



## ESTABLISHING VEGETATIVE FILTER STRIPS ON RILL-IRRIGATED ROW FIELDS

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# Establishing Vegetative Filter Strips on Rill-Irrigated Row Fields

The establishment of vegetative filter strips (VFSs) on the ends of rill- or furrow-irrigated crop fields has proven to be an effective best management practice (BMP) to lower the suspended sediment and soluble nutrient load originating on irrigated farmland. However, these reductions can only be achieved if the VFS is fully established before the crop irrigation season begins. This portion of the WSU Extension series on VFSs provides tips on establishing VFSs.

Generally, the first two or three flushes of irrigation water down a rill-irrigated field at the beginning of the growing season result in significantly large discharge rates of suspended sediment and dissolved nutrients. This is because the soil is still relatively loose from being worked and planted and has not fully settled. Granulated or liquid fertilizers that are applied on the soil surface are highly susceptible to being washed away during these early irrigation events as well. Establishing a VFS before the beginning of the irrigation season can greatly mitigate the loss of soil and nutrients early in the growing season by successfully intercepting and treating water flow.

## Establishment

One approach to ensure that a VFS is established and ready to receive surface runoff prior to the commencement of the irrigation season is to plant the strip the previous fall. Fall establishment is only an option when you are using winter-hardy, cool-season grasses to create your VFS. Planting VFSs in the fall occurs after harvest, which is a period when many farmers have fewer time demands and farm labor is generally in abundant supply. Fall establishment also allows for an extended period of growth over late fall and early spring, significantly increasing the chances that your strip will be functional before the next irrigation season begins. Fall planting enables the growing grasses of the VFS to utilize the natural rainfall of the winter and early spring months when the majority of the natural precipitation falls in central and eastern Washington.

Spring establishment is a second option to consider when establishing a VFS. Spring establishment allows for the entire field to be worked at the same time, negating the need to specifically work up the filter strip area in autumn in preparation for fall planting. In order to ensure strip viability prior to the start of the irrigation season, it is necessary to plant the strip at the earliest possible time. This will require the application of irrigation water localized to the strip area. Unfortunately, irrigation water may be unavailable through irrigation districts during the early spring months, in which case other water sources are required.

The use of warm-season grasses in VFSs, which may be preferable for your situation, does not allow for fall establishment. Spring establishment allows for the use of warm-season grasses that would not survive the winter if first established in the fall. Warm-season grasses grow prolifically during the summer months but may grow slowly during the early spring months.

## Irrigation requirements

One paramount aspect of successful VFS establishment is the use of irrigation. VFSs established in both spring and fall will require frequent irrigation to support the early growth stages of the filter strip vegetation. As grass seeds are planted at shallower depths than most row-crop seeds, adequate soil moisture must be maintained in the upper levels of the soil for successful germination. Secondly, establishment must occur prior to the arrival of freezing winter temperatures. Fall establishment takes place after harvest. This is sometimes at a time when irrigation water from many irrigation districts may no longer be available. In this case, it is important to pre-irrigate the plots before the irrigation water is turned off so that the seeds will be planted into moist soil. The cooler temperatures and lower crop water use demands in the fall may allow the VFSs to be established without supplemental irrigation water under some conditions.

## Soil preparation

VFSs function most effectively when water spreads out evenly over the entire strip area. A fairly level seed bed with a gentle slope (0.5% or less) to ensure drainage is ideal for an effective VFS. A narrow shovel cultivator can be used to prepare the site before planting. Any furrows or depressions in the site must be filled in and leveled before seeding the area. A seed drill can then be utilized to plant the seed at the optimal planting depth for the particular species you are using, or the seed can be broadcast by hand or with a spreader. A conventional tractor-pulled roller can then be used to pack the seeded area to ensure timely germination. Other equipment appropriate for planting grasses can be used as well.

If the VFS is downslope of the crop and directly above the agricultural return flow ditch, a three-point ditcher should be avoided (Bodah et al. 2012; Campo-Bescós et al. 2015). A three-point ditcher casts soil to both sides of the newly formed ditch and forms a mound at the base of the VFS that significantly impedes drainage (Figures 1 & 2). This can lead to an overabundance of flooding in the VFS which will significantly reduce its effectiveness.

Three-point ditchers are commonly used in conjunction with rill irrigation as the furrows penetrate the uphill mound created by the ditcher. However, when utilizing a VFS, furrows will not extend through the strip to the agricultural return flow ditch. Instead, we recommend using a rear blade equipped with a hydraulic tilt to form the agricultural return flow ditch, as this implement casts soil only to one side and does not impact the drainage of the filter strip (Figures 3 & 4).

