USDA PLANTS database at https://plants.sc.egov.usda.gov/home or contact the nearest Plant Materials Center or plant materials specialist at https://www.nrcs.usda.gov/wps/portal/nrcs/main/plantmaterials/contact/directory/ that serves the State. Additional technical resources are on the National Plant Materials Program website at https://www.plant-materials.nrcs.usda.gov/.



Introduction

NRCS Conservation Practice Standard (CPS) Vegetative Barrier (VB) (Code 601) is a conservation buffer practice consisting of permanent strips of stiff, narrow (3- to 5-ft wide), dense vegetation planted along the general contour of slopes or across concentrated flow areas at angles convenient for farming (Kemper et al., 1992; fig. 1). They reduce sheet and rill erosion, decrease ephemeral gully erosion, manage water flow, stabilize steep slopes, and trap sediment (Dabney et al., 1993; Meyer et al., 1994, fig. 2). Vegetative barriers may be used in conjunction with other conservation practices or conservation tillage system (McGregor and Dabney, 1993) to reduce soil erosion and improve water quality.

Figure 1: Vegetative barrier planted to 'Alamo' switchgrass in a cotton field in Quitman county, MS.

Figure 2: Vegetative barrier trap sediment on the upslope side of the barrier.

Vegetative Barrier Vegetation Requirements

Research at the USDA-Agricultural Research Service, National Sedimentation Laboratory, Oxford, MS, established minimum stem diameter and stem density values for vegetation stiffness index (VSI) for concentrated flow areas (VSI = 0.10) and other purposes (VSI = 0.05) to improve the efficiency of conservation buffer practices such as NRCS CPSs Filter Strip (Code 393), Field Border (Code 386), Riparian Forest Buffer (Code 391), and Contour Buffer Strips (Code 332) (table 1).

Selecting Grasses for Vegetative Barriers

Research has shown that perennial grasses that have coarse stems will work as VB if they can be established as a uniform and dense strip and are tolerant of sediment deposition (Dabney et al., 1999). Vegetative barriers consist of stiff, erect, perennial grasses adapted to local soil and climatic conditions with enough stem strength to remain erect against expected water flows.

Suitable VB plants must satisfy several criteria. They must be tolerant to the following: (a) herbicides used on adjacent cultivated crops; (b) partial shading from cultivated crops; (c) inundation by sediment; (d) local climatic extremes (wetness, drought, freezing temperatures, etc.); and, (e) easily established (Dewald et al., 1996). They must also be long-lived and manageable as a narrow strip, non-weedy and not too competitive with adjacent cultivated crops.

Table 1. Stem diameter and minimum stem density values for vegetation stiffness index (VSI) of 0.10 and 0.05[1/].

Stem Diameter (Inches)	Concentrated Flow Areas Stem Density Per Square Foot @ VSI=0.10	Other Purposes Stem Density Per Square Foot @ VSI=0.05
0.10	1,000	500
0.15	200	100
0.20	60	30
0.25	30	15
0.30	15	7
0.35	7	4
0.50	3	2
=/>1.00	1	1

1/ Table adopted from the 2020 revised Vegetative Barrier Practice Standard.

Stem Properties of Warm and Cool Season Grasses

Plant Materials Centers collected stem diameter and stem density values of commercially available cultivars and pre-varietal germplasms of native and introduced, cool and warm season perennial grasses to determine their usefulness as a vegetative barrier based on the calculation of VSI of the grass (Dunn and Dabney, 1996).

$$\text{Vegetation Stiffness Index} = \text{Stems/ft}^2 \times \text{Stem diameter to the } 4^{th} \text{ power}$$

For example: Grass has 70 stem/ft^2 with an average stem diameter of 0.20. To calculate the VSI multiply 70 by 0.20 to the 4th power. The VSI calculation is 0.112.

