VA RUSLE2 Plan Printout w/ Details

Detailed printout of RUSLE2 calculation for multiple fields, one or more management alternatives per field

I. Client/Tract ID & Summary

Client/Owner name: Happy EQIP Applicant
Tract #: 1234
Location: Virginia\Washington County

Printout date: August 8, 2007
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USDA Service Center/Location: NRCS VA State Office, Richmond

Narrative description of plan, fields, and/or management alternatives being compared:
This plan compares two continuous corn silage production systems described below across three slopes. This plan is being developed in support of a potential cropland EQIP application seeking continuous no-till (329) and Soil Conditioning Index (328) payments.

- BEFORE: 1 year rotation, with corn silage planted no-till (NT), followed by rye silage (harvested) planted with chisel/disk tillage (CT). Dairy manure is applied ahead of both crops.
- AFTER: 1 year rotation, with corn silage planted no-till (NT), followed by rye cover crop (not harvested) planted no-till (NT) with a Great Plains type drill. Dairy manure is applied ahead of corn only. This rotation meets the definition of "continuous no-till" under VA practice standards.

The slopes compared range from a relatively flat bottomland field (Field 1) to a moderately sloping upland field (7%) to a steep (C slope, 14%) field.
Because of the practical difficulties associated with farming on the contour on these landscapes, no credit is given for that practice.

Summary of RUSLE2 output for each field & management alternative:

Field name	*Description*	*Cons. plan. soil loss, t/ac/yr*	*Soil conditioning index (SCI)*	*STIR value*
1 (Ernest silt loam 2%)	**Before: Corn silage NT, Rye silage CT**	**4.6**	**-0.39**	**110**
1 (Ernest silt loam 2%)	**After: Corn silage NT, Rye cover crop NT**	**1.3**	**0.49**	**10**
2 (Frederick silt loam 7%)	**Before: Corn silage NT, Rye silage CT**	**12**	**-0.96**	**110**
2 (Frederick silt loam 7%)	**After: Corn silage NT, Rye cover crop NT**	**3.0**	**0.35**	**10**
3 (Frederick silt loam 14%)	**Before: Corn silage NT, Rye silage CT**	**26**	**-2.1**	**110**
3 (Frederick silt loam 14%)	**After: Corn silage NT, Rye cover crop NT**	**6.7**	**0.059**	**10**

Definitions of terms like soil loss, SCI, STIR are also found at the end of this document!

INTERPRETATION:
General: Converting from the BEFORE (pink) to AFTER cropping system is predicted to result in

significant conservation and production efficiency benefits over time. These improvements are due in large part to the reduction in soil disturbance which is reflected in the STIR (soil tillage intensity rating) values for the two rotations. These values of 110 vs. 10 are based solely on the different ground-engaging tools used in the two systems and stay constant across all slopes or soil types. Excessive soil disturbance damages soil in multiple ways (erosion, "burning off" of organic matter through oxidation, damage to soil structure, etc.). The low STIR of 10 achieved with the continuous no-till AFTER rotation is considered optimal for purposes of soil quality improvement in VA no-till and crop rotation practice standards. Eliminating tillage trips should also save time and fuel.

Field 1: This flat field has a soil loss tolerance "T" value of 3 ton/ac/yr. The BEFORE system results in predicted soil loss in excess of T and a negative Soil Conditioning Index (SCI) of -0.39. This cropping system is predicted to degrade soil productivity and deplete soil organic matter over time. The BEFORE system does not meet VA NRCS quality or RMS criteria for erosion and soil quality, which require soil loss to T or less and a positive SCI. Note that conservation compliance for USDA program eligiblity ***is*** achieved, however. Switching to the continuous no-till AFTER system brings soil loss below T and increases SCI to +0.49, which predicts soil organic matter will build at a minimum to intermediate rate. The AFTER condition meets VA RMS criteria as well as SCI threshold of +0.25 for EQIP 328/329 eligiblity.

Field 2: This field with a slope of 7% has a T value of 5 t/ac/yr. Switching cropping systems results in a similar pattern of results as described above for Field 1. The BEFORE system is losing soil far in excess of T, has a strongly negative SCI indicating an extreme degree of soil organic matter depletion over time, and does not meet VA quality/RMS criteria. Also, the BEFORE system does ***not*** satisfy USDA conservation compliance requirements for USDA program participation. The AFTER cropping system on this slope meets T, has an SCI value that predicts soil organic matter will build (minimum performance level), achieves conservation compliance, meets VA quality/RMS criteria, and meets SCI requirements for EQIP eligiblity.

