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VEGETATIVE FILTER STRIP USE AS A RILL-IRRIGATED BEST MANAGEMENT PRACTICE

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What are best management practices?

Best management practices (BMPs) are a series of guidelines and that help farmers reduce the impact that farming has on the local environment by limiting the amount of aquatic pollution that comes from farms. You may have heard of conservation tillage practices, strip cropping, and sediment retention ponds, all of which are examples of BMPs that farmers can implement on their land. Vegetative filter strips (VFSs) are BMPs as well since they help to mitigate pollution and keep farm soil and nutrients on the farm itself and out of the local river, stream, or lake.

What are VFSs?

A VFS consists of an area of land planted with vegetation designed to reduce the amount of pollutants in surface runoff. Most VFSs are comprised of grasses due to their dense growth patterns and ease of management. This BMP is typically easy to install and maintain, often making VFSs attractive systems to help improve surface water quality.

VFS as a BMP

It is important to note that no single BMP, including VFSs, is designed to be used exclusively. BMPs are designed to be used in conjunction with one another, and their use should be combined to manage agricultural pollutants most effectively. The use of VFSs is not applicable to every situation, and there are instances in which the implementation of other BMPs may be just as effective, or even more effective, in reducing suspended sediment and dissolved nutrient loads in surface-irrigated agricultural runoff.

VFS cover crops

The vast majority of VFSs are comprised of grass species due to their ease of planting, relatively low maintenance requirements, and dense stand formation, which is optimal for VFS performance. However, vegetative ground cover other than grass can be utilized as long as it forms a dense stand for effective treatment (Figure 1). A VFS does not have to be land that is taken out of production. With proper management, VFSs can serve as hay or forage fields and can be managed to produce a crop of their own.

Figure 1: Not all VFSs are comprised of grass. Here, an alfalfa VFS at the end of a furrow-irrigated potato field. (Photo by B. Bodah)

VFS vegetation must be capable of withstanding the unique stresses that accompany its use, such as increased sediment deposition and potentially prolonged saturation of the root zone. Bunch grasses and vegetation that do not form dense stands are not good choices for VFSs.

What do VFSs remove?

VFSs are commonly used to remove suspended sediment, nitrogen (N) compounds, and phosphorus (P) compounds from surface water. VFSs have also been shown to effectively reduce herbicide and pesticide residues from farm surface water runoff (Krutz et al. 2005). In addition, they can reduce the amount of surface runoff by increasing infiltration into the soil (Bodah et al. 2012; Bodah 2013).

How do they work?

The paramount function of a VFS is to slow down water as it flows over land (Muñoz-Carpena et al. 1999). The grass stems that make up the VFS itself serve as a physical impediment to water flowing through the strip, decreasing its velocity (Blanco-Canqui et al. 2004). A slower water velocity increases residence time, or the time it takes water to move over the VFS, which allows for a greater amount of water to infiltrate the soil. Water that enters the soil transports with it the dissolved nutrient load. Plant uptake or microbial action can then remove excess nutrients. Similarly, dissolved herbicides and pesticides (and other organic contaminants) can be treated by soil microbes.

The reduction in water speed also allows for more suspended sediments to settle out in the VFS. As suspended sediments are removed from the water, sediment-bound nutrients and pesticides are removed from the surface water as well.

VFS locations and sizes

VFSs have traditionally been widely established in riparian areas along stream or river banks. However, VFSs are very adaptable and can be successfully utilized on a wide variety of different locations, such as downslopes of croplands and animal facilities or along roadways. VFSs can be adopted to fit for specific soil types and climatic conditions.

VFSs are most commonly established on areas of land with slight slopes between 0–5%. However, VFSs have been shown to be effective on fields with slopes of up to 10% if managed properly (Dillaha et al. 1989). Determining the width of a strip for use on a certain parcel of land is directly tied to the conditions of that area. For a demonstration of the effectiveness of on-farm VFSs that were as narrow as 10 ft in width, see *Vegetative Filter Strips as a Best Management Practice on Rill-Irrigated Row Fields*.