The product from the VSI calculation must be $\geq$ 0.10 for concentrated flow areas and $\geq$ 0.05 for other conservation buffer practices such as CPSs Filter Strip (Code 393), Field Border (Code 386), Riparian Forest Buffer (Code 391), and Contour Buffer Strips (Code 332).

Plant grasses at the recommended critical area (CPS Critical Area Planting (Code 342)) seeding rate for quick, dense stands to meet the minimum requirements for VSI. Grasses listed in tables 2 and 3 met the VSI of 0.10 and/or 0.05. It is important to note that grass cultivars or pre-varietal germplasm selections that meet VSI requirements in the region tested may not necessarily meet the VSI requirements when grown in a different region of the United States, where adapted. For example, ‘Alamo’ switchgrass met the VSI requirements for concentrated flow areas in Kingsville, TX, and Coffeeville, MS, but did not meet the VSI requirement in Beltsville, MD. However, Alamo met the VSI of 0.05 for other purposes of the practice in MD. To determine the area of adaptation of a cultivar or pre-varietal germplasm, see the release brochure hyperlinked in tables 2 and 3 or visit the Plant Materials Program Releases webpage.

It is critical that conservation planners plan the VB practice based on cultivars or pre-varietal releases from table 2 and 3 and not based on the species alone, unless the VSI of the grass is known. Furthermore, do not recommend unnamed species (VNS or variety not stated). If a perennial grass has the desirable characteristics of a VB species, and is not on the list, a VSI must be determined before recommending it for the practice. Failure to consider this step in the planning process may jeopardize the planting and effectiveness of the conservation practice. Named selections of grasses which do not meet a VSI of at least 0.05 at the time of this publication are included in Appendix A, tables 4 and 5. As additional measurements are made some of these grasses may be found to meet VSI or 0.10 or 0.05 and these tables will be updated.

Table 2. Warm and cool season perennial grasses meeting the vegetation stiffness index of 0.10 and 0.05.

Cultivar/Pre-varietal Germplasm	Scientific Name	Common Name	PMC where stem attributes were measured
Alamo	*Panicum virgatum*	switchgrass	Kingsville, TX; Coffeeville, MS
Falfurrias Germplasm	*Sporobolus wrightii*	big sacaton	Kingsville, TX
Magnar	*Leymus cinereus*	basin wildrye	Aberdeen, ID
Sunshine	*Chrysopogon zizanioides*	vetivergrass	Kingsville, TX; Hoolehua, HI
Timber Germplasm	*Panicum virgatum*	switchgrass	Cape May, NJ

Table 3. Warm and cool season perennial grasses meeting the vegetation stiffness index of 0.05.

Cultivar/Pre-varietal Germplasm	Scientific Name	Common Name	PMC where stem attributes were measured
Alamo	*Panicum virgatum*	switchgrass	Beltsville, MD
Atlantic	*Panicum amarum*	coastal panicgrass	Cape May, NJ; Beltsville, MD
Blackwell	*Panicum virgatum*	switchgrass	Beltsville, MD
Bromar	*Bromus marginatus*	mountain brome	Pullman, WA
Coastal Germplasm	*Sorghastrum nutans*	Indiangrass	Cape May, NJ
High Tide Germplasm	*Panicum virgatum*	switchgrass	Cape May, NJ
Kanlow	*Panicum virgatum*	switchgrass	Manhattan, KS
Niagara	*Andropogon gerardii*	big bluestem	Beltsville, MD
Rumsey	*Sorghastrum nutans*	Indiangrass	Beltsville, MD
Southlow Germplasm	*Andropogon gerardii*	big bluestem	Beltsville, MD
Suther Germplasm	*Sorghastrum nutans*	Indiangrass	Cape May, NJ

Planting Vegetative Barriers

General Planning

Plan the VB practice several months in advance of the planting. Row spacing and width of the farming equipment are critical factors in the planning process. Planners may need to adjust the location of the VB in the field based on the producer's row crop equipment. For example, a producer with 8 row, 40-in. equipment (26.7 ft wide), may prefer to make two passes between each VB so the distance between each barrier would be about 54 ft.

