Mitigating Soil Disturbance in Organic Systems

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Fact or Fiction?

- Soil Disturbance in a typical Organic system is greater than a typical conventional system.

- Since Organic systems typically rely on tillage for weed control, soil loss is always higher than a mulch-till or even a conventional system.

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Organic systems rely on many practices and activities for weed control, not just tillage. However, tillage is the primary suppression technique.

Is Organic No-Till Possible?

Yes!

But, that is another presentation altogether.

http://www.conservationwebinars.net/webinars/reduced-tillage-in-organic-specialty-crop-systems
http://www.conservationwebinars.net/webinars/organic-no-till-systems

Steps to Mitigating Soil Disturbance in Organic Systems

- Get the field management details
- Identify when soil loss occurs
- Identify potential mitigation alternatives
- Assess the effects of those alternatives
- Implement the agreed-to alternative(s)

Getting the field management details

- It is essential that you know the details of the field operations to accurately determine the soil loss rate and to know what part(s) of the year/rotation soil loss is most prominent.

A not-uncommon description of a clients field operations for a mixed vegetable rotation

Prepare and fertilize seed bed in the spring for sweet **corn** with tandem disk as soon as it is dry and warm enough. Plant in April/May. Hand pick corn in the summer. Prepare and fertilize seed bed in the spring for **tomatoes** with tandem disk as soon as it is dry and warm enough. Lay plastic mulch and plant. Hand pick tomatoes all summer long. Prepare and fertilize seed bed in the spring for **pumpkins** with tandem disk as soon as it is dry and warm enough. Pick Pumpkin early October. Prepare and fertilize seed bed in early May for **peas**. Machine harvest in July.

Getting the field management details

During the Inventory and Evaluation phase of the Conservation Planning process, the planner must ask about:

- What the producer does (e.g. plow, disk, plant, weed, harvest etc.)
- When the producer does it (e.g. Nov 15-plow, April 1-disk, April 15-plant, every 2 weeks after planting until canopy closure in early June-weed, July 15-harvest, etc.)
- How the producer does it (e.g. 4-bottom moldboard plow to 8” depth at a 45° angle from the western edge of the field, tandem disk at 6” depth at 90° angle from plow direction, tine weeder for first 2 passes then rotary row weeder after, etc.)

Getting the field management details

Management: CMZ 60\c.Other Local Mgt Records\Corn,sweet,SD,cultivated - Tomatoes,SD,plastic - Squash,SD - Peas,SD,drilled;mod Z60

Graphic
Rel. row grade, %: 100

Long-term natural rough., mm: 6.0
Normally used as a rotation?: Yes
Duration, yr: 4

Management STIR: 450
Avg. annual STIR: 110

Add to this management to make new one: Open

How set crop year end/start?: set by user

View/edit rotation builder used to make this management: open

Fuel for all operations: default
Base equiv. diesel use, gal/ac: 14.8
Base energy use , BTU/ac: 2100000
Base fuel cost, US$/ac: 0

Irrigation system: no irrigation

Crop Year STIR Values

Crop year	STIR	Crop	Start date, m/d/y	End date, m/d/y
1	127	Corn, sweet	7/11/0	10/1/1
2	91.9	Tomato, fresh mkt	10/2/1	10/1/2
3	150	Squash	10/2/2	10/1/3
4	78.7	Peas, green, drilled	10/2/3	7/10/4