## Species selection

VFSs can be established with nearly any grass or vegetative species that exhibits a high stem density and can thrive under the specific conditions that will be present throughout the life of the strip. Cool-season species should be used if you will be choosing fall establishment because their greatest growth takes place in the autumn and early spring months. Susceptibility to sediment deposition is also a key factor to take into account. Certain grass species are particularly vulnerable to sediment deposition early in their lifespan (Figure 5). Utilizing one of these species can lead to failure in establishing a VFS due to the heavy sediment deposition rates that can occur, particularly during spring irrigation.



Figure 1: A three-point ditcher casts soil to both the uphill (B) and downhill (A) sides of a ditch. (Photo by B. Bodah)

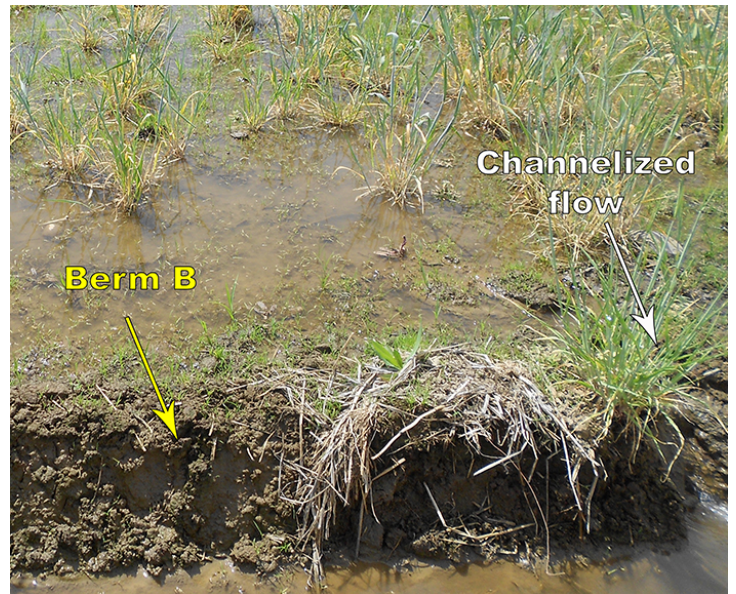


Figure 2: Close-up of Figure 1 showing impeded drainage and formation of channelized flow. (Photo by B. Bodah)



Figure 3: Agricultural return flow ditch created using a rear blade. Notice, only one berm created. (Photo by B. Bodah)



Figure 4: Unimpeded VFS drainage into the return ditch allows the vegetation to thrive. (Photo by B. Bodah)



Figure 5: High rates of sediment deposition can overwhelm certain grass species. (Photo by B. Bodah)

Regular sediment deposition and prolonged saturation of the root zone are conditions that frequently accompany filter strips.

The Forage Crop Pocket Guide, published by the International Plant Nutrition Institute (IPNI) is a tool to help you select which grass or forage species would work with your particular conditions. Consult your local Extension agent or Natural Resources Conservation Service field office after selecting a species from the Forage Crop Pocket Guide to ensure that it will suit your particular needs and be able to thrive under your conditions.

## Plan for adequate strip placement

In an ideal world, VFSs would never be driven on; however, we realize that they will see some traffic by farm equipment. Nevertheless, it is of the utmost importance to refrain from such traffic during strip establishment and any period when the soil is wet. While you are establishing your VFS, stay off and let it grow. This ensures that the strip will function as intended and all of the time and energy put into establishing the strip will have been well spent and not wasted.

## Avoid traffic on strip after planting

VFSs work best when people, machines, and animals stay off of them. Driving over a strip or grazing animals on a strip during strip establishment can lead to many complications, including:

- **Soil compaction**—The more compact a soil is, the harder it is for water to enter that soil. Driving over a strip with heavy farm equipment or machinery can compact the soil beneath the surface. Since VFSs function by allowing water to enter into the soil, this can lead to decreased strip effectiveness.
- **Uneven surfaces**—Utilizing an established strip as a turn row or for grazing animals after planting also leads to the formation of tire or animal tracks on the soil surface. VFSs work best when they are on a relatively even surface with a slight slope so that water can spread over them evenly. Tracks can provide additional impediments to the flow of water which can lead to areas of the strip not receiving adequate water during establishment and remaining dry and largely void of vegetation (Figure 6).
- **Channeling**—Tractor tires and livestock tracks commonly lead to channelization. As water preferentially flows through channels, this will increase velocity and reduce the amount of time water spends in the strip (residence time). This phenomenon decreases the effectiveness of the strip, and the problem gets worse with time as erosion deepens the channels (Figure 6).



Figure 6: An example of what not to do while establishing your VFS. (Photo by B. Bodah)

***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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