Cropping history is also important in the planning process because residual herbicide from a previous season may damage or affect germination of the VB grass. The use of precision agriculture technology such as GPS guidance systems and/or field mapping, allow a producer to plan where future VBs will be installed prior to their establishment. Detailed planning can prevent loss to a producer because the strip(s) can be unplanted to the cash crop and excluded from herbicide use.

Timing

It is beneficial for the producer to get as many of the normal cropping system applications (tillage, spraying, etc.) completed before seeding the VB. This may cause the planting date to be later than the normal planting window of the VB grass species, but with less risk of mechanical or herbicide injury to young seedlings. Soil moisture should be the limiting factor on the latest possible planting date of a VB.

Planting

After laying out the VB strip(s) according to the design plan and specifications in the VB practice standard, determine the total number of linear feet of VB to plant (fig. 3). The total number of linear feet is important for calculating the amount of seed needed for the VB.

Figure 3: Determine the number of linear feet of VB to plant.

For example*: 5,000 linear feet of planned VB multiplied by 5 ft (width of the VB) equals 25,000 ft^2 divided by 43,560 equals 0.6 acres.*

$$\frac{5000\ ft * 5ft}{43{,}560\ ft^2\ in\ an\ acre} = 0.6\ acres$$

The critical area (conservation practice standard 342) seeding rate for the VB species is 10 PLS/acre. The amount of seed needed to purchase is 6 PLS lbs. It's always a good idea to purchase a few extra pounds of seed in case there are issues during the planting operation.

*10 PLS lbs * 0.6 acres = 6 PLS lbs*

Seedbed Preparation

A 5-ft-wide rototiller is ideal for preparing a seedbed for VB planting (fig. 4). Firm the soil using a cultipacker or similar implement prior to planting (fig. 5). Broadcast seed with hand-operated spreader and cultipack afterwards to ensure a seed-to-soil contact (fig. 6) or use a cultipacker seeder to plant the seed and firm the soil in one operation (fig. 7). For vegetative plant materials, establish a double row of transplants, 6 inches apart in the concentrated flow areas (fig. 8). Additional measures to secure new transplants in the concentrated flow areas may include staking haybales end to end on the upslope side of the VB or attaching burlap or silt fencing to stakes across concentrated flow area to protect the transplants until they are established (fig. 9).

Figure 4: Preparing a seedbed with a 5-ft wide rototiller.

Figure 5: Firm the soil prior to planting.

Figure 6: Planting VB on a well-prepared seedbed.

Figure 7: Cultipacker seeder.

Figure 8: Repairing washout in concentrated flow areas using ‘Alamo’ switchgrass transplants.

Figure 9: Haybales positioned across the concentrated flow area to protect new ‘Alamo’ switchgrass transplants.

Maintenance

To repair washouts in the concentrated flow areas or fill in gaps in the VB, follow the general guidance provided above for establishing plants in concentrated flow areas.

Control weeds in the VB before they become aggressive or spread into the adjacent crop. Apply labeled herbicides that will not harm the VB species or the cash crop. Spot spraying weeds with a broad-spectrum herbicide is also an option for controlling weeds in the VB. Contact your local extension weed specialist for assistance with herbicide recommendations, rates and dates of application in your state.

Generally, enough fertilizer is applied during the fertilization of the cash crop to maintain healthy VB plants. However, if this is not the case, fertilize the VB plants with a maintenance fertilizer rate to keep plants growing vigorously.

Mowing VB may be used as a management practice to encourage the development of a dense stand and prevent shading of crops in adjacent rows. Mow no closer than 15 inches. Mowing in concentrated flow areas is discouraged because it will reduce stem diameter and lower the VSI. If residue control is needed in concentrated flow areas, mow in the dormant season.

For more information on design specifications, operation, and maintenance refer to the CPS Vegetative Barrier (Code 601) (National Conservation Practice Standards).