Operations | Info

Management Operations

Date, m/d/y (+ / -)	End/Start crop year?	Operation	Vegetation	Yield (harv. units), #/ac	Type of cover material	Cover matl add/remove, lb/ac	Cover from addition, %	Standing res. added by op. desc., lb/ac
4/25/1	No	Disk, tandem heavy primary op.						
5/1/1	No	Add mulch			Manure, poultry	2000	13	
5/1/1	No	Disk, tandem secondary op.						
5/5/1	No	Harrow, coiled tine						
5/10/1	No	Fert applic. surface broadcast						
5/10/1	No	Planter, double disk opnr	Corn, sweet	10000				
6/1/1	No	Cultivator, row 3 in ridge						
6/15/1	No	Cultivator, row 3 in ridge						
10/1/1	Yes	Harvest, hand pick vegetables						
11/1/1	No	Winter kill annual crop				2700	64	1800
5/15/2	No	Disk, tandem heavy primary op.						
5/20/2	No	Add mulch			compost	4000	93	
5/20/2	No	Disk, tandem secondary op.						
5/25/2	No	Harrow, coiled tine						
5/25/2	No	Plastic mulch applicator 50 percent cover						
5/25/2	No	Planter, transplanter, vegetable on 8 inch high beds	Tomato, fresh mkt	500				
10/1/2	Yes	Harvest, hand pick vegetables						
10/1/2	No	Plastic mulch, remove						
11/1/2	No	Winter kill annual crop				1900	67	1300
5/15/3	No	Disk, tandem heavy primary op.						
5/20/3	No	Add mulch			compost	4000	93	
5/20/3	No	Disk, tandem secondary op.						
5/25/3	No	Harrow, coiled tine						
5/25/3	No	Planter, transplanter, vegetable, no-till	Squash	10000				
6/8/3	No	Cultivator, row 3 in ridge						
6/22/3	No	Cultivator, row 3 in ridge						
7/1/3	No	Cultivator, row 3 in ridge						
7/8/3	No	Weed control, manual hoe			weeds; 0-3 mo	50	2.6	
7/22/3	No	Weed control, manual hoe			weeds; 0-3 mo	50	2.6	
10/1/3	No	Harvest, hand pick vegetables						
11/1/3	No	Winter kill annual crop				1100	47	720
5/1/4	No	Disk, tandem heavy primary op.						
5/5/4	No	Harrow, coiled tine						
5/5/4	No	Drill or air seeder, hoe/chisel openers 6-12 in spac.	Peas, green, drilled	2000				
7/10/4	No	Harvest, vine crops, mechanical				450	23	0

Getting the field management details

Effects of some field operation choices in RUSLE2

Management Operations

Date, m/d/y	End/Start crop year?	Operation	Vegetation	Yield (harv. units), #/ac	Type of cover material	Cover matl add/remove, lb/ac
5/15/2	No	Disk, tandem heavy primary op.				
5/20/2	No	Add mulch			compost	4000
5/20/2	No	Disk, tandem secondary op.				
5/25/2	No	Harrow, coiled tine				
5/25/2	No	Planter, transplanter, vegetable on 8 inch high beds	Tomato, fresh mkt	500		
6/8/2	No	Weed control, hoeing in row			weeds; 0-3 mo	50
6/22/2	No	Weed control, hoeing in row			weeds; 0-3 mo	50
7/6/2	No	Weed control, hoeing in row			weeds; 0-3 mo	50
7/20/2	No	Weed control, hoeing in row			weeds; 0-3 mo	50
8/3/2	No	Weed control, hoeing in row			weeds; 0-3 mo	50
8/17/2	No	Weed control, hoeing in row			weeds; 0-3 mo	50
8/31/2	No	Weed control, hoeing in row			weeds; 0-3 mo	50
10/1/2	No	Harvest, hand pick vegetables				
11/1/2	No	Winter kill annual crop				1900

Description	Change in Soil Loss (%)
Tomato - benchmark	-
Tomato - lighter disk	-20
Tomato - heavier disk	16
Tomato - flame weed 1st month	-8
Benchmark w/ plastic mulch (50% cover)	-33
Light disk w/ plastic mulch (50% cover)	-45
Benchmark w/ plastic mulch but forget to remove it	-94