Field 3: This field with a steep slope will also benefit greatly by changing to the AFTER cropping system. The BEFORE system is predicted to dramatically degrade the soil resource over time, with soil loss in the range of 8 times T! The BEFORE system on this slope also does ***not*** achieve USDA conservation compliance. Although the AFTER system results in significant improvement and achieves conservation compliance, the predicted soil loss is still in excess of T. This means that the management system is predicted to degrade the soil resource over time and neither meets VA quality/RMS criteria nor current VA EQIP eligiblity criteria. The SCI value is barely positive, indicating a long-term soil organic matter trend that is on the borderline between depletion and maintenance. On this slope, please consider including a ***perennial forage crop*** in the rotation, which will likely bring performance up to a soil organic matter building level (and may also be eligible for EQIP payments).

CONCLUSION:

If the AFTER system is acceptable, we can proceed with EQIP application for no-till and SCI payments on Fields 1 and 2. We will need to come up with another alternative for Field 3 due to slope, mostly likely including a perennial, if EQIP payments are desired.

II. RUSLE2 Plan Inputs

1. CLIMATE (R FACTOR)

Climate Location: Virginia\Washington County (R Factor: 180 US)

2 & 3. SOIL & TOPOGRAPHY (K and LS FACTORS)

Field name	*Soil*	*Slope T Value, t/ac/yr*	*Slope length, ft*	*Slope steepness, %*
1 (Ernest silt loam 2%)	Washington County, VA\14B ERNEST SILT LOAM, 2 TO 7 PERCENT SLOPES\Ernest silt loam 85%	3	150	2.0
2 (Frederick silt loam 7%)	Washington County, VA\16B FREDERICK SILT LOAM, 2 TO 7 PERCENT SLOPES\Frederick silt loam 85%	5	100	7.0
3 (Frederick silt loam 14%)	Washington County, VA\16C FREDERICK SILT LOAM, 7 TO 15 PERCENT SLOPES\Frederick silt loam 75%	5	79	14

4A. CROP MANAGEMENT (C FACTOR) SUMMARY – ALL FIELDS/ALTERNATIVES

RUSLE2 crop management file name for each field & management alternative:

Field name	*Description*	*Management*
1 (Ernest silt loam 2%)	Before: Corn silage NT, Rye silage CT	CMZ 64\c.Other Local Mgt Records\FEB06 TRAINING\A.CORN.sil.NT/Rye.sil.CT.chtw.disk.cpck
1 (Ernest silt loam 2%)	After: Corn silage NT, Rye cover crop NT	CMZ 64\c.Other Local Mgt Records\FEB06 TRAINING\C.CORN.sil.NT/Rye.covr.NT.fcdr
2 (Frederick silt loam 7%)	Before: Corn silage NT, Rye silage CT	CMZ 64\c.Other Local Mgt Records\FEB06 TRAINING\A.CORN.sil.NT/Rye.sil.CT.chtw.disk.cpck
2 (Frederick silt loam 7%)	After: Corn silage NT, Rye cover crop NT	CMZ 64\c.Other Local Mgt Records\FEB06 TRAINING\C.CORN.sil.NT/Rye.covr.NT.fcdr
3 (Frederick silt loam 14%)	Before: Corn silage NT, Rye silage CT	CMZ 64\c.Other Local Mgt Records\FEB06 TRAINING\A.CORN.sil.NT/Rye.sil.CT.chtw.disk.cpck
3 (Frederick silt loam 14%)	After: Corn silage NT, Rye cover crop NT	CMZ 64\c.Other Local Mgt Records\FEB06 TRAINING\C.CORN.sil.NT/Rye.covr.NT.fcdr

4B. CROP MANAGEMENT (C FACTOR) DETAILS – SELECTED ALTERNATIVES

a. BEFORE or CONVENTIONAL TILLAGE SYSTEM

- Rotation Duration: 1 yr

- Crops / vegetations in rotation and long-term yield averages:

Vegetation	*Yield units*	*Yield (# of units)*
Corn, silage	tons	23.0
Rye, cereal silage	tons	12.0

- Field operation dates and descriptions, manure application rates, etc.:

Date	*Operation*	*Vegetation*	*Yield (# harv. units)*	*Type of cover material*	*Cover matl add/remove, lb/ac*

5/5/1	Planter, double disk opnr w/fluted coulter	Corn, silage	23.0		
5/7/1	Manure spreader, slurry			Manure, slurry	1100.0
9/5/1	Harvest, silage				551.00
9/20/1	Chisel, twisted shovel				
9/25/1	Disk, tandem secondary op.				
10/1/1	Cultipacker, roller				
10/5/1	Drill or airseeder, double disk	Rye, cereal silage	12.0		
11/5/1	Manure spreader, slurry			Manure, slurry	1100.0
4/21/2	Harvest, silage				202.99

External residue (i.e., manure) application rates in RUSLE2 are expressed in lbs of "effective" dry matter per acre. For liquid, slurry, poultry, and semi-solid manures, "effective" dry matter in = 50% of actual dry matter