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Appendix A

Grasses listed in tables 4 and 5 **do not meet the VSI of 0.10 and/or 0.05** at the time of publication and are included for reference.

Table 4. Warm and cool season perennial grasses that may have potential to meet the vegetation stiffness index of 0.05 with additional stem counts but are not currently recommended for use in the VB practice.

Cultivar/Pre-varietal Germplasm	Scientific Name	Common Name	PMC where stem attributes were measured
Bison	*Andropogon gerardii*	big bluestem	Bismarck, ND
Bonilla	*Andropogon gerardii*	big bluestem	Bismarck, ND
Kaw	*Andropogon gerardii*	big bluestem	Bismarck, ND
Rountree	*Andropogon gerardii*	big bluestem	Bismarck, ND
Whitepass Germplasm	*Elymus glaucus*	blue wildrye	Pullman, WA
Red River Germplasm	*Spartina pectinata*	prairie cordgrass	Bismarck, ND
Americus	*Sorghastrum nutans*	Indiangrass	Americus, GA
Carthage	*Panicum virgatum*	switchgrass	Cape May, NJ
Cave-in-Rock	*Panicum virgatum*	switchgrass	Beltsville, MD; Elsberry, MO
Shawnee	*Panicum virgatum*	switchgrass	Elsberry, MO
Shelter	*Panicum virgatum*	switchgrass	Beltsville, MD
Alamo	*Panicum virgatum*	switchgrass	Americus, GA
Alkar	*Thinopyrum ponticum*	tall wheatgrass	Pullman, WA

Table 5. Warm and cool season perennial grasses that have been evaluated and **do not meet** the vegetation stiffness index for concentrated flow areas or other purposes of the practice.

Cultivar/Pre-varietal Germplasm	Scientific Name	Common Name	PMC where stem attributes were measured
Rio	*Leymus triticoides*	beardless wildrye	Lockeford, CA
Berber	*Dactylis glomerata*	orchardgrass	Lockeford, CA
Windbreaker	*Sporobolus wrightii*	big sacaton	Lockeford, CA
Bell	*Chloris gayana*	rhodesgrass	Hoolehua, HI
Blackwell	*Panicum virgatum*	switchgrass	Manhattan, KS
Prairie View Germplasm	*Sorghastrum nutans*	Indiangrass	Beltsville, MD
Forestburg	*Panicum virgatum*	switchgrass	Bismarck, ND
Dacotah	*Panicum virgatum*	switchgrass	Bismarck, ND
Sunburst	*Panicum virgatum*	switchgrass	Bismarck, ND
NE 28	*Panicum virgatum*	switchgrass	Bismarck, ND
Trailblazer	*Panicum virgatum*	switchgrass	Bismarck, ND
NE 2643	*Panicum virgatum*	switchgrass	Bismarck, ND
Shawnee	*Panicum virgatum*	switchgrass	Bismarck, ND
Pathfinder	*Panicum virgatum*	switchgrass	Bismarck, ND
Shelter	*Panicum virgatum*	switchgrass	Bismarck, ND
Manska	*Thinopyrum intermedium*	pubescent wheatgrass	Bismarck, ND

Cultivar/Pre-varietal Germplasm	Scientific Name	Common Name	PMC where stem attributes were measured
Manifest	*Thinopyrum intermedium*	Intermediate wheatgrass	Bismarck, ND
Bounty	*Andropogon gerardii*	big bluestem	Bismarck, ND
Latar	*Dactylis glomerata*	orchardgrass	Pullman, WA
Union Flat Germplasm	*Elymus glaucus*	blue wildrye	Pullman, WA
Whitmar	*Pseudoroegneria spicata ssp. inermis*	bluebunch wheatgrass	Pullman, WA
Secar	*Elymus wawawaiensis*	Snake River wheatgrass	Pullman, WA
Durar	*Festuca brevipila*	hard fescue	Pullman, WA
Canbar	*Poa secunda*	Canby bluegrass	Pullman, WA