Des Moines Lobe Till Plain

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.

Site description

Figure 1. Des Moines Lobe Till Plain and study site.

The Des Moines Lobe Till Plain is a nearly level to gently rolling plain. Subsurface drainage tiles are commonly used to lower water tables in this area. Corn and soybeans are the major crops with some cropland used for hay. A farm was selected to represent the typical soil type and slope steepness in this region (Figure 1). The study area is about 110 acres with a mean slope of one percent. Nicollet clay 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

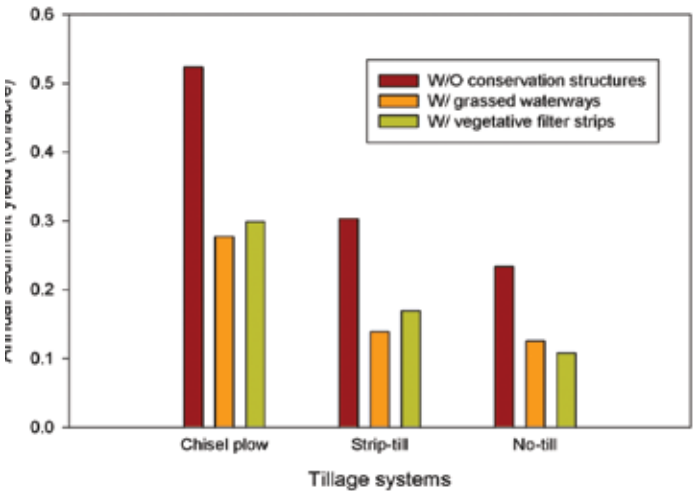

Figure 2. Impact of tillage systems and conservation structures on amount of soil leaving the field.

The Water Erosion Prediction Project (WEPP) model was used to estimate the annual soil loss from the study field. With relatively low sediment yield in the study area, no-till and strip-till systems still reduced sediment export by 55 and 42 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 delivery to waterways.

Cash flow and economic benefits

The six-year (2002-2008) yield study in central Iowa showed that the chisel plow system had higher corn yields 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, 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 relatively limited in this area due to the low sediment yield. 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.

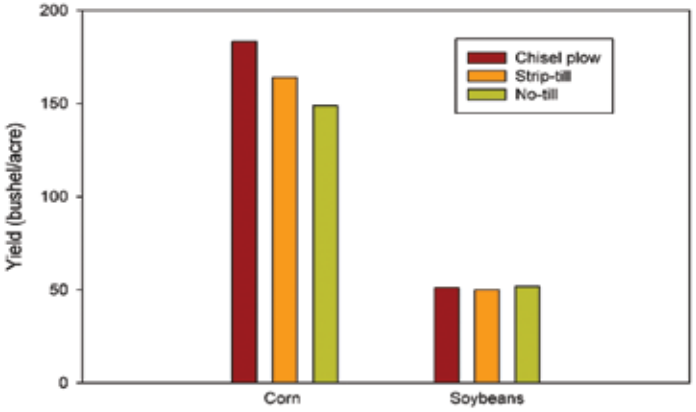

Figure 3. Yields of corn and soybeans under different tillage systems in a corn-soybean rotation.

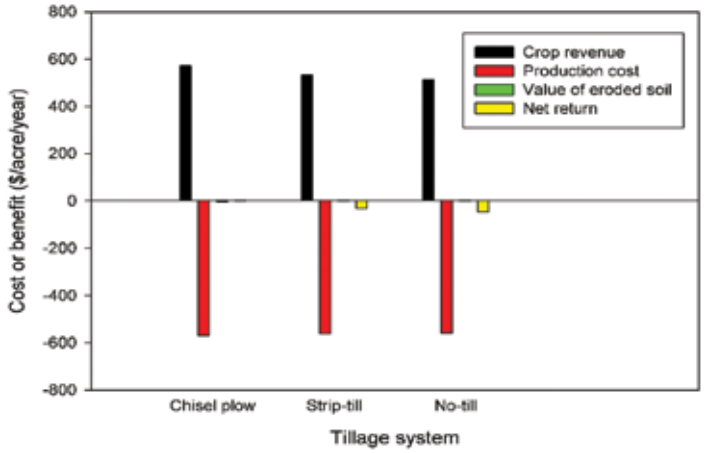

Figure 4. Costs and returns of corn-soybean rotation under different tillage systems. Net return = crop revenue – (production cost + value of eroded soil). The value of eroded soil was estimated at $6.20/ton.

Compared to the chisel plow system, many conservation practices showed a net cost even after taking 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 strip-till with filter strips had the greatest economic benefit in the study area, increasing the net benefit by $6 per acre while reducing soil loss.

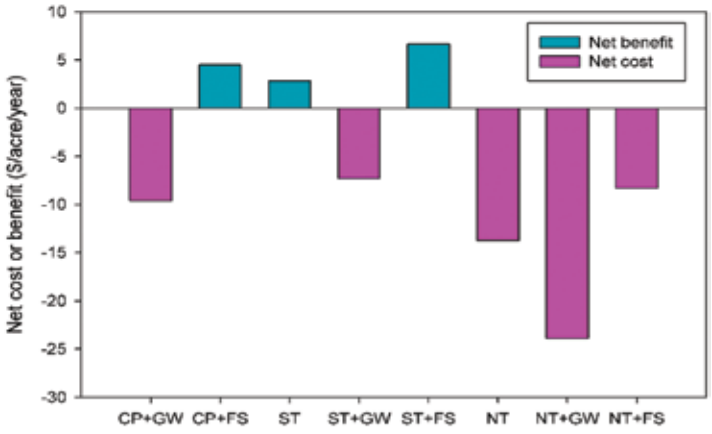

Figure 5. Net benefit or cost of conservation practices compared to the chisel plow tillage system.

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

Iowa Learning Farms
219B Davidson Hall
Iowa State University
Ames, Iowa 50011-3080
ilf@iastate.edu

www.extension.iastate.edu/ilf

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