http://www.conservationwebinars.net/webinars/rusle2-in-organic-systems

Getting the field management details

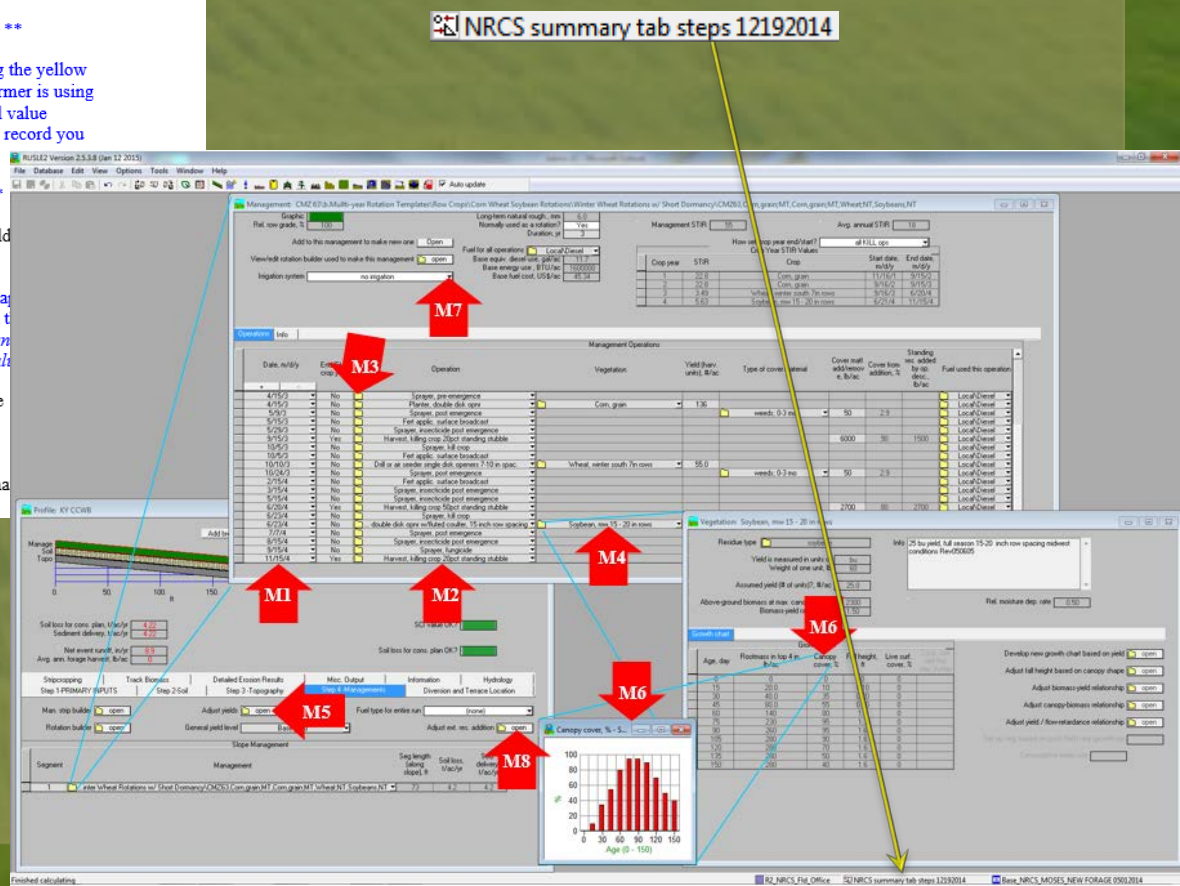
United States Department of Agriculture
NRCS Natural Resources Conservation Service

RUSLE2 Information Gathering

Management Questions: Select the RUSLE2 management template that best describes the client's crop or rotation and check each line of the record you selected and answer the following question. Questions are referenced on Figure 2.

