NATURAL RESOURCES CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE

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Natural Resources Conservation Service

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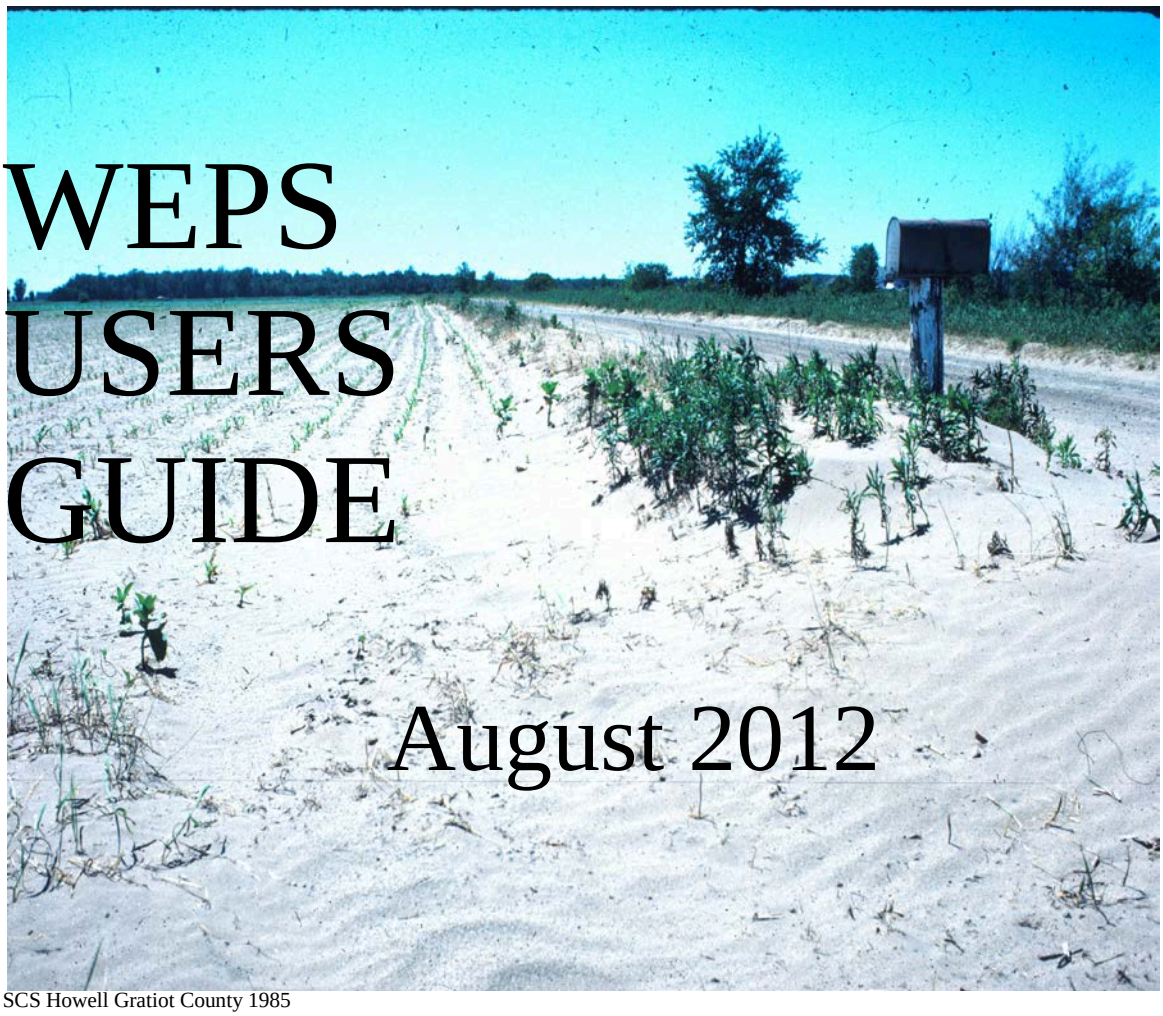
# Wind Erosion Prediction

