IOWA Learning Farms

Building a Culture of Conservation

Farmer to Farmer: Iowan to Iowan

Supplement to
Water Quality and Conservation Practices

Southern Thin Loess and 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.

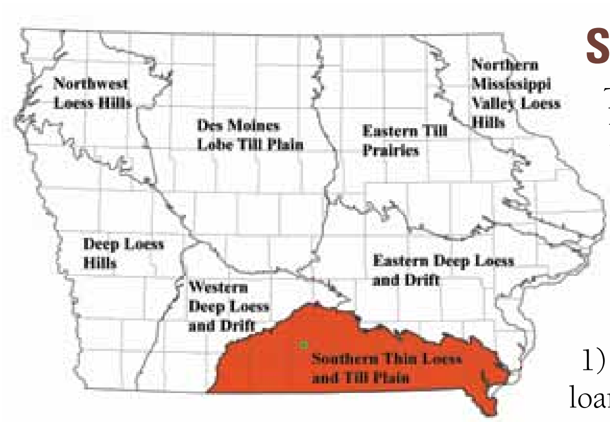

Figure 1. Southern Thin Loess and Till Plain and study site.

Site description

The Southern Thin Loess and Till Plain area has steep rolling hills interspersed with areas of level upland divides and level alluvial lowlands. Loess soils make up a good share of the ridgetops and upper side slopes, while glacial till soils are more prominent on steep side slopes. The cropland is used for corn, soybeans, other feed grains, and hay. The farm selected to represent the typical soil type and slope in this region (Figure 1) is about 60 acres with a mean slope of 7.5 percent. Grundy silt loam is the predominant soil in the 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

The Water Erosion Prediction Project (WEPP) model was used to estimate the annual soil loss from the study field. By combining more surface residue cover with fewer and shallower tillage passes, no-till and strip-till systems reduced sediment yield by 83 and 74 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 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. Terrace systems greatly reduced sediment yield through slowing surface runoff and minimizing rill erosion. The effectiveness of conservation structures in sediment reduction was less significant in the no-till and strip-till systems (Figure 2), due to already reduced soil loss from upland soils and low suspended solid concentration in the flow water.

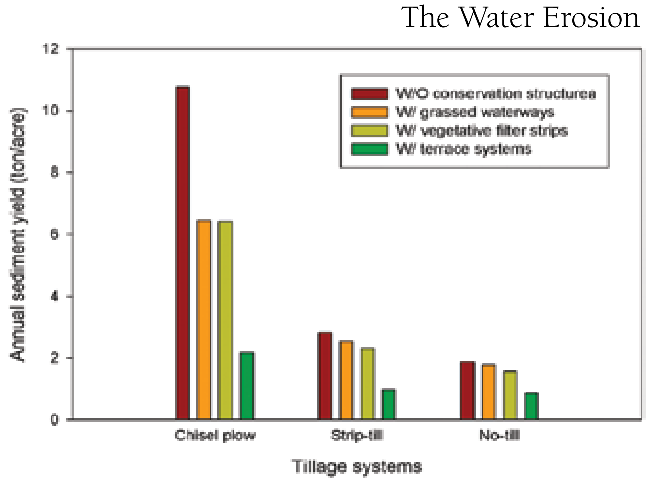

Figure 2. Impact of tillage systems and conservation structures on amount of soil leaving the field.

Cash flow and economic benefits

The six-year (2002-2008) yield study in this area (McNay farm) showed that corn yields were very low compared to other parts of Iowa, probably due to the limited rooting depth potential and slowly permeable subsoils. Soybean yields under chisel plow were slightly higher than under no-till and strip-till (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 to be $6.40 per ton, including the on-site and off-site values. Because of the extreme low yields of corn and soybeans and the high cost of seeds and chemicals at current market prices, the net return from growing corn or soybeans could be negative (Figure 4).

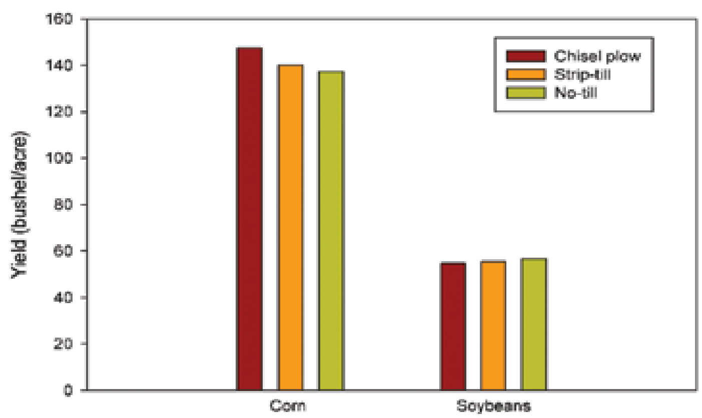

Figure 3. Yields of corn and soybeans under different tillage systems in a corn-soybean rotation.

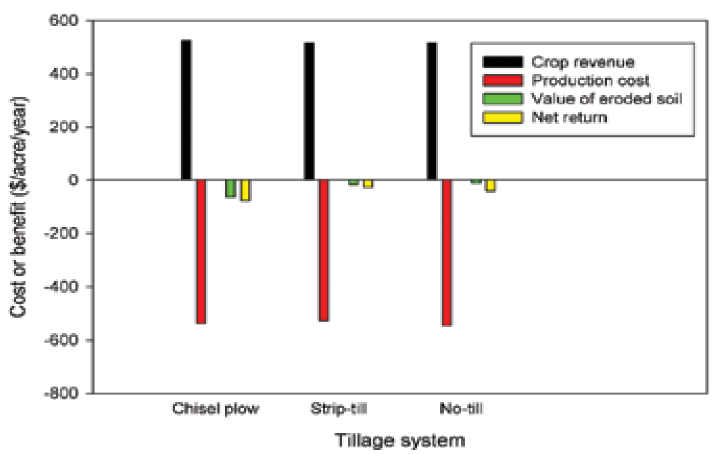

Figure 4. Costs and returns of corn-soybean rotation under different tillage systems. Net return = crop revenue – (production cost + value of eroded soil). The value of eroded soil was estimated at $6.40/ton.

Compared to the chisel plow system, most conservation practices showed a net benefit after taking all the costs and benefits into account (Figure 5). Among the investigated practices, the use of no-till with filter strips had the greatest economic benefit in the study area, increasing the net benefit by $70 per acre while reducing soil loss.

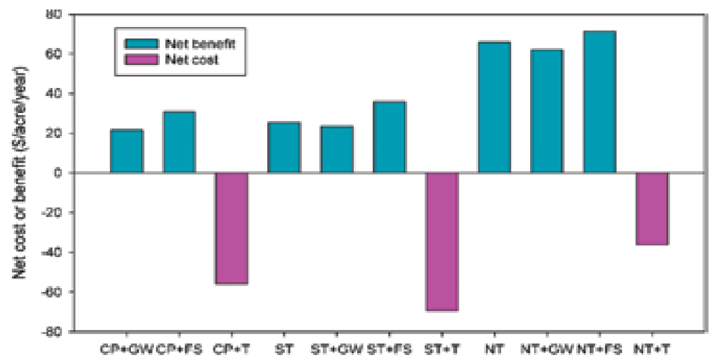

Figure 5. Net benefit or cost of conservation practices compared to the chisel plow tillage system.

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, T=terraces.

For more information

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