Resources Conservation Practices

Soil Erosion & Water Quality

Conservation Quiz

1. What's the difference between ephemeral and gully erosion?

2. How does soil erosion by water contribute to poor water quality?

3. How can surface water quality be improved?

(Answers located on page 3.)

Soil erosion is a gradual process that occurs when the impact of water or wind detaches and removes soil particles, causing the soil to deteriorate. Soil erosion by water, and the impact of sediment-attached nutrients (i.e., phosphorus) on lakes and streams, creates problems for both agricultural land and water quality.

Preventing the topsoil from eroding must be an integral part of any soil management system if water quality is to be improved. Several conservation management practices can be used to reduce or control soil water erosion, but the factors that accelerate or control soil water erosion need to be understood.

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Extension and Outreach

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The Effects on Water Quality

Water quality is affected significantly by soil erosion. Increased levels of nitrogen and phosphorus, along with higher sediment loads, are the leading contributors to reduced water quality. Nitrogen and phosphorus move from fields to surface water when sediment is transported through runoff and soil erosion. As a result of the nitrogen- and phosphorus-enriched sediments, eutrophication—the growth of algae and other aquatic plants—occurs, decreasing dissolved oxygen levels.

Preventing Erosion and Improving Water Quality

Surface water quality can be improved by using best management practices to reduce soil erosion. Those practices include conservation tillage, residue management, grassed waterways, terraces, conservation buffers, crop rotations, and contour farming. A single management practice typically can control soil erosion; however, multiple practices are required where complex topography exists.

Plant residue management is another way of controlling erosion by intercepting rain drops thereby reducing surface runoff and protecting soil surface particle detachment.

Types of soil erosion

(As defined by Glossary of Soil Science Terms, 1996, Soil Science Society of America)

1. Sheet erosion—The removal of a relatively uniform thin layer of soil from the land surface by rainfall and largely unchanneled surface runoff.

2. Rill erosion—An erosion process on sloping fields in which numerous and randomly occurring small channels of only several inches in depth with steep sides are formed by running water.

3. Ephemeral erosion—Small channels eroded by concentrated flow that can be easily filled by normal tillage, only to re-form again in the same location by additional runoff events.

4. Gully erosion—The erosion process whereby water accumulates and often repeats in narrow channels and, over short periods, removes the soil from this narrow area to considerable depths, in terms of channels too deep to easily ameliorate with ordinary farm tillage equipment.

Conservation and best management practices

- *Crop rotations*

  Extended crop rotation and permanent cover crops effectively protect the soil from the impact of raindrops. The thick, fibrous root systems associated with cover crops also bind the soil particles together (Table 1).

- *Residue management*

  Plant residue controls soil erosion by intercepting raindrops, blocking wind erosion, reducing surface water runoff, and preventing soil detachment. When using a combination of conservation tillage practices and surface residue management, it is critical to maintain the highest amount of residue cover possible (Figure 1).

- *Tillage practices*

  Whether using no-till, conservation tillage, or conventional tillage systems, harvest is the best time to begin the next year's residue management. For effective soil erosion control, try to maintain residue cover of 30 percent or more during the off-season and at planting time.

- *Grassed waterways*

  Wide, shallow, sod-lined waterways reduce the speed of water by providing a grass cushion and preventing gully formation. They also act as a filter by trapping sediment and protecting covered soil from being detached and transported (Figure 2).

- *Terraces*

  Terraces break up slope lengths and reduce steepness to reduce surface flow and sediment transport. They are easily adapted to producers' needs, soil type, and equipment (Figure 3).

- *Conservation buffers*

  Buffers (areas or strips of land in which permanent vegetation is established near row crops) are designed to intercept sediment flow and protect the soil from detachment (Figure 4).

- *Contour farming*

  Planting rows on the contour helps channel small runoff streams across, rather than down, the slope and creates a speed bump for larger flows (Figure 5).

Crop residue can provide an excellent soil cover after harvest and enhance snow harvesting during the off season, improve soil water intake by preventing soil surface sealing due to rain drop impact, and consequently, reduce surface runoff. Also, equally important in minimizing soil erosion, is the adoption of a cropping system along with conservation tillage practices such as, no-till, strip-till, ridge-till, etc. The degree of effectiveness of different tillage practices depends on the degree of soil manipulation, which effects the residue distribution on the soil surface. Table 1 shows combinations of different cropping systems and the relative scale of erosion hazard associated with each system.

Table 1. Relative erosion hazards of selected cropping systems.

Cropping System	Relative Erosion (%)
Fallow	244
C-S	120
C-C-S	112
Continuous Corn	100
C-C-C-Ox	73
C-C-Ox	68
C-Ox	59
C-C-C-O-M	46
C-C-O-M	32
C-C-O-M-M	27
C-C-O-M-M-M	22
C-O-M	17
C-O-M-M	12
C-O-M-M-M	10
Continuous Meadow	0

C, corn; S, soybean; O, oats; Ox, oats with green manure crop; M, meadow.

Quiz Answers: 1. Ephemeral channels are easily filled in by tillage passes; gullies are not. 2. Runoff water carries nitrogen- and phosphorus-enriched sediment to water bodies, causing algae and other aquatic plants to grow, which decreases dissolved oxygen levels. 3. By using conservation tillage, conservation buffers, grassed waterways, etc. to reduce soil erosion.

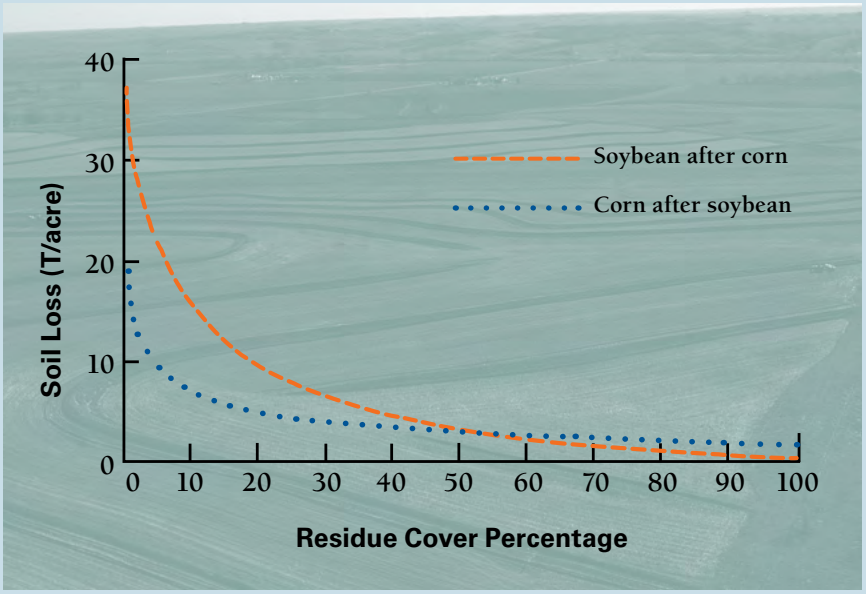

Figure 1. Soil loss due to water erosion in relation to percent residue cover for Iowa, based on the Universal Soil Loss Equation.

Figure 2. Grassed waterway.

Figure 3. Contour terraces.

Figure 4. Conservation buffers.

Figure 5. Contour farming.

All photographs are from the NRCS Web site photo gallery (www.nrcs.usda.gov).

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