Vegetative Barrier

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Tree ring with lemon grass vegetative barrier.
Photo courtesy of AJ Ilai.

Introduction

Vegetative barriers, or grass hedges, are perennial strips of strong, erect, and condensed vegetation planted alongside the contour of slopes within fields or rows across drainage ways or concentrated across general flow areas that allow for convenient farming. It is an alternative soil conservation method used to reduce sheet and rill erosion, reduce ephemeral erosion, reduce the formation of classic gully formation, reduces the speed of the water flow, and assists with filtering sediments and excess nutrients that may pollute farming areas (Natural Resources Conservation Service, April 2003), as well as improve wildlife habitats. Vegetative barriers are beneficial to farmland, grazing land, and areas that can adapt easily to perennial vegetation.

Benefits of vegetative barrier

Reduce sheet and rill erosion

Vegetative barrier practices assist with reducing sheet and rill erosion. Sheet and rill erosion occurs simultaneously when raindrops dislodge soil particles, by wind, or transported through surface runoff. Water infiltration in increased, which in turn reduces the volume of runoff secreted. When runoff water is redistributed, it creates sheet flow; compared to concentrated flow, sheet flow is less erosive (Los, Anderson, and Gantzer, 2001).

Figure 1. Example of sheet and rill erosion that occurred from a thunderstorm. Source: http://vro.agriculture.vic.gov.au/dpi/vro/vrosite.nsf/pages/lwm_land_deg_soil-erosion_sheet-rill-erosion

Figure 2. Rill and sheet erosion occurring on a cultivated land.
Source: https://www.qld.gov.au/environment/land/management/soil/erosion/types

Reduces ephemeral erosion

Ephemeral erosion is a type of water erosion that forms in loamy soils by waterfall erosion, channel erosion along gully beds, or landslide erosion on gully banks (Geyik, 1986). Vegetative barriers are used to assist with reducing ephemeral gully formations that can occur from an increase of surface runoff. Deep-rooted vegetative barriers disperse concentrated water flow into wider farm areas which result in water deposited into the field. This becomes available for field crops or may slow leaking from the barrier.

Figure 3. Example of ephemeral gully erosion pictured by Natural Resources Conservation Service. Source: https://columbustelegram.com/community/banner-press/news/controlling-ephemeral-gully-erosion/article_853240d2-396b-5dac-9597-f3dea3204d55.html

Reduces formation of classic gully erosion

Classic gully erosions are found in natural drainage areas or depressions. They may occur from ephemeral gullies that have settled into the field and cannot be managed by tillage operations because of its extreme channel depth (e-FOTG Wisconsin, 2017) and can be permanent. Vegetative barriers assist with preventing and stabilizing existing classic gullies from increasing in size.

Figure 4. Gully erosion that occurred in Ohio in Spring 2017. Source: https://agbmps.osu.edu/scenario/gully-erosion-concentrated-surface-flow

Reduce speed of water flow

Vegetative barriers are implemented to help reduce the speed of water flow across a slope or farm area. Reducing the speed flow of water also ensures the flow into streams and ditches are uniform and stable. This prevents further erosion development (Los, Anderson, and Gantzer, 2001) and ultimately, promotes water conservation. When surface runoff is managed, this promotes detention and infiltration of excess nutrients leaching into ground water sources.

Improves soil quality

As mentioned, vegetative barriers reduce the speed of water flow and enables a dispersed uniform water flow. This allows water to become available to broader areas, which helps maintain proper levels of soil moisture. When tillage practices are implemented, this can move soil and sediments downslope; in turn, vegetative barriers act as a trapping system to catch sediments. This prevents farming and surrounding areas from becoming polluted or excess nutrients and sediments from entering surface water bodies.

Improves wildlife habitats

Vegetative barriers are a valuable wildlife habitat by providing travel lanes and in-field escape covers. Native species or adapted species are incorporated to provide food and cover for the inhabiting wildlife (Los, Anderson, and Gantzer, 2001). For more information on guidance for choosing species that meet wildlife objectives, please contact an agricultural extension agent at the University of Guam Cooperative Extension Program.

Disadvantages of vegetative barriers

- Establishment of vegetative barriers take extra costs for plant materials, labor, and maintenance.
- Vegetative barriers can be problematic to establish and maintain in nutrient-deficient soils and regions with arid/semi-arid climates.
- Vegetative barriers reduce crop space and potential crop profit.
- Vegetative barriers may attract other pests or wildlife that could affect production of crops.

Choosing a vegetative barrier

Before implementing this conservation practice, farmers should consider the type of soil, crop selection, and grass that is suitable for vegetative barriers. It is important to consider the following characteristics when choosing a grass species: stem strength, plant density, invasive growth, and the possibility of being a host for invasive and non-invasive pests and diseases (Watershed

Academy Web, n.d.). The chosen grass species should be a perennial plant which can live for a longer period of time. Some perennial grasses that can be used on Guam and throughout the islands of the Pacific region include lemongrass, *Cymbopogon citratus* (Figure 1); *Guinea grass, Panicum maximum* (Figure 2); para grass, *Bracharia mutica*; or wild cane, *Saccahrum spontaneum*, (Personal communication with Joseph Tuquero, 2021). Please refer to Table 1 for more information on suitable grass species used for vegetative barriers.

