IOWA Learning Farms

Building a Culture of Conservation

Farmer to Farmer: Iowan to Iowan

Supplement to
Water Quality and Conservation Practices

Eastern Till Prairie

Environmental and economic benefits of conservation practices

Iowa has severe water-induced soil erosion and associated water quality problems because of intense agricultural activities. Soil erosion can be reduced through better field residue management and other conservation practices including reduced tillage, crop rotation, contour cropping, terracing, and vegetative filtering. The effectiveness of a given conservation practice depends on a number of factors including climate, soil type, topography, cropping systems, and existing conservation practices in that area. This study investigates the environmental and economic benefits of selected conservation practices under a corn-soybean rotation in different Iowa regions.

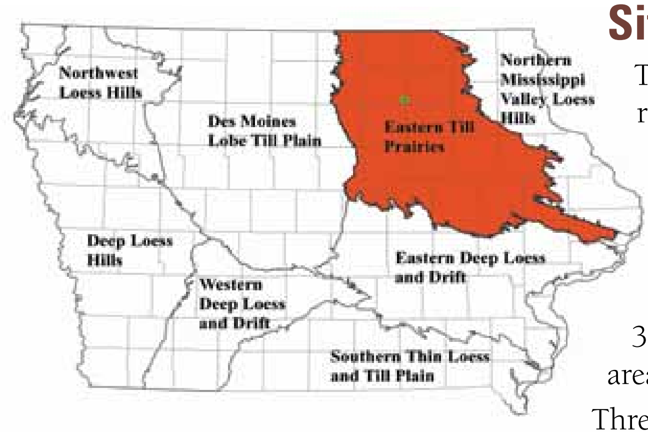

Figure 1. Eastern Till Prairie and study site.

Site description

The land of the Eastern Till Prairies is nearly level to gently rolling with long slopes and is covered with glacial till and outwash deposits. Subsurface tile drainage lines are commonly used to lower water tables and to increase crop production. Corn and soybeans are the major crops in this area. The farm selected to represent the typical soil type and slope (Figure 1) is about 200 acres with a mean slope of 3.2 percent. Kenyon loam is the predominant soil in the study area.

Three common tillage systems (no-till, strip-till, and chisel plow) and three conservation structures (grassed waterways, vegetative filter strips, and terrace systems) were used for investigating environmental and economic benefits on sediment reduction.

Reducing sediment with conservation practices

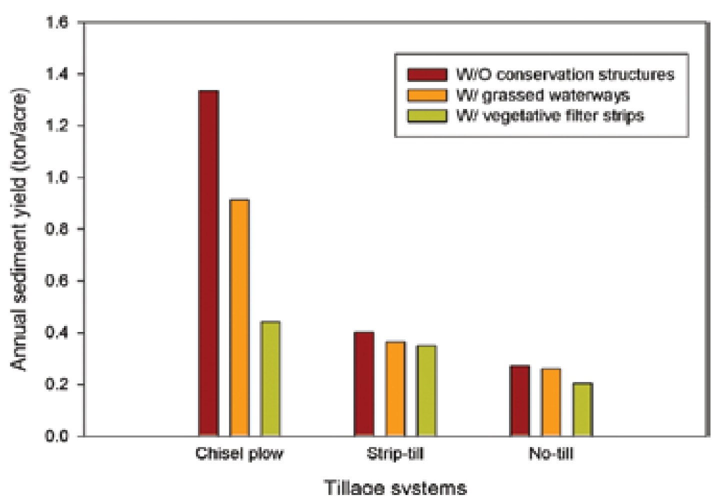

Figure 2. Impact of tillage systems and conservation structures on amount of soil leaving the field.

The Water Erosion Prediction Project (WEPP) model was used to estimate the annual soil loss from the study field. By providing more surface residue cover with fewer and shallower tillage passes, no-till and strip-till systems reduced sediment yield by 80 and 70 percent, respectively, compared to the chisel plow system (Figure 2). Conservation structures also greatly reduced sediment yield, particularly with the chisel plow system. Grassed waterways helped to minimize channel erosion and retain sediments from upland fields. Converting a portion of a row-cropped field to perennial vegetative strips was very effective in reducing sediment runoff. The effectiveness of grassed waterways and filter strips in trapping sediment was less significant in the no-till and strip-till systems (Figure 2), due to the already-reduced soil loss from upland soils and low suspended solid concentration in the flow water.

Cash flow and economic benefits

The six-year (2002-2008) yield study in this area (Nashua) showed that the chisel plow system had more bushels per acre of corn than the strip-till (four bu.) and no-till (14 bu.) systems. Soybean yields showed little response to tillage operations (Figure 3). But the no-till and strip-till systems reduced crop production costs such as machinery, fuel and labor, when compared to the chisel plow system.

