Eastern Deep Loess and Drift

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.

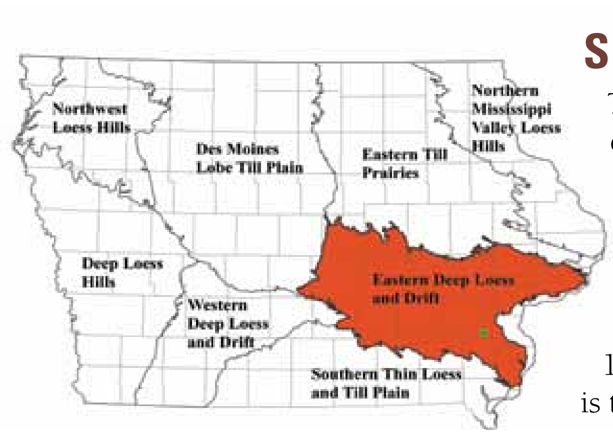

Figure 1. Eastern Deep Loess and Drift and study site.

Site description

The Eastern Deep Loess and Drift area consists of soils developed in loess on broad, convex ridgetops and upper side slopes. Soils developed in glacial till dominate the steeper side slopes. Corn and soybeans are the major crops on the less sloping soils. Hay and pasture are in areas where the slopes are steeper. The selected farm represents the typical soil type and slope in this region (Figure 1). The study area is about 190 acres with a mean slope of 0.9 percent. Nira silty clay loam is the predominant soil.

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.

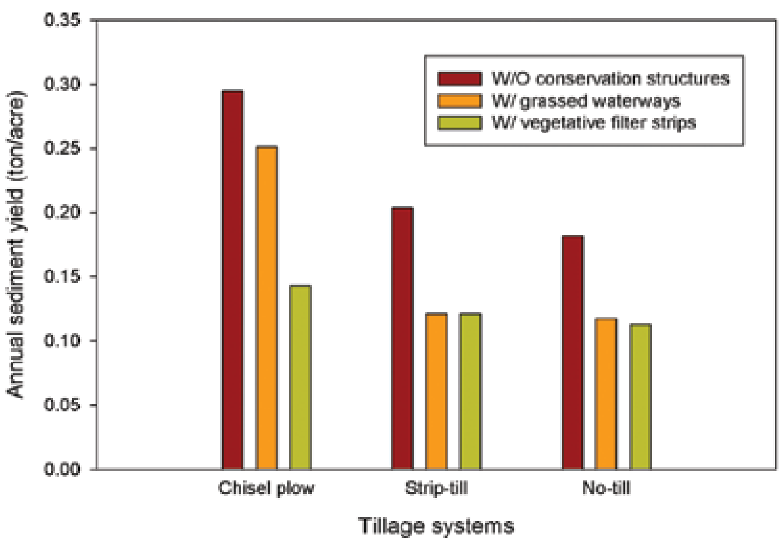

Figure 2. Impact of tillage systems and conservation structures on amount of soil leaving the field.

Reducing sediment with conservation practices

The Water Erosion Prediction Project (WEPP) model was used to estimate the annual soil loss from the study field. With relatively low sediment yield in the study area, no-till and strip-till systems still reduced sediment production by 38 and 30 percent, respectively, compared to the chisel plow system (Figure 2). Grassed waterways reduced sediment yield, minimizing channel erosion and retaining sediments from upland fields. Converting a portion of a row-cropped field to perennial vegetative strips was very effective in reducing sediment runoff.

Cash flow and economic benefits

The six-year (2002-2008) yield study in this area showed that the chisel plow system had higher corn yields with six more bushels per acre than the strip-till and no-till 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 $6.20 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 because of market prices and production costs.

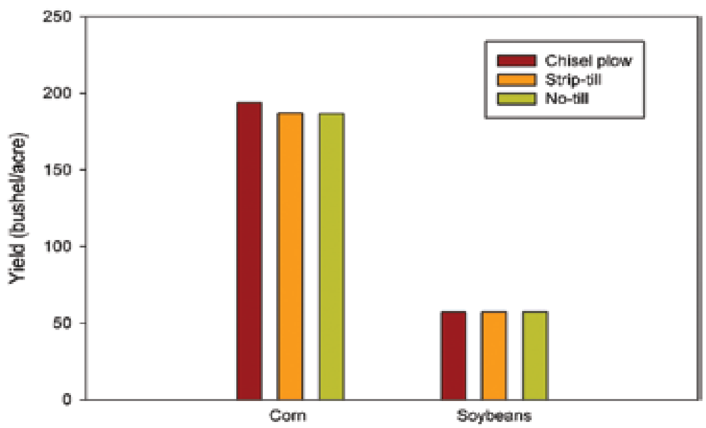

Figure 3. Yields of corn and soybeans under different tillage systems in a corn-soybean rotation.

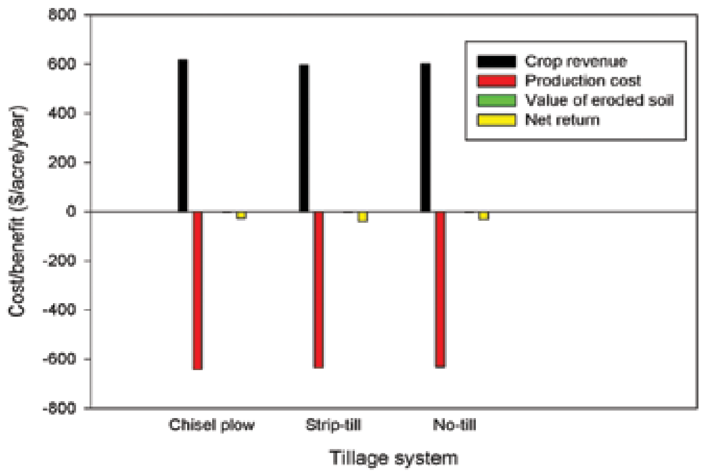

Figure 4. Costs and returns of corn-soybean rotation under different tillage systems. Net return = crop revenue – (production cost + value of eroded soil). The value of eroded soil was estimated at $6.20/ton.

Compared to the chisel plow system, most conservation practices showed a net cost even after taking into account the soil value and the savings in production costs (Figure 5). This is caused by the higher yields under the chisel plow system as well as the relatively small benefit from sediment reduction in this flat region. Among the investigated practices, the use of chisel plow with filter strips had the greatest economic benefit in the study area, increasing the net benefit by $1 per acre while reducing soil loss.

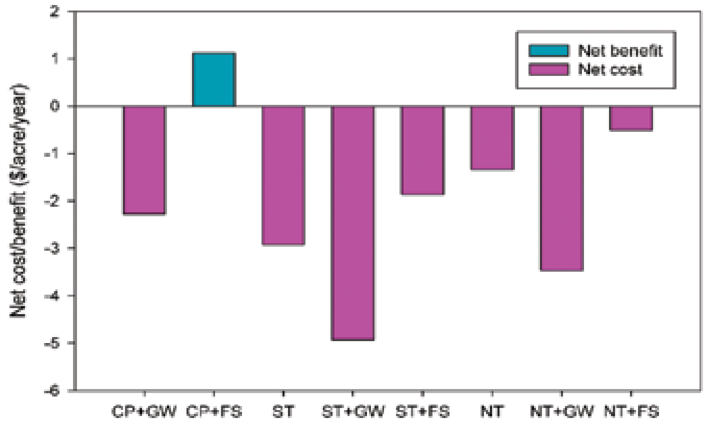

Figure 5. Net benefit or cost of conservation practices compared to the chisel plow tillage system.

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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