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# Vegetative Filter Strips

## near surface water in the Pacific Northwest

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Recent concerns about surface water quality near agricultural production areas have stimulated interest in "best management practices" to reduce the risk of off-site sediment, pesticide, and nutrient movement. Vegetative filter strips can be one component of an integrated management system to reduce these risks.

Vegetative filter strips are areas of low-growing, dense plantings between agriculture, forestry, or other disturbed areas and surface water, such as field drainage ditches and streams (Figure 1). The purposes of vegetative filter strips are to trap sediment, nutrients, and pesticides from runoff water; reduce ditchbank erosion; and suppress weeds growing in areas surrounding crop production.

### Benefits of vegetative filter strips

Vegetative filter strips can provide several long-term benefits to agricultural producers and the environment. These benefits include the following.

- **Protection of highly erodible ditch and stream banks.** Growers often have two choices (Figure 2): allow weeds to proliferate in waterways surrounding agricultural fields, thus risking contamination and spread of invasive species; or control weeds in waterways, leaving the soil bare and prone to erosion within the waterway. Vegetative filter strips include deeply rooted plant species that can reduce the risk of erosion from runoff water and ditch or stream discharge.
- **Weed suppression in filter strips.** The species used in vegetative filter strips should be competitive with common weed species. Rapidly growing, dense filter strip plant species will suppress weeds, thus reducing the risk of weed movement into crop production areas. Additionally, weed suppression through competition reduces the need for herbicide use near surface water.

In recent research conducted at Oregon State University, creeping red fescue in a vegetative filter

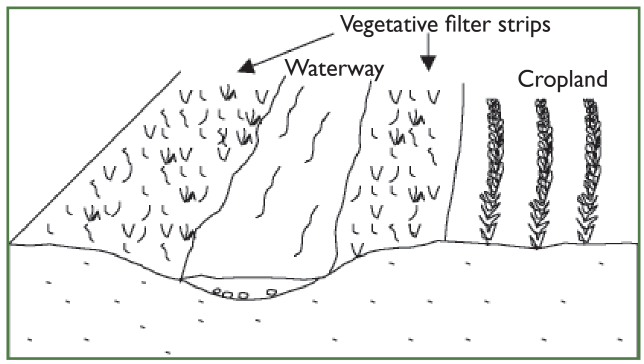


*Figure 1. Vegetative filter strips are areas of desirable vegetation between potential sources of contaminants and surface water sources. They trap sediment, nutrients, and pesticides in runoff water.*

*Figure 2. Current ditch and streambank management practices often result in weedy vegetation that contaminates nearby crops (left) or bare ground that is prone to soil erosion and allows field runoff water to drain unfiltered into water sources (right). Photograph at left courtesy of Mark Mellbye.*

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strip was compared to conventional management strategies in which the herbicides diuron and glyphosate were used in an attempt to maintain weed-free bare ground. By August in the first year after planting, creeping red fescue ground cover was greater than 90 percent, and weed suppression was better than with the conventional herbicide treatment (Table 1, below, and Figure 3, back page). The experiment was repeated in 2004 with similar results (data not shown).

- **Reduction in sediment, nutrient, and pesticide loss from surrounding agricultural fields.** Vegetative filter strips not only reduce erosion from within the ditch or streambank where they are planted, but also from surrounding fields.

  Soil sediments carry strongly adsorbed nutrients and pesticides, such as diuron. Vegetative filter strips slow the rate of water flow prior to reaching the surface water. As the flow rate slows, heavier sediments settle out in the filter strip, thus reducing soil, pesticide, and nutrient contamination of waterways. In research conducted in Montana, vegetative filter strips reduced sediment concentrations in runoff water by 68 percent.

## Challenges to effective vegetative filter strips

Vegetative filter strips are an effective method to protect surface water near agricultural production, but they are not without challenges.

- **Vegetative filter strip establishment can be difficult.** Areas surrounding waterways often are not suitable for crop production; land slope, poor soil, and washout from runoff precipitation events can hinder plant establishment. These same impediments hold true for vegetative filter strip plantings.

  Early-season erosion of bare soil after filter strip planting can lead to washout prior to establishment. This situation can be at least partially alleviated with the use of erosion control blankets or nurse cropping (see page 4).

- **Vegetative filter strips require some maintenance.** Weed control and fertility management are required, especially in the first year after vegetative filter strip planting. Maintenance requirements are similar to those required in healthy pasture management. Weed control is necessary until the filter strip planting is dense enough to compete with weeds.

  After establishment, occasional mowing or spot application of an appropriate registered herbicide is sufficient for maintenance weed control. As with pasture management, periodically conduct soil tests and apply amendments as appropriate to support long-term filter species growth and competitiveness.