- Additional RUSLE2 crop management info:
  - Rock cover: 0 %
  - Adjust res. burial level: Normal res. burial
  - RUSLE2 management file name: Base management: c.Other Local Mgt Records\FEB06 TRAINING\A.CORN.sil.NT/Rye.sil.CT.chtw.disk.cpck

b. AFTER or CONTINOUS NO-TILL SYSTEM

- Rotation Duration: 1 yr

- Crops / vegetations in rotation and long-term yield averages:

Vegetation	*Yield units*	*Yield (# of units)*
Corn, silage	tons	25.0
Rye, winter cover	pounds	4500

- Field operation dates and descriptions, manure application rates, etc.:

Date	*Operation*	*Vegetation*	*Yield (# harv. units)*	*Type of cover material*	*Cover matl add/remove, lb/ac*
5/1/1	Manure spreader, slurry			Manure, slurry	1100.0
5/5/1	Planter, double disk opnr w/fluted coulter	Corn, silage	25.0		
9/5/1	Harvest, silage				595.58
10/5/1	Drill or airseeder, double disk, w/ fluted coulters	Rye, winter cover	4500		
4/21/2	Sprayer, kill crop				641.10

External residue (i.e., manure) application rates in RUSLE2 are expressed in lbs of "effective" dry matter per acre. For liquid, slurry, poultry, and semi-solid manures, "effective" dry matter in = 50% of actual dry matter

- Additional RUSLE2 crop management info:
  - Rock cover: 0 %
  - Adjust res. burial level: Normal res. burial
  - RUSLE2 management file name: Base management: c.Other Local Mgt Records\FEB06 TRAINING\C.CORN.sil.NT/Rye.covr.NT.fcdr

5. SUPPORT PRACTICES (P FACTOR) SUMMARY

Summary of support practices selected for each field & management alternative:

Field name	*Description*	*Contouring system*	*Support practices*	*Terrace/diversion system*
1 (Ernest silt loam 2%)	Before: Corn silage NT, Rye silage CT	default	-- none --	-- none --
1 (Ernest silt loam 2%)	After: Corn silage NT, Rye cover crop NT	default	-- none --	-- none --
2 (Frederick silt loam 7%)	Before: Corn silage NT, Rye silage CT	default	-- none --	-- none --
2 (Frederick silt loam 7%)	After: Corn silage NT, Rye cover crop NT	default	-- none --	-- none --
3 (Frederick silt loam 14%)	Before: Corn silage NT, Rye silage CT	default	-- none --	-- none --
3 (Frederick silt loam 14%)	After: Corn silage NT, Rye cover crop NT	default	-- none --	-- none --

6. RUSLE2 SOFTWARE DETAILS

- Program version: Nov 13 2006
- Database name: moses.new.VASO.CLL.070507
- Plan file name: plans\Lawrence.Chris.Basic.R2.Plan

III. RUSLE2 Plan Outputs & Definitions

1. SOIL LOSS ESTIMATES & SOIL QUALITY SCORES – ALL FIELDS & ALTERNATIVES:

Field name	*Description*	*Cons. plan. soil loss, t/ac/yr*	*Sed. delivery, t/ac/yr*	*Soil conditioning index (SCI)*	*STIR value*
1 (Ernest silt loam 2%)	Before: Corn silage NT, Rye silage CT	4.6	4.6	-0.39	110
1 (Ernest silt loam 2%)	After: Corn silage NT, Rye cover crop NT	1.3	1.3	0.49	10
2 (Frederick silt loam 7%)	Before: Corn silage NT, Rye silage CT	12	12	-0.96	110
2 (Frederick silt loam 7%)	After: Corn silage NT, Rye cover crop NT	3.0	3.0	0.35	10
3 (Frederick silt loam 14%)	Before: Corn silage NT, Rye silage CT	26	26	-2.1	110
3 (Frederick silt loam 14%)	After: Corn silage NT, Rye cover crop NT	6.7	6.7	0.059	10

Cons. Plan. Soil Loss, t/ac/yr = Soil loss for conservation planning in tons/acre/year
Estimate of average annual rainfall-induced soil loss (detachment of soil particles & transport downhill) over the length of the modeled slope. It is critical to understand that this value represents a long-term (20- to 30-year) average, not a prediction of actual soil loss in any single year. This is the number to use for conservation planning and to compare with the field's "T" soil loss tolerance value. This number is a measure of the likelihood of degradation by erosion of the soil resource in upslope (steeper) areas of the field. Very little credit is given for any sediment deposition that may occur towards the bottom of the modeled slope (for example, due to an end-of-slope filter strip), because upslope areas are still being degraded.

