THE EFFECTS OF CONSERVATION TILLAGE ON EROSION IN NORTH WEST FLORIDA

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Because of topography, soils, climate and poorly managed intensive cultivation, a significant percentage of cropland is eroding faster than the topsoil can be replenished through natural processes. The soils are dominantly well and moderately well drained with sandy surface layers over loamy and clayey subsoils. They occur on nearly level to moderately steep slopes that extend 20 to 600 feet. The surface layers have weak granular or single grain structure with very friable or loose consistency which are highly susceptible to erosion under intensive cultivation. The subsoils are strongly acid and low in fertility. In many fields, the subsoil is exposed and mixed with the remaining topsoil resulting in excessive crusting, cloddiness, reduced rainfall infiltration, and a poor medium for root growth.

Northwest Florida includes 17 counties extending from the Alabama and Georgia line on the north and the Gulf of Mexico on the south. Annual rainfall varies within the area but averages about 58 inches. About 60 percent of the total rainfall as well as highest intensity rains occur from December through April when most cultivated soils are bare and vulnerable to erosion. The rainfall factor for the USLE is the highest in the nation. The range of temperatures are such that allow for a long growing season which is suitable for multi-cropping coupled with conservation tillage.

There are 784,168 acres of cropland making up 30,446 fields in the area according to a recent study made by the Soil Conservation Service. Using the factors in the Universal Soil Loss Equation (USLE), the following data indicates the acres and the annual soil loss by water and wind.

Table 1.

Sheet and Rill Erosion*			Wind Erosion*			
< 5	5-10	> 10	< 2	2-5	5-10	> 10
168,361	316,063	271,276	147,202	174,202	213,814	58,140

* Shown in tons per acre per year

The USLE calls for factors such as rainfall, soil type, cropping system, slope length, steepness and existing conservation practices on the field to predict annual tons of soil eroded from each acre.

The purpose for the study was to group as well as locate those fields losing less than 5 tons of soil per acre per year, those losing between 5 and 10 tons and those losing more than 10 tons per acre per year. Special effort then is first directed toward erosion control treatment on those fields with more than 10 tons soil loss per acre per year.

Placing an economic value on conservation tillage is a difficult task. Table 2 reflects soil loss after treatment and cost of different treatments as they are applied to a field that is eroding at 16.6 tons/acre annually.

Presently, the erosion rates on 35% of NW Florida's cropland is high enough to threaten long term productivity. To help reduce this soil loss, research and all disciplines in agriculture are constantly seeking new ways to help producers develop and apply affordable conservation practices. Conservation tillage is once such practice that is now growing rapidly.

Table 2 – Corn on Dothan Sandy Loam with 4 percent slopes.

Conservation Treatment					Erosion Tons/Ac	Treatment Cost $	Cost Per Ton $	Net Return $
Conven. Tillage	Conser. Tillage	Contour	Terrace & Cover	Winter Cover				
**					16.6	00	00	131.07
**		**			8.32	4.26	0.51	126.81
**			**		4.71	22.26	1.87	108.81
**				**	12.47	8.70	2.09	122.37
**				**	3.53	32.65	2.49	98.43
	**				4.44	-19.81	-1.63	150.88
	**	**			2.22	-16.33	-1.13	147.40
	**		**		1.26	1.67	0.11	129.40
	**			**	3.33	-11.11	-0.84	142.18
	**		**	**	0.94	11.81	0.75	119.26

** Indicates practice performed.

The negative figures reflect a savings as compared to a cost in Table 2. It is evident that conservation tillage is one of the most cost-effective treatments that can be applied to reduce erosion on those critically eroding fields.

Conventional tillage shows a net return of $131.07 per acre with no conservation practices and a soil loss of 16.6 tons per acre per year. Soil losses can be brought down to 3.5 tons per acre per year with conventional tillage, terraces, contouring and winter cover crops but the profit turns out to be only $98.43 per acre. The same soil and crop, however, treated by the lone practice of conservation tillage would yield a profit of $150.88 with a tolerable erosion rate of 4.4 tons per acre per year.

The report revealed that there were 194,683 acres of conservation tillage during the 1983 cropping season, which is a good indicator that the producers in the area can see the beneficial effects. One such effect is increased production per unit of land. By selecting crop varieties that are best suited to an early or late growing season, two or more crops may be grown in sequence on the same land in the same year. For example, early, short season corn varieties and late season soybean varieties may be selected to be grown the same year on the same land. Multicropping can be accomplished successfully with a conservation tillage system. The conservation tillage system provides for timing the harvest of one crop and planting the second crop more efficiently than with a conventional tillage system. The producer will also better utilize his fertilizer and chemicals with multicropping than with one crop per year conventional tillage system.

Conservation tillage may not be pretty, but it is one of the most cost effective solutions to the erosion problem on cropland. For example, a conventional tilled corn field, clean and bare at planting, on 3% slopes, 200 feet long and on Dothan soil results in 11 tons of soil loss per acre per year. By growing another crop such as small grain after the corn harvest, the soil loss will reduce to 7 tons per acre per year. Using the same crops on the same land, but by using a conservation tillage method and utilizing the previous crop residue, the soil loss by sheet and rill erosion is 3 tons per acre per year. The erosion rate can be reduced as much as 5.5 tons per acre per year by contour farming the field. With a conservation tillage method and contouring, the erosion on this field will be less than 2 tons per acre per year.

Some other beneficial effects of conservation tillage not readily recognized by producers is the prevention of pollution of nearby water with soil particles carried by runoff water. Those soil particles carry attached atoms of fertilizer and chemicals that are included in water pollutants.

It is estimated that about two dollars worth of fertilizer is lost per ton of soil loss. Conservation practices and good management can almost totally eliminate this problem.

Conserving soil moisture for crop use with conservation tillage is accomplished in two ways. First, the crop residue promotes cooler temperatures at the soil surface and less evaporation occurs. Second, conservation tillage allows for a reduced number of tillage operations that reduces moisture in the plow layer. For example, irrigated peanuts and corn in small grain residues grown by two separate producers in the 1983 growing season required only one half as much irrigation water as their conventionally tilled irrigated fields with the same treatments. Both no-till and conventional tilled fields yielded about the same, but the no-till fields required less labor and time.

Soil compaction has a direct impact on yields. Most producers to not *see* these losses. Soil compaction problems are often misdiagnosed as some other crop problem. Conservation tillage equipment with subsoilers or straight shank chisels will break up or shatter the compacted layer that restricts water and air penetration, root development, and reduces the water holding capacity of the soil. Conservation tillage reduces the number of tillage operations, thus reduces the traffic pressure which causes compaction. There is no permanent cure for soil compaction, but when the soil is not too wet, conservation tillage is a good start toward reducing the problem. Using in-row subsoilers in conjunction with conservation tillage, multicropping, contouring and good management, over 500,000 acres of cropland in northwest Florida can have sheet and rill erosion reduced to tolerance levels. However, many fields have large and/or shallow gullies (ephemeral erosion) occurring which conservation tillage alone cannot solve. These areas usually have extremely high amounts of soil loss and require mechanical practices such as terraces and grassed waterways to control the erosion.

In summary, the crop residues left on the surface with conservation tillage reduce wind velocity thereby protecting young crops from the effects of the wind and abrasion from blown soil particles. Wind erosion can be reduced to tolerance levels with conservation tillage. In combination with multicropping, conservation tillage is an excellent tool for erosion control on intensively cultivated land.

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