  The effectiveness of vegetative filter strips in reducing water contamination depends on uniform distribution of field runoff water and slow water flow. Reseed erosion channels or bare areas to prevent further degradation. Erosion channels or bare areas become large problems quickly.

- **Vegetative filter strips can serve as a refuge for crop pests.** Rodents, insects, pathogens, and weeds that damage nearby crops can inhabit filter strips. Pest management in vegetative filter strips near waterways is difficult given that management options are limited to those appropriate for use near surface water.

- **Vegetative filter strips are less effective in removing contaminants dissolved in water than those adsorbed to sediment.** Nitrates and some herbicides are dissolved in water and not bound to sediment. As long as the soil is not saturated, vegetative filter strips are effective in removing dissolved contaminants because they allow water to infiltrate the soil prior to reaching a waterway.

  However, dissolved compounds are not trapped by filter strips after the soil is saturated. While sedimentation continues after soil has reached water-holding capacity—the water flow rate still is slowed by filter species—the quantity of runoff water reaching a waterway is not reduced.

Table 1. Creeping red fescue and weed ground cover and biomass (large-scale vegetative waterway study, 2003, Willamette Valley, Oregon).

| | Cover crop (% ground cover) | | | Weeds (% ground cover) | | |
|---|---|---|---|---|---|---|
| **Treatment** | **6/5** | **7/18** | **8/14** | **6/5** | **7/18** | **8/14** |
| Creeping red fescue | 87 | 80 | 93 | 0 | 4 | 1 |
| Diuron/glyphosate | 0 | 0 | 0 | 0 | 8 | 7 |
| | **Cover crop biomass (lb/A)** | | | **Weeds biomass (lb/A)** | | |
| **Treatment** | **6/5** | **7/18** | **8/14** | **6/5** | **7/18** | **8/14** |
| Creeping red fescue | 1,008 | 746 | 827 | 0 | 9 | 0 |
| Diuron/glyphosate | 0 | 0 | 0 | 0 | 113 | 138 |

## Characteristics of an effective vegetative filter strip

The effectiveness of a vegetative filter strip depends on several factors. Before planting, consider the following.

- **Appropriate land slope and filter strip width.** The land slope of the surrounding fields and of the filter strip itself determines, in part, the water flow rate through the filter strip. Steeper slopes require wider filter strips so that runoff water is slowed enough to allow sedimentation. In general, filter strips are most effective in removing sediment in the first 8 to 12 feet of width. Wider filter strips will trap finer sediments. Also consider the size, soil type, and tillage of surrounding fields, and the intensity and duration of rainfall, when deciding how wide to make a filter strip.
- **Water infiltration rate.** High soil infiltration rates trap more dissolved contaminants than low infiltration rates. In most areas west of the Cascades in the Pacific Northwest, however, infiltration rate is a moot point after the soil is saturated in winter months.
- **Water flow within the filter strip.** More sedimentation occurs where water flow is uniform and shallow than in areas where runoff is channeled through a low percentage of the filter strip area, thus increasing flow rate. Smooth waterway soil preparation prior to planting and maintenance after establishment can alleviate channeling.
- **Filter strip plant selection.** Filter strip plant species should be competitive and grow densely with a fibrous, deep root system, but must not spread into nearby crop production and become weedy, particularly near seed crop production fields. Near seed production fields, choose filter plant species for which there are adequate control options in the cropping system.

  Several potential filter crop species were evaluated for early establishment with minimal maintenance inputs and weed suppression in Oregon's Willamette Valley (Tables 2 and 3). Potential filter species were planted in the fall. By June of the establishment year, birdsfoot trefoil, red clover, and creeping red fescue provided greater than 65 percent ground cover. Creeping red fescue provided greater weed suppression in the establishment year than the conventional herbicide treatment (diuron + glyphosate).

  This research supports anecdotal observations of creeping red fescue filter strip plantings near agricultural fields in Dayton, Oregon. These roadside plantings of creeping red fescue continue to suppress weeds with minimal maintenance requirements and provide dense, uniform ground cover without becoming weedy in nearby seed production fields more than 20 years after planting.

## Vegetative filter strip establishment

Successful establishment of vegetative filter strips requires early and rapid plant growth soon after seeding and before significant heavy precipitation. In general, establishment practices are similar to those used in establishing a pasture. Consider the following steps for rapid plant establishment.