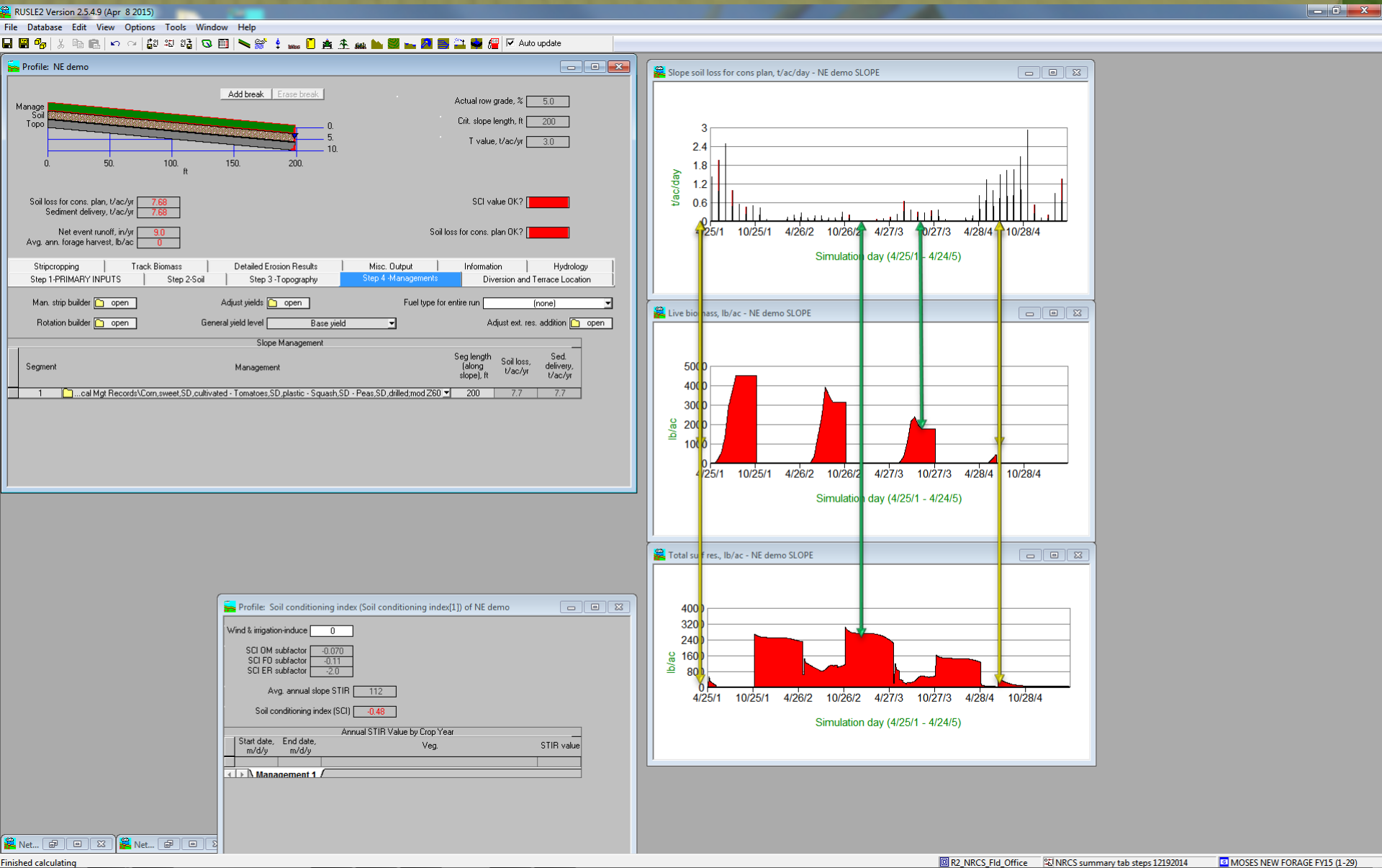
1. Are the dates of the selected operations correct? _____ If not, make it so. **
2. Are the operations selected in the correct order? _____ If not, make it so. **
3. Are the operations selected correct? _____ Check information by clicking the yellow folders for details. What you are looking for here is that, for example, if a farmer is using a "tandem disk" ensure that the implement operation depth and residue burial value observed in the field operation is the same as that stated in the "tandem disk" record you choose from the RUSLE2 database. **
4. Is/are the correct vegetation(s) selected? _____ (see 6. for more detail) **
5. Is/are the yield(s) reported in the RUSLE2vegetation record and the field yield consistent? _____**
6. Is the correct vegetation record selected? _____ This can be checked by gra %canopy of the vegetation selected and matching it up with the vegetation in t *Note: vegetation records have a % canopy value for each day of the record an associated total yield value. Changing the yield value will change canopy val*
7. Is the field irrigated? _____ If yes, enter irrigation information in the management record if you are modeling an irrigated crop.
8. If external residues (e.g. manure, mulch, compost, etc.) are being applied, wha being applied and when (i.e. which crop(s))? _____T/Ac.

For use with "NRCS summary tab steps 12192014" user template



Similar information needed for WEPS

Identifying when Soil Loss Occurs



What are SCI and STIR?

Soil Conditioning Index (SCI):

- A quick way to characterize the organic matter dynamics of a farming system.
  - OM is the organic material or biomass factor.
  - FO is the field operations factor.
  - ER is the erosion factor.

Soil Tillage Intensity Rating (STIR):

- Value reflects the kind of soil disturbance as well as the severity of the disturbance caused by tillage operations.
  - Operational speed of tillage equipment
  - Tillage type
  - Depth of tillage operation
  - Percent of the soil surface area disturbed

Soil Loss Mitigation Alternatives

Mitigating offsite soil loss impacts (i.e. sediment delivery)

- Field Border
- Filter Strip
- Riparian Forest Buffers
- Sediment Basin
- Grassed Waterways