# WEPS USERS GUIDE



## August 2012

SCS Howell Gratiot County 1985

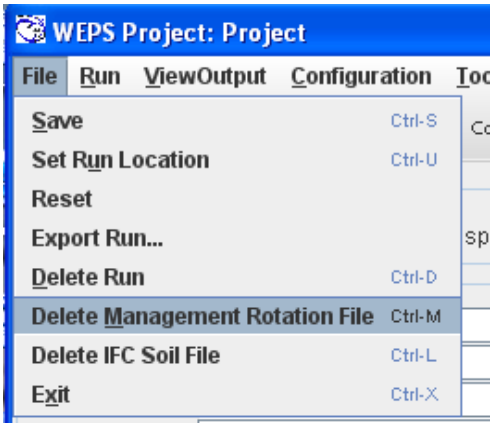
Edits by J Grigar State, Agronomist and Tony Wernette, Big Rapids, FO

**Exercises Introduction: Evaluating Wind Erosion Problems with WEPS**

These exercises are designed to provide the user with step-by-step examples of some common tasks performed with the WEPS model. These exercises cover many topics including basic model operation, file management, and building and editing field management rotations within the Management/Crop Rotation Editor of WEPS (MCREW). The focus of the exercises should be on learning to use WEPS for conservation planning. Although the exercise scenarios use locations in various parts of the United States, the skills learned in each exercise are intended to build the users proficiency with WEPS that are applicable in many locations. Therefore, new users are encouraged to complete **all** the exercises regardless of location of the scenario. First time users should start with the first exercise then work through sequential examples as the knowledge skill and abilities learned is progressive from the first exercise to the last. Since WEPS is constantly being improved and parameters modified, the results may not exactly match those reported in the exercises. This is not unexpected.

**Note:** *As the WEPS model finishes a given run, it sometimes displays a warning that one or more of the crops simulated did not reach maturity.* This is not uncommon, especially for crops that are harvested before reaching maturity such as forage crops. If such a message is obtained, click "OK" to complete the run. *If most of the year's crops reach about 95% maturity the run is OK to use.* However, if many crop years are lower than 95%, check that the planting and harvesting dates for the crop are as expected for the location being simulated. If it still does not reach 95%, contact the Natural Resources Conservation Service (NRCS) Database Manager or NRCS Wind Erosion Specialist. The user should resolve such maturity issues for crops that are harvested after reaching maturity.

**Definitions and Considerations**




**Projects and Runs**: A "**WEPS Project**" is a directory or a working area where WEPS simulation runs are created. **WEPS Project.wpj files are located at:** *C\Documents and Settings\Your Name\My Documents\My WEPS Files\Project.wpj*.

A project stores all the parameters and files for the current simulation run being prepared within the WEPS interface, as well as any files used in the past for previous runs. For example, the project will contain soils .ifc files and management .man files. *Clean out project files when no longer needed by clicking the File menu on the main interface and selecting one of the delete functions.*

A **"WEPS Run"** refers to a single simulation of a field with all associated input and output files. Each run is stored in a separate folder or subdirectory which by default is located under the current WEPS run directory. **WEPS Runs are located at:**

*C:\Documents and Settings\your name\My Documents\My WEPS Files\Runs*.

A WEPS run subdirectory stores a copy of all input files used to make the simulation run, together with the output files generated from those inputs. Therefore, it is possible to recall the identical WEPS run at a later date (and presumably get the same outputs when using the same version of WEPS 1.2.9 and the weather generators/databases) because the original input files are still available.

To review a previous run use the View Output Menu. A re-run is not necessary since the outputs are stored in the run directory. However, there are several different output reports. To view additional output reports load the previous run and re-run the simulation. *Run directories make it relatively easy to archive or remove WEPS runs as alternative erosion planning scenarios are tested for a field or farm.* For example, if a change is made to create a different management alternatives, all the information in this new scenario is saved to a new subdirectory under a new WEPS run name when the simulation is made. *Use the File, Export Run function on the main interface to send Run directory files to another location.*

Name all runs and files in WEPS carefully. Consider using the abbreviations to describe run names so the name is not difficult to view in windows. Some special characters that are not allowed in file or directory names used in WEPS include: @? ‘ ` & ~ / \ < > | : * ”.