Sed. Delivery, t/ac/yr = Sediment delivery, tons/acre/year
Estimate of the amount of sediment delivered by runoff to the end of the modeled slope. This is RUSLE2's best estimate of long-term average "edge of field" soil loss. Full credit is given for any sediment deposition that occurs anywhere on the modeled slope due to reductions in slope grade, filter strips, terraces, etc. This number is not used for conservation planning, but may be used for other environmental applications (e.g., P-Index). In many cases, RUSLE2 users will model slopes as uniform with no structural practices, vegetative features (filter strips), or breaks in topography that result in sediment deposition. In this typical situation, results for sediment delivery and soil loss for conservation planning will be identical.

Soil conditioning index (SCI)
Soil organic matter (SOM) or soil carbon (C) trend score. If SCI is negative (less than zero), SOM and soil C and soil quality are predicted to decline over time on the modeled slope under the modeled management system. If SCI is positive (greater than zero), SOM and soil C and soil quality are predicted to stay the same or to increase over time. SCI scores usually range from -1 to +1 in typical VA situations, although more extreme values are possible. SCI is an index score (no units) designed solely for comparing the relative impact of different management alternatives on long-term soil quality trends. When calculating SCI, RUSLE2 considers three key factors: (1) amount of surface and subsurface biomass returned to the soil; (2) tillage-induced oxidation of soil carbon; and (3) predicted sheet & rill erosion. Climate and soil type inputs are also considered due to the influence of these factors on soil C oxidation trends.

STIR = Soil Tillage Intensity Rating (average annual value for the overall crop rotation)
Measure of intensity of tillage or soil disturbance. STIR is an index (no units) designed solely for comparing the relative impact of different management alternatives on soil disturbance. STIR increases with increasing tillage and can range from 0 to 200+. Average annual STIR values (shown in this printout) reflect the total amount of soil disturbance that occurs during the overall rotation, averaged across the number of years in the rotation. STIR values can also be calculated for individual crops (shown only in the VA Profile Printout w/ Details). The STIR for an individual crop represents the sum of all soil disturbance associated with establishing and harvesting that crop. STIR values in the 5 to 20 range are typical of no-till crops and/or continuous no-till or low soil disturbance cropping systems. In long rotations with a mix of tilled and no-till and/or perennial crops, the average annual STIR for the overall rotation may be relatively low even if significant tillage occurs in individual years and STIR values for one or more crops in the rotation are relatively high.

2. FUEL USAGE & COST ESTIMATES (adjusted for soil texture):

Field name	*Description*	*STIR value*	*Fuel cost, US$/ac*
1 (Ernest silt loam 2%)	Before: Corn silage NT, Rye silage CT	110	22.4
1 (Ernest silt loam 2%)	After: Corn silage NT, Rye cover crop NT	10	9.84
2 (Frederick silt loam 7%)	Before: Corn silage NT, Rye silage CT	110	22.4
2 (Frederick silt loam 7%)	After: Corn silage NT, Rye cover crop NT	10	9.84
3 (Frederick silt loam 14%)	Before: Corn silage NT, Rye silage CT	110	22.4
3 (Frederick silt loam 14%)	After: Corn silage NT, Rye cover crop NT	10	9.84

Fuel cost, US$/ac
Estimate of total cost of fuel consumed by all field operations over the full duration of the modeled crop rotation. RUSLE2 calculates this value using the Equivalent Diesel Use (gal/ac) output and the user-selected fuel type and cost ($/gal) (neither can be shown in a Plan printout).

In order to make a valid overall fuel cost comparison between management alternatives, it is especially important that a fuel type and unit fuel cost should be selected for each alternative under consideration. Therefore, the user should check RUSLE2 to verify that all fuel related inputs are correct before drawing conclusions from the fuel cost estimates in this printout.

RUSLE2 fuel usage results are expressed as total fuel used over the full duration of the rotation (i.e., gal/ac), **not** average annual fuel use (i.e., gal/ac/yr). Therefore, be very careful when using these values to compare relative fuel efficiency of two crop rotations that differ in duration!

Fuel usage results are derived from built-in estimates of "typical" fuel needs for each field operation in the RUSLE2 database. When interpreting these results, remember that most RUSLE2 management files were created with the goal of modeling operations and processes that impact soil loss. Therefore, some fuel-consuming operations with no impact on soil loss may not be listed in management files (e.g., post-emergence pesticide applications, hay tedding and raking, etc.). If you wish to improve the accuracy of fuel usage estimates and comparisons, make sure that all field operations (including those with no soil loss impact) are included in the relevant RUSLE2 management files.

RUSLE2 fuel usage estimates also reflect an adjustment based on soil type (i.e., finer texture requires more energy to till). RUSLE2 makes this soil type adjustment to fuel usage for every operation, including operations that do not disturb soil. Therefore, keeping soil type constant for all management alternatives under consideration will also help ensure a more accurate fuel usage comparison.