Soil Loss Mitigation Alternatives

Other soil loss mitigating techniques

- Strip crop
- Diversions and Terraces
- Mid-slope buffers
- Contour farming

Results of Some Mitigation Alternatives

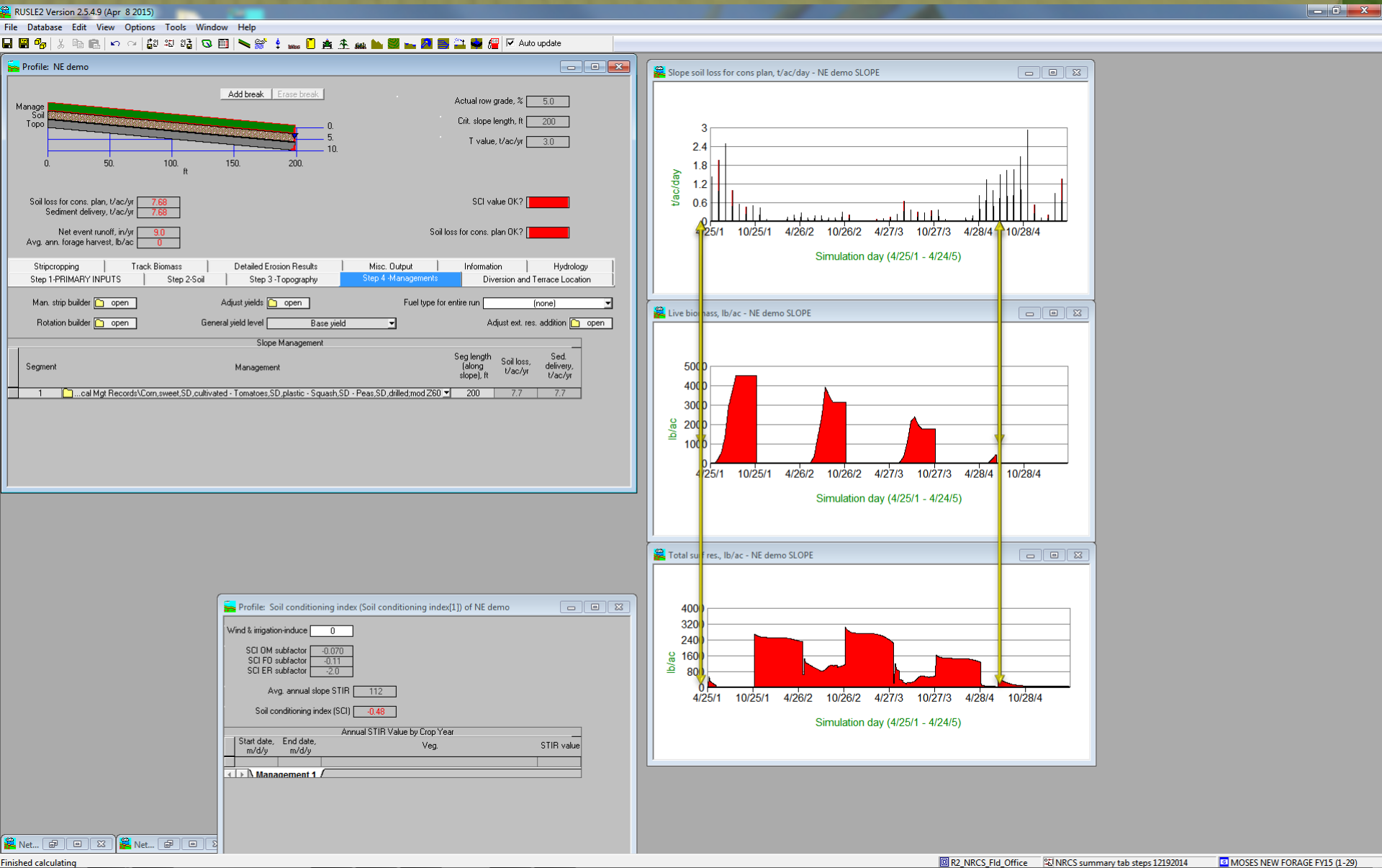
Description	Cons. Plan. Soil Loss, t/ac/yr	Sed. Delivery, t/ac/yr	Soil Conditioning Index (SCI)
Benchmark Condition	7.67	7.67	-0.48
Sediment Basin at the Bottom	7.67	0.562	-0.48
Planting on the Contour	4.07	4.07	-0.19
Planting on the Contour & strip cropping	3.39	3.00	-0.18
Planting on the Contour & midslope diversion	2.4	1.94	-0.11
Planting on the Contour & midslope buffer	2.74	2.39	-0.007
Planting on the Contour & filter strip	3.06	0.471	-0.0035

Soil Loss Mitigation Alternatives

Mitigating in-field soil loss

- Change timing of tillage events
  - Switching from Fall to Spring tillage
- Incorporate Cover Crops in the rotation
  - Look for times when there is little cover or residue in the field
  - Look for opportunities to grow cover crops simultaneously with cash crops
- Incorporate more high residue cash crops in the rotation
- Strip cropping with perennial hay crop in the rotation

Remember our Benchmark Condition



Results of Some Mitigation Alternatives

Original Corn-Tomato-Squash-Peas Rotation

Description	Cons. Plan. Soil Loss, t/ac/yr	Sed. Delivery, t/ac/yr	Soil Cond. index (SCI)
Benchmark Condition (Original Corn-Tomato-Squash-Peas Rotation)	7.67	7.67	-0.48
Added cover crops	3.76	3.76	-0.068
Added cover crops & contouring	1.18	1.18	0.13
Added cover crops & contouring & additional 1T compost	0.854	0.854	0.2