Table 1. Vegetative Barrier Suitable Species

Common Name/Cultivar	Scientific Name	Approximate Stem Diameter (in.)	Approximate Mature Height (ft.)	Adapted Elevation (ft.)	Adapted to Annual Rainfall 1/
banagrass 2/ 7/	*Pennisetum purpureum*	0.83	15	0 - 3,000	40+
greenpanicgrass 2/ 5/ 7/ 'Petrie'	*Urochloa maxima*	0.19	5	0 - 2,500	25 - 70
lemongrass	*Cymbopogon citratus*	0.19	4	0 - 4,000	50+
'Mott' dwarf elephantgrass 4/	*Pennisetum purpureum*	0.55	12	0 - 3,000	40+
Napier x pearl millet hybrid 4/ 'PMN Hybrid'	*Pennisetum purpureum* x *Pennisetum glaucum*	0.53	12 - 15	0 - 3,000	40+
piligrass 2/ 3/	*Heteropogon contortus*	0.18	5	0 - 2,000	15 - 45
Rhodesgrass 2/ 6/ 'Bell', 'Katambora', 'Nemkat' 5/	*Chloris gayana*	0.19	5	0 - 3,000	25 - 45
'Sunshine' vetivergrass 4/ 5/ 6/	*Chrysopogon zizanioides*	0.36	8	0 - 3,000	35+
wild cane hybrid 4/	*Saccharum* hybrid clone *Moentai*	0.70	15	0 - 3,000	35+

Source: https://www.nrcs.usda.gov/Internet/FSE_PLANTMATERIALS/publications/hipmstn14436.pdf

Vegetative barriers should be tolerant or able to withstand both dry and wet soil conditions. The grass species should be strong enough to emerge from pile of sediments or have the ability to shoot out new plants from a buried stem (Los, Anderson, and Gantzer, 1914). Vegetative plants used for barriers can be done vegetatively or sown through seeds.

Figure 5. Lemongrass used as a vegetative barrier at the demonstration garden at University of Guam.
Photo courtesy of AJ Ilai.

Figure 6. Guinea grass, *Panicum maximum*
Source: https://www.greener.land/index.php/product/vegetative-lines-with-vetiver-grass/

Farmers from the Pacific islands prefer using vetiver grass (*Vetiveria zizanioides syn. Chrysopogon zizaniodes*) as a vegetative barrier because it is strong enough to withstand different soil conditions and filters sediments very well. Because vetiver grass is sterile, it prevents the spreading of more grass and is low maintenance. It is a type of grass that has few pests and can tolerate conditions where grass fires may occur. Vetiver grass in inexpensive, easy to grow, and refrains from interfering with the growth of most crops (CTAHR, n.d.)

Figure 7. Vegetative lines with vetiver grass.
Source: https://www.greener.land/index.php/product/vegetative-lines-with-vetiver-grass/

Where to apply vegetative barriers

Selecting a proper grass species, prior land preparation, and maintenance management all play a crucial role in establishing successful vegetative barriers. Vegetative barriers are recommended to be planted in concentrated flow areas, on or near the contour within fields that have moderate to steep slopes. Vegetative barriers are designed to prevent erosion that may occur on sloping croplands, so it is crucial to have ensure a suitable outlet is present (NRCS, April 1997). This conservation technique is established to slow down the movement of water on soil surfaces. Maximum potential of vegetative barriers is best implemented in concentrated flow areas where development of erosion has occurred and can be controlled. This method can also be used in cohesion with other conservation management practices like conservation crop rotation. Vegetative barriers provide a water detention barrier to promote uniformity of runoff and nutrient uptake (Kika de la Garza Plant Materials Center, n.d.).

Planting vegetative barrier

Prior soil preparation and areas that are free of plant competition is crucial for success of vegetative barriers. Vegetative barriers should be established horizontally parallel to each other and as close to the contour as possible. This is to ensure that minor adjustments are needed for farming operations. Vegetative barriers should be designed to be "at least" 3 feet wide with approximately 50 stems per square foot of vegetation (Watershed Academy Web, n.d.). Vegetative barriers should be structurally placed in a single or two offset rows with grasses that range from small to moderate sizes and 18-inches to 36-inches apart. Approximately 70% of airflow should be able to filter through the barrier, so grasses should be a minimum of 15 inches in height throughout the year (Kika de la Garza Plant Materials Center, n.d.).

It is important to note that rows that are planted less than 18-inches apart will cause plant competition and improper uniformity and functionality of the vegetative barrier.

Maintenance

Vegetative barriers should be monitored frequently to make sure there is no opening space developed among the defensive strips of vegetation (NRCS, April 2003). The density of the vegetation is maintained by replanting of washouts and submerged plants. The spreading of the barrier plants should be controlled to avoid interfering with the nearby cropland. Weeds growing in and around the barrier should be controlled to lessen competition with the nearby crops. Even though the vegetative barriers are receiving washed down nutrients from the nearby cropland, they may need sufficient fertilizer to remain steady to resist runoff (NRCS, April 2003).

Vegetative grass species that are known for becoming tall growing will need mowing maintenance. It is important to establish their placement wider than the recommended 3 feet to ensure mowing equipment can be accommodated.

Pest and disease management

Vegetative barrier should be monitored and controlled regularly when signs of pests and diseases are present.

For additional information on pest and disease management, please contact an agricultural extension agent at the Guam Cooperative Extension, College of Agricultural and Life Sciences, University of Guam at 735-2080.

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