RUSLE2 SOIL EROSION CALCULATIONS ON CONSERVATION TILLAGE SYSTEMS

Steve Boetger
USDA-NRCS
2614 NW 43rd St.
Gainesville, FL. 32606
Steve.Boetger@fl.usda.gov

INTRODUCTION

The Revised Universal Soil Loss Equation, Version 2 (RUSLE2) is an upgrade of the text-based RUSLE DOS version 1. It is a computer model containing both empirical and process-based science in a Windows environment that predicts rill and interrill erosion by rainfall and runoff. RUSLE2 was developed primarily to guide conservation planning, inventory erosion rates and estimate sediment delivery. Values computed by RUSLE2 are supported by accepted scientific knowledge and technical judgment, are consistent with sound principles of conservation planning, and result in good conservation plans.

MATERIALS AND METHODS

Using RUSLE2 Version 1.26.6.4, release date November 13, 2006. Climate data from Jackson County, Florida, soil data is the Dothan loamy sand map unit from the Jackson County Soil Survey, slope length was 100 feet and the percent slope was 4 percent. Crops evaluated were peanuts and cotton using three different management scenarios. The managements used for peanuts were: 1. spring disk, residue left 2. strip till into rye cover crop, residue left, and rye is no till 3. no till into rye cover crop, residue left, and rye is no till. Managements for the cotton were: 1. spring disk 2. strip till into rye cover crop, rye is no till 3. no till into rye cover crop, rye is no till. Erosion rates were evaluated on each management. The soil conditioning index, which is a prediction tool that is used to estimate whether applied conservation practices will result in maintained or increased levels of soil organic matter, was evaluated to determine if there was an improving trend with the use of conservation tillage. Another indicator that was evaluated was the soil tillage intensity rating. This indicator is based on the amount of tillage and how that tillage disturbs the soil surface. Fuel usage and cost were evaluated based on all operations using diesel as the fuel type.

RESULTS AND DISCUSSION

Using the RUSLE2 worksheet erosion calculation I evaluated the three managements on peanuts. See Table 1 for the results of these managements on erosion rate, soil conditioning index, soil tillage intensity rating, fuel usage, and fuel cost.

Table 1

Management on Peanuts	Erosion rate(tons/ac/yr)	Soil Conditioning Index	Soil Tillage Intensity Rating	Fuel Usage (gal./ac)	Fuel Cost ($/ac)
Spring disk, residue left	15	-1.4	142	3.9	$9.775
Strip till into no till rye cover crop with residue left	4.9	-0.050	35.7	3.8	$9.456
No till into no till rye cover crop with residue left	4.7	-0.013	30.7	2.3	$5.823

In evaluating the results of the three different managements on peanuts for erosion rate shows that the most erosive is the spring disk. There is a significant decline when strip tillage with a no till rye cover crop is used. The drop in the erosion level is due to more residue being left on the soil surface, because the only soil disturbance is in the strip area. There is a lesser reduction in erosion when using no till instead of strip till. The soil conditioning index shows a negative number in all three managements, which indicates a decreasing trend in soil organic matter. In the strip till and no till managements the negative number is closer to zero than the conventional tillage, which is a better trend. The number is negative due to the drilling of the rye cover crop. The soil tillage intensity rating is worst when the number is large, which indicates a large amount of tillage disturbing the soil surface. This is the case with the spring disk in the first management. The number is much lower for both the strip till and no till managements, since there is a limited area on the soil surface that is being tilled. Fuel usage for the spring disk and strip till managements are quite close in number due to the amount of tillage to be done in preparing the seed bed and planting of the crop. In the no till management there is a significant reduction in fuel use due to the fact of no tillage. The fuel cost mirrors the fuel usage in the three managements with the spring disk and strip till being more than the no till.

Using the RUSLE2 worksheet erosion calculation I evaluated the three managements on cotton. See Table 2 for the results of these managements on erosion rate, soil conditioning index, soil tillage intensity rating, fuel usage, and fuel cost.

Table 2

Management on Cotton	Erosion rate (tons/ac/yr)	Soil Conditioning Index	Soil Tillage Intensity Rating	Fuel Usage (gal./ac)	Fuel Cost ($/ac)
Spring disk	19	-1.8	149	5.2	$12.96
Strip till into no till rye cover crop	3.2	0.18	8.59	4.2	$10.48
No till into no till rye cover crop	1.6	0.34	3.55	2.7	$6.843

In evaluating the results of the three different managements on cotton for erosion rate shows that the most erosive is the spring disk. There is a significant decline when strip tillage with a no till rye cover crop is used. The drop in the erosion rate is due to more residue being left on the soil surface, because the only soil disturbance is in the strip area. There is a continued reduction in erosion (by half the amount) when using no till instead of strip till. The soil conditioning index shows a negative number in the spring disk management, which indicates a decreasing trend in soil organic matter. In the strip till and no till managements the number is positive, which indicates an increasing trend in soil organic matter. The soil tillage intensity rating is worst when the number is large, which indicates a large amount of tillage disturbing the soil surface. This is the case with the spring disk in the first management. The number is tremendously lower for both the strip till and no till practices, since there is a limited area on the soil surface that is being tilled. Fuel usage for the spring disk and strip till practices are not quite as close in number as in the peanut crop above, but still due to the amount of tillage to be done in preparing the seed bed and planting of the crop. In the no till operation there is a significant reduction in fuel use due to the fact of no tillage being done. The fuel cost mirrors the fuel usage in the three managements with the spring disk and strip till being more than the no till.

CONCLUSION

In conclusion, these three managements on peanuts shows that conventional tillage with a disk even with residue left still causes the most soil erosion rate, has the highest negative numbers for the soil conditioning index, the highest soil tillage intensity rating and the most fuel usage and cost when compared to the two conservation tillage managements. In comparing the conservation tillage managements, the strip till in peanuts has a slightly higher erosion rate, a higher and negative number for the soil conditioning index, a higher soil tillage intensity rating, and higher fuel use than the no till management, but the fuel

use was slightly lower than the spring disk. In cotton the same conclusion can be drawn as in peanuts with the conventional tillage, but when comparing the two conservation tillage managements it clearly shows the no till management is superior to the strip till. This superiority is shown in half the reduction in soil erosion rate and both managements show a positive soil conditioning index, but the no till is twice as much in number as the strip till. This also relates to fuel usage, which is half the amount of strip till. So, in the big picture if a producer has the equipment or the means to rent or buy the equipment to convert to either strip till or no till, then they can save money in fuel, lower their soil erosion rate, add more organic matter to the soil which improves soil quality and this will increase their yields and their profits.

REFERENCES

RUSLE2 Web-site. 13 July 2004. Revised Universal Soil Loss Equation, Version 2. 17 May 2007. <http://fargo.nserl.purdue.edu/rusle2_dataweb/RUSLE2_Index.htm>