Results of Some Mitigation Alternatives

Alternative Corn-Tomato-Squash-Cabbage Rotation

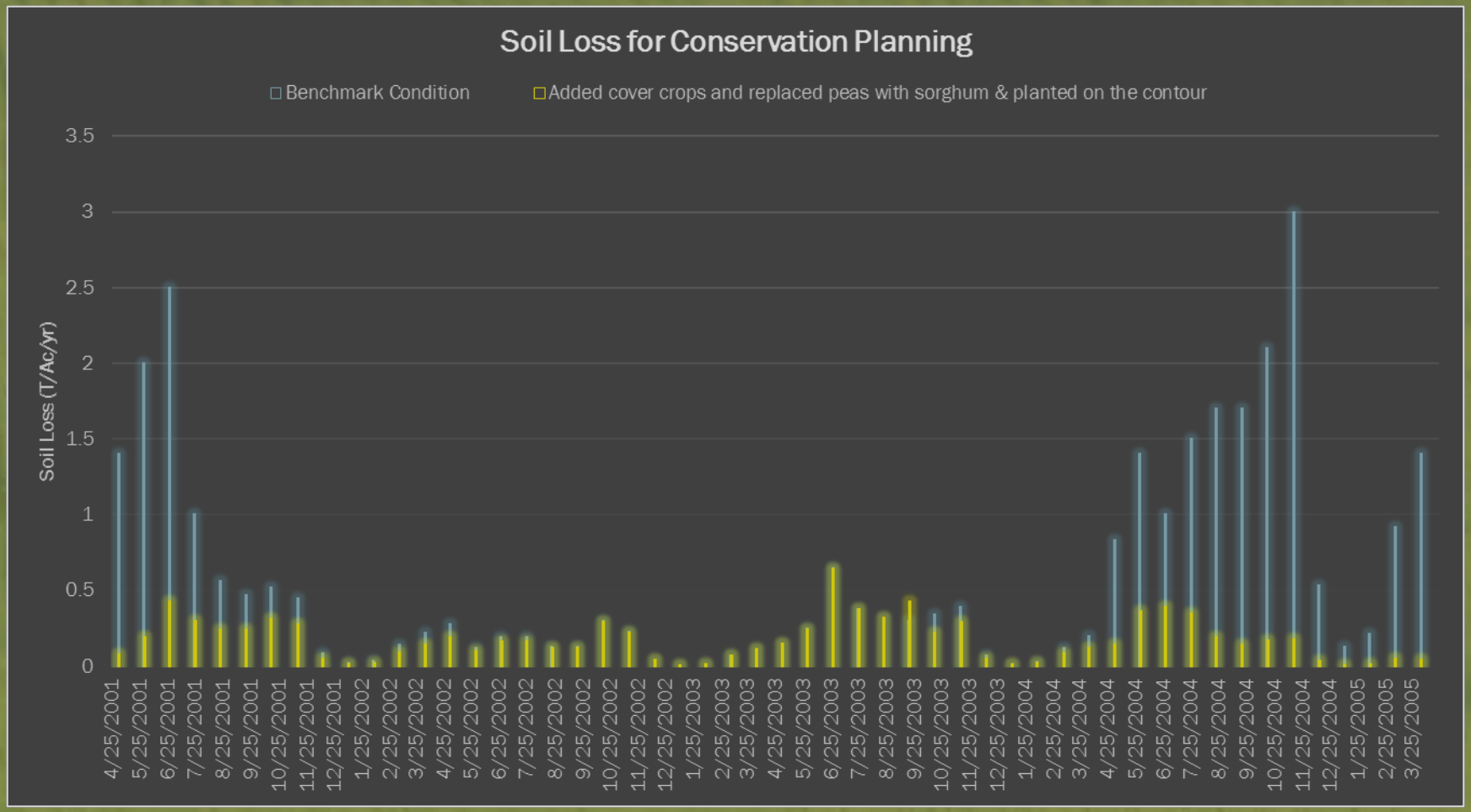
Description	Cons. Plan. Soil Loss, t/ac/yr	Sed. Delivery, t/ac/yr	Soil Cond. index (SCI)
Benchmark Condition (Original Corn-Tomato-Squash-Peas Rotation)	7.67	7.67	-0.48
Added cover crops & replaced peas with cabbage	3.35	3.35	-0.014
Added cover crops & contouring & replaced peas with cabbage	0.935	0.935	0.18
Added cover crops & contouring & replaced peas with cabbage & additional 1T compost	0.8	0.8	0.23