**Templates**: A **"Template"** is a pre-built management rotation file or crop file. Management templates are accessed through the Management Template folder and are located on the C: drive at:

*C:\Documents and Settings\All Users\Application Data\USDA\WEPS\Databases\nrcs\man*.

**Management templates** (made by WEPS users) are stored at:

*C:\Documents and Settings\All Users\Application Data\USDA\WEPS\Databases\nrcs**man**\local*

**Crop templates** (made by WEPS Users) are located in:

*C:\Documents and Settings\All Users\Application Data\USDA\WEPS\Databases\nrcs**crop**s\local*

Save local Crop or management templates in the local folder with a localized Bio Adjustment Factor. *It is very helpful to save a "calibrated" local management file to a place where all users in a work group can use it. Use the Configuration; Edit Configuration pull down to store the local management files to a shared server location*

Soil files are stored at:

*C:\Documents and Settings\All Users\Application Data\USDA\WEPS\Databases\nrcs\soil*

Several county soil files are usually placed on a shared drive in a FO. Users will need to "map to" that drive to access the county soils. Use the Configuration, Edit Configuration function on the main interface. If the user needs to run the model separated from the server, the common soils directory can be downloaded to the above location and the lookup pointed back to the above location using the configuration editor. NRCS users see *How to Access the Local Soils Data for detailed instructions.*

Obtain soil files directly from the National Soil Survey Center in Lincoln, NE using the Soils pull down and selecting NRCS Soil Data Mart function. Users must have an internet connection to use this function.

**Simulation Region Orientations and Angles**: Field orientation and direction of tillage within the simulation region in WEPS are independent and measured relative to true North (0 degrees). Both the field orientation and tillage direction can be adjusted in WEPS. Angles are important in WEPS because wind directions are simulated to mimic the historic wind direction distribution for the selected location. Wind direction varies from day to day therefore, erosion losses will also vary relative to field angle or ridge orientation. **Rotate a field in WEPS to represent the actual orientation on the landscape.** Field orientation will only rotate in a range of ±45 degrees. Obtain the desired field size and width by rotating and adjusting the field length, width and orientation. **Also, enter tillage direction relative to true North in the management editor (MCREW)**. For example, if a rectangular field has the long side oriented 20.0 degrees from true North and tillage is performed parallel to the long field side, enter the tillage direction as 20.0 degrees within the Management Editor.

**Plant Damage**: Consider wind erosion damage to plants. Crops are damaged by blowing soil particles, exposure of plant roots, plant burial by drifting soil, or desiccation and twisting of plants. NRCS published a table listing the tolerance of various crops to blowing soil (USDA-NRCS, 2000) National Agronomy Manual; Table 502-4, pg 502-19). Refer to this table as needed during the exercises (Table 11). Crops can sometimes tolerate greater amounts of blowing soil than the crop tolerance, but yield and quality can be adversely affected.

Open the detailed report and review the first two week management periods and see if the combined wind erosion total is less than the crop tolerance in Table 1. If the rate exceeds the crop tolerance then adjustments in the system are in order. Add a cover crop, more crop residue, and manure with straw bedding or mulch at plant time, to reduce soil loss below crop tolerance.

**Table 1** Crop tolerances used by Natural Resource Conservation Service (NRCS) to design wind erosion control methods (USDA-NRCS, 2000).

| Tolerant # | Moderate Tolerance | Low Tolerance | Very Low Tolerance |
|---|---|---|---|
| "T" | 2 ton/ac | 1 ton/ac | 0 to 0.5 ton/ac |
| Barley | Alfalfa (mature) | Broccoli | Alfalfa (seedlings) |
| Buckwheat | Corn | Cabbage | Asparagus |
| Flax | Onions (> 30 days) | Cotton | Cantaloupe |
| Grain Sorghum | Orchard Crops | Cucumbers | Carrots |
| Millet | Soybeans | Garlic | Celery |
| