CONSTRUCT GRASSED WATERWAYS

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Description
Grassed waterways are channels of grass within fields (e.g. arable land) that are constructed in order to get a more condensed and controlled overland water flow with low velocities. The application of such a measure is shown in figure 1.

Figure 1. Pictures of the application of a grass waterway
(Source: Green and Haney BMP SERA-17; Photo by Ontario Ministry of Agriculture and Food).

Rationale, mechanism of action
Runoff water flows over the grass rather than tearing away soil and forming a larger gully. An outlet is often installed at the base of the drainage way to stabilize the waterway and prevent a new gully from forming. The vegetation within the waterway may act as a filter, absorbing some of the chemicals and nutrients in runoff water. As a result, nutrient losses caused by soil erosion and runoff will be reduced (Green and Haney, 2005; Wallander and Konop,?; Fiener and Auerswald, 2009; Hunt et al., 2007; Kenwick et al., 2009; Shelton et al., 2009; Zhou et al., 2009). By constructing grassed waterways the pathway of the overland water flow is changed in such a way that the water flow is controlled with velocities is rate is reduced. As a result sedimentation of particles will increase and therefore, the amount P loss to surface water will be reduced. For soluble P components the impact of the measures on the P losses of P components in soil solution is less known. Soluble components are defined as material that is still in solution after filtering by 0.45 μm. In this case the P loss to surface water will be reduced if during the transport process there is interaction with the surface layer with a lower P status. Especially, reactive inorganic P components, will react with the soil layer and the P concentration in runoff water will decrease. Reduction of the amount of soluble organic compounds will probably hardly take place, because these are mostly not reactive.
However, grassed waterways will also lead to a change of the water flow from overland flow to subsurface flow or downward seepage. Because of the infiltration also the P loss of overland flow by soluble P components will be reduced. On the other hand, P losses via subsurface pathways can increase because of the increase of water flow by this pathway. The overall effect will highly depend on the hydrological situation and physical and chemical (P) status of the soil in relation to the decrease of overland P losses.

However, in most situations this effect will be small compared to reduction of P losses by overland flow.

Applicability
The measure will be most effective when applied under field conditions where transport of particulate P components by overland flow causes the main P loss to surface water. This will be the case in hilly areas with high rainfall intensities. The amount of erosion depends also on the tillage, crop type, contoured and terraced fields and potato ridges. Compared to arable land grassland is rather effective to reduce the water flow rate and therefore more effective in reducing P losses by erosion. As a result constructing grassed waterways within e.g. arable land will have a positive effect on reducing P losses by erosion.
There are also some limitations. Grassed waterways need sufficiently sized land areas and specific additional treatment (working around it with farm equipment). There is also a loss of acreage for crop production.

Effectiveness, including certainty
The effectiveness of grassed waterways depends on soil characteristics, land slope and topography, the vegetation, area for establishment and a correct construction and maintenance. A wider grassed waterway with established vegetation will be more effective at trapping sediment and reducing pollutants, due to greater surface contact area and greater contact time with runoff (Green and Haney, 2005; Fiener and Auerswald, 2009; Hunt et al., 2007; Kenwick et al., 2009; Shelton et al., 2009; Zhou et al., 2009).

Time frame
The impact of the measure will turn out at the short term, within a year.

Environmental side-effects / pollution swapping
The risks of environmental side-effects and pollution swapping are minimal. However, it has been discussed before that shift of water flow from overland through the (sub)soil can increase the P losses via the subsurface.

Relevance, potential for targeting, administrative handling, control
The option can be relevant for those fields that cause diffuse P losses by overland flow at local scale. Selection of such fields by modeling approaches or by local experience are highly recommended.

Costs: investment, labor
The main costs are caused by labor in order to construct the grass waterways, for maintenance during the year, and by loss of productive land.

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