Impact of Grassed Waterways and Compost Filter Socks on the Quality of Surface Runoff from Corn Fields

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Introduction & Objective

- Conservation tillage can help control soil loss, but herbicides and nutrients are often detected at high concentrations in surface runoff, particularly in the first few events after application.
- One method to mitigate this concern is to install conservation buffers, such as riparian forest buffers, filter strips, and grassed waterways between cropland and receiving bodies of water.
- Conservation buffers, however, are of limited effectiveness in reducing the concentrations of dissolved substances and concentrated flow reduces their ability to retain sediment and chemicals attached to particulate matter.
- Compost filter socks (mesh bags filled with composted bark and wood chips) may help improve the effectiveness of grassed waterways by trapping solids and increasing chemical sorption.
- We diverted surface runoff from two small watersheds into paired grassed waterways to determine if concentrations of sediment, herbicides, and nutrients can be reduced by placing compost-filled filter socks in the waterways.

Materials & Methods

- Surface runoff from a no-till and a disked watershed were monitored for two crop years (2007 and 2008).

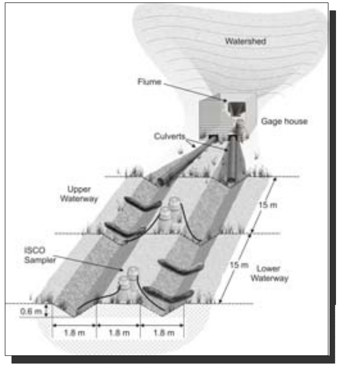
Tillage Treatments and Watershed Characteristics

Watershed	Tillage	Area (ha)	Average Slope (%)	Maximum Length (m)	Dominant Soil Series†	Waterway Slope (%)
WS 118	No-till	0.79	10	132	Coshocton silt loam	3.3
WS 127	Disked	0.67	9	104	Coshocton silt loam	4.0

† Coshocton - Fine-loamy, mixed, active, mesic Aquultic Hapludalf

- The watersheds were seeded with glyphosate-tolerant (Roundup Ready™) corn and treated with atrazine and alachlor at planting in May. They were also treated with glyphosate in mid-June and received a second application 2-3 weeks later. The disked watershed was cultivated once in June and once in July for additional weed control.
- Runoff volumes exiting the watersheds were measured using H flumes and data loggers were used to record the hydrographs.
- Culverts below the flumes diverted runoff into two, 30-m long, parallel grassed waterways constructed to NRCS specifications. Diversion ditches prevented runoff that did not originate on the watersheds from entering the waterways.
- Two, 46-cm diameter, filter socks were placed 7.5 m apart in the upper half of one waterway and in the lower half of the other waterway. Each year new socks were installed and their positions (upper vs. lower) in the waterways were reversed.

Materials & Methods (cont.)



Waterway and Sampling System Design

Waterway Construction August 2005

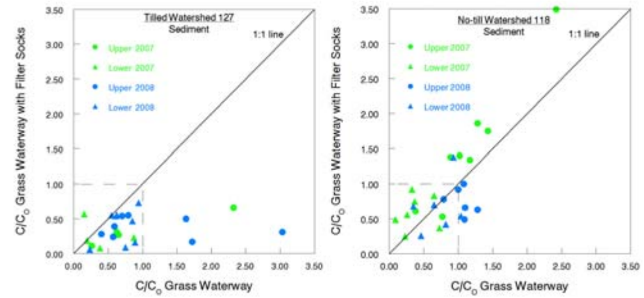
- Five ISCO™ samplers were used for each watershed. One was installed just below the H flume and the other four were 15 m and 30 m downstream in each waterway.
- When runoff in the flume reached ~ 50 liters per minute discrete samples were simultaneously obtained from all five positions. Additional samples were obtained every 10 to 20 minutes as long as flow remained above the threshold.

Flume, Sampler, and Culvert Diversions in Gage House of Watershed 118

Samplers and Filter Socks in Lower Waterway of Watershed 118

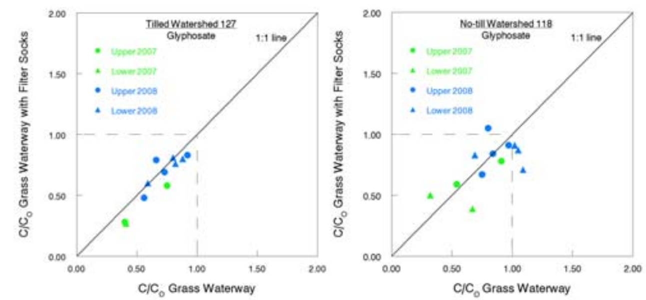
- Samples were analyzed for atrazine, alachlor, and glyphosate using HPLC; sediment by filtration; and nutrients by ion chromatography.
- Flow-weighted average concentrations (FWAC) were calculated for each runoff event using the concentrations measured for individual samples and flow volumes computed from the hydrographs. Flow-weighted average concentrations were calculated for samples collected at 15 m and 30 m assuming the flow volumes were half those measured at the flume.
- Effect of the filter socks and grassed waterways on concentrations was determined by dividing the FWAC at 15 m (C) by the FWAC at the flume (C_o). C/C_o values < 1 indicated a reduced concentration of the measured parameter compared to the input concentration. Likewise, C/C_o values at 30 m were calculated by dividing the concentration at 30 m by the input concentration at 15 m.

Results



Points plotting below the 1:1 line indicate a net reduction in concentration due to filter socks compared to unamended grassed waterways

- Tillage contributed to yearly, flow-weighted average, sediment concentrations for the tilled watershed that were ~ 5X higher than for the no-till watershed.
- Filter socks contributed to an additional 49% reduction (Sig. at $P \leq 0.05$) in average sediment concentration in the tilled watershed with an average C/C_o of 0.35 compared to 0.84 for waterways without socks.
- Probably as a result of low sediment concentrations, filter socks did not enhance sediment removal in the grassed waterways below the no-till watershed.



- Filter socks contributed to a significant additional 5% reduction in glyphosate concentration and an 18% reduction in alachlor concentration (data not shown) for the runoff from the tilled watershed, but did not have a significant effect for the no-till watershed. No significant effects were noted for atrazine concentration.
- The filter socks tended to slightly increase nutrient concentrations, probably because of their presence in soluble forms in the compost. Estimated additional amounts ranged from 0.04 kg (PO_4-P) to 1.25 kg (K), thus are likely to be inconsequential (data not shown).

Conclusions

- Filter socks enhanced sediment removal in the grassed waterways when sediment concentrations were high by filtering and slowing runoff.
- Filter socks decreased alachlor and glyphosate concentrations due to increased sorption either on the compost or due to increasing contact time with the soil and grass thatch in the waterways.