The value of soil lost from the field due to erosion was estimated at $6.10 per ton, including the on-site and off-site values. The benefit of sediment reduction is limited in this area due to the low sediment production. Because of the high cost of seeds and chemicals and the relatively low price of corn and soybeans at current market prices, the net return from growing corn or soybeans might be negative (Figure 4), and will vary depending on market prices and production costs.

Compared to the chisel plow system, most conservation practices had a net benefit after taking all the costs and benefits into account (Figure 5). Among the investigated practices, the use of strip-till alone had the greatest economic benefit in the study area, increasing the net benefit by $9 per acre while reducing soil loss.

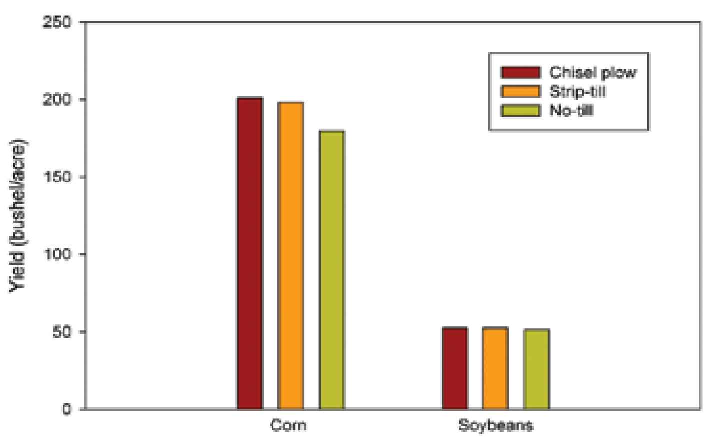

Figure 3. Yields of corn and soybeans under different tillage systems in a corn-soybean rotation.

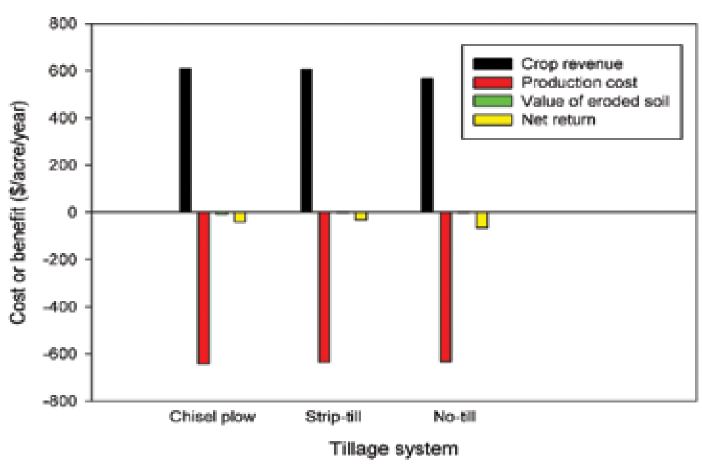

Figure 4. Costs and returns of corn-soybean rotation under different tillage systems. Net return = crop revenue – (production cost + value of eroded soil). The value of eroded soil was estimated at $6.20/ton.

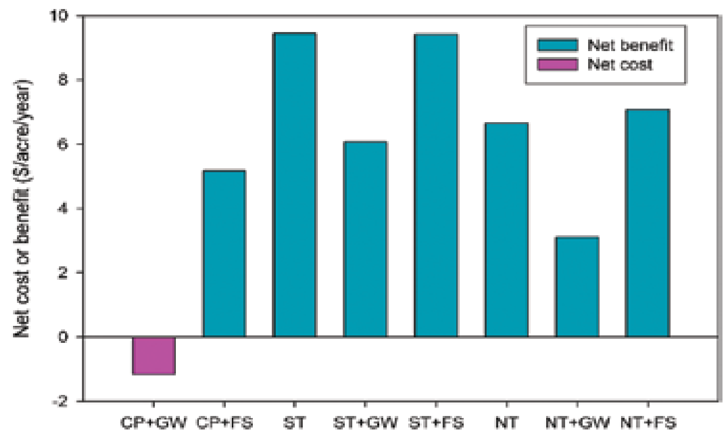

Figure 5. Net benefit or cost of conservation practices compared to the chisel plow tillage system.

Net benefit = crop revenue – (production cost + investment on conservation structure + value of eroded soil). A positive value indicates a net benefit for adopting the conservation practice(s).

Abbreviations: NT=no-till, ST=strip-till, CP=chisel plow, GW=grassed waterways, FS=filter strips.

For more information

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