Results of Some Mitigation Alternatives

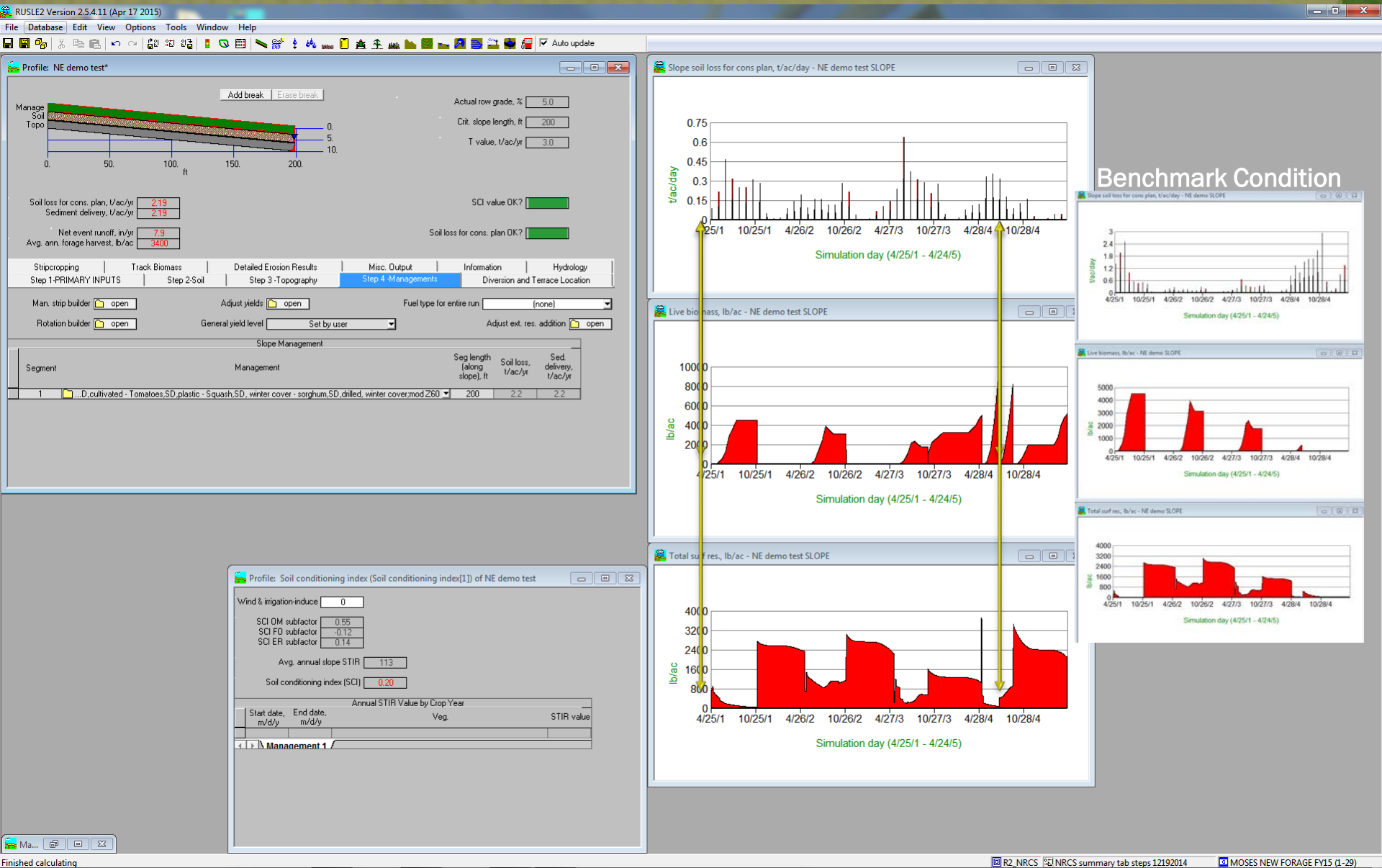
Alternative Corn-Tomato-Squash-Sorghum(hay) Rotation

Description	Cons. Plan. Soil Loss, t/ac/yr	Sed. Delivery, t/ac/yr	Soil Cond. index (SCI)
Benchmark Condition (Original Corn-Tomato-Squash-Peas Rotation)	7.67	7.67	-0.48
Added cover crops & replaced peas with sorghum-hay	2.19	2.19	0.20
Added cover crops & contouring & replaced peas with sorghum-hay	0.427	0.427	0.33
Added cover crops & contouring & replaced peas with sorghum-hay & additional 1T compost	0.424	0.424	0.34