Conditions required for effective treatment

In order for a VFS to function properly, the flow of water throughout the area should be spread evenly over the entire strip. Concentrating flow only in certain areas can lead to localized erosion and channelization. Channelization allows water to bypass large areas of the strip, significantly decreasing the treatment area and reducing strip effectiveness.

Dense, relatively uniform stands of grass or other target vegetation should be maintained at all times within the strip (Figure 2). Weed pressures should be kept to a minimum through the regular application of herbicides (if permitted) or mechanical mowing. The presence of broadleaf weeds decreases stem density and can lead to channelized flow. Similarly, bare spots should be reseeded regularly to avoid localized erosion and channelized flow and to maintain effective treatment throughout the entire buffer strip.

VFS maintenance

VFSs require regular maintenance to combat weed pressures, sediment deposition, bare spots, and channelization. These topics are discussed in *Managing and Maintaining Vegetative Filter Strips on Rill-Irrigated Row Fields*. Of particular note, though, are issues associated with:

Figure 2: It is important to maintain dense, uniform stands of vegetation for efficient VFS function. (Photo by B. Bodah)

- Weed control—Effective and regular weed control throughout the lifespan of a VFS is of paramount importance in maintaining a dense and uniform stand of grass. Areas of grass that are outcompeted by weeds can lead to bare patches and eventual channelization, both of which reduce VFS effectiveness.
- Plant height requirements—VFS vegetation ideally should be maintained around 4 inches in height (6 inches in particularly sandy soil to ensure grass roots are secure). Thus, mowing should be conducted regularly to ensure that the vegetation does not become too long. Maintaining a mowed strip encourages a stand of vegetation with a high stem density and prevents matted areas of overgrown vegetation. Regular mowing can also discourage certain wildlife from taking up residency within a filter strip. (Different types of buffer strips can be used if wildlife promotion is desired, but in this case, VFSs are used exclusively to mitigate water quality issues.)

VFS lifespans

A successful VFS is continually gaining sediment through deposition. Therefore, the lifespan of the strip is limited and will vary depending on local conditions and the lifecycle of the vegetative species used to create the strip. Typical lifespans of on-farm VFSs can be as long as five years depending on local soil conditions, slope, and vegetation requirements. In areas where sediment deposition is greatly reduced, VFSs can persist for greater amounts of time provided the consistent and thick vegetative cover is maintained. Once a VFS becomes ineffective due to sediment accumulation, the land can be leveled and the VFS can be replanted.

For further information

If you are considering the implementation of a VFS on your farm, see WSU Extension Publications *Managing and Maintaining Vegetative Filter Strips on Rill-Irrigated Row Fields* (FS214E), *Establishing Vegetative Filter Strips on Rill-Irrigated Row Fields* (FS216E), and *Vegetative Filter Strips as a Best Management Practice on Rill-Irrigated Row Fields* (TB17E). These will list a much more detailed description of maintenance requirements, establishment issues, VFS placement, and demonstrated effectiveness.

Glossary of terms

Microbial action—the consumption (eating), uptake, or interaction with dissolved nutrients by microscopic organisms (bacteria, fungi, etc.) that degrade or consume those nutrients to support the life processes of the microbe.

Nutrient load—the amount (load) of nutrients that are present in a given volume of water.

Sediment load—the amount (load) of suspended sediment that is carried by a given volume of water.

Surface runoff—the horizontal flow of water over a land surface, driven by gravity, resulting from: 1. rain or irrigation application faster than water can drain into the soil; or 2. water falling on an impervious surface (pavement, frozen soil, soil crust, etc.).

This document was adapted from:

Bodah, B. W. "Effective Suspended Sediment and Soluble Nutrient Load Mitigation in Irrigated Agricultural Return Flows Through the Use of Vegetative Filter Strips." PhD diss., Washington State University, 2013.

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