- **Prepare a firm, smooth seedbed with a slope appropriate for the width of the waterway and**

Table 2. Vegetative filter strip species and weed ground cover, measured using the transect method (vegetative waterways species selection study, 2003, Willamette Valley, Oregon).

| | Cover crop (% ground cover) | | | | Weeds (% ground cover) | | | |
|---|---|---|---|---|---|---|---|---|
| Treatment | 4/21 | 5/21 | 6/24 | 7/25 | 4/21 | 5/21 | 6/24 | 7/25 |
| Weedy check | 0 | 0 | 0 | 0 | 30 | 55 | 68 | 60 |
| Birdsfoot trefoil | 12 | 25 | 70 | 53 | 12 | 30 | 30 | 47 |
| Red clover | 37 | 52 | 70 | 37 | 13 | 17 | 17 | 60 |
| White clover | 13 | 18 | 27 | 12 | 18 | 35 | 47 | 70 |
| Alfalfa | 23 | 7 | 10 | 8 | 10 | 30 | 67 | 73 |
| Creeping red fescue | 58 | 68 | 67 | 73 | 3 | 8 | 17 | 18 |
| Diuron/glyphosate | 0 | 0 | 0 | 0 | 22 | 47 | 20 | 57 |

Table 3. Vegetative filter strip species and weed biomass (vegetative waterways species selection study, 2003, Willamette Valley, Oregon).

| | Cover crop (lb/A) | | Weeds (lb/A) | |
|---|---|---|---|---|
| Treatment | 5/21 | 7/30 | 5/21 | 7/30 |
| Weedy check | 0 | 0 | 922 | 2,505 |
| Birdsfoot trefoil | 198 | 1,761 | 470 | 831 |
| Red clover | 513 | 1,124 | 378 | 442 |
| White clover | 212 | 1,315 | 351 | 681 |
| Alfalfa | 107 | 50 | 164 | 1,516 |
| Creeping red fescue | 555 | 1,618 | 19 | 197 |
| Diuron/glyphosate | 0 | 0 | 541 | 1,837 |

*Figure 3. Creeping red fescue filter strip 10 months after planting in the Willamette Valley, Oregon.*

*Figure 4. Firm, smooth seedbed prepared for vegetative filter strip planting. Erosion control fabric used near field tile drains.*

**land served by the filter strip** (Figure 4). Proper seedbed preparation is critical, given that the filter strip will be a long-term planting. Test soil pH and fertility, and add appropriate soil amendments for the chosen filter strip species prior to final seedbed preparation and planting.

In highly erodible areas, such as where field tile lines drain into waterways, consider lining the bottom and sides of the filter strip with erosion control fabric or blankets. Filter strip species grow through the fabric, while the soil is protected from erosion prior to dense plant growth.

- **Seed filter strip species.** Several methods will work. In accessible areas, filter strip species can be drilled with a conventional or no-till drill. Spin-seeding with a tractor-mounted or hand seeder, followed by light incorporation with a rake or harrow, is easy and often sufficient.

In research, hydroseeding filter plant species with a mix of seed, water, and a hydroseeding mulch was very successful (Figure 5). The hydroseeding mulch holds water near the planted seed, protects the ground from early erosion prior to plant establishment, and results in rapid filter strip plant growth prior to heavy precipitation. Custom hydroseeding by companies specialized in turf seeding or erosion control is available in most areas.

Nurse-cropping filter strip species with rapidly growing annuals, followed by removal of the nurse crop with mowing or registered herbicides can be very effective in protecting new filter strip plantings from erosion in the establishment year. For example, consider planting creeping red fescue mixed with annual ryegrass in highly erodible areas. Desiccate or mow the annual ryegrass after the creeping red fescue is established. Two or three mowings may be needed. Additionally, consider planting a native species in the bottom portion of waterways that often are under water, where filter species such as creeping red fescue or clover will not persist.

## Summary

Despite the challenges in establishment and maintenance of vegetative filter strips, they can be a useful component of a management system to protect surface water from soil sediment, nutrients, and pesticides used in nearby crop production. Vegetative filter strips will not solve all potential contamination issues, but should be combined with other best management practices, including soil testing prior to nutrient management and variable rate fertility and pest management.

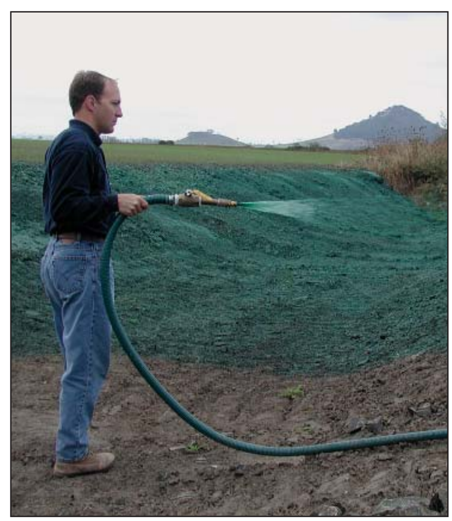

*Figure 5. Hydroseeding creeping red fescue in vegetative filter strips.*


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