Results of Some Mitigation Alternatives

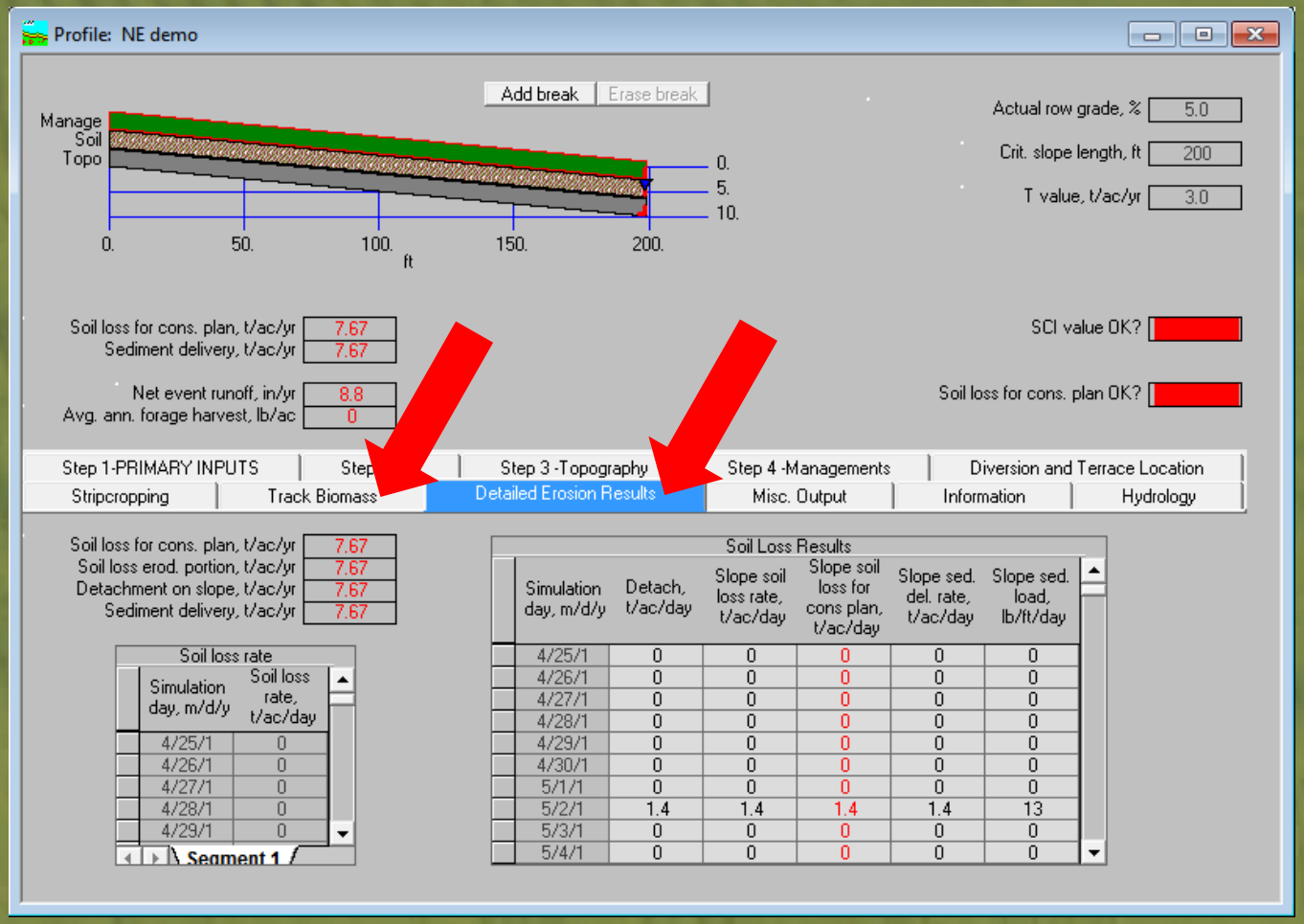


Identifying when Soil Loss Occurs



Benchmark Condition

How to See & Graph Important Information to in RUSLE2



Review the Steps to Mitigate Soil Disturbance in Organic Systems

- Get the field management details
- Identify when soil loss occurs
- Identify potential mitigation alternatives
  - Changing/substituting tillage implements
  - Inclusion of cover crops
  - Adding compost/mulch
  - Changing crops in the rotation
- Assess the effects of those alternatives
- Implement the agreed-to alternative(s)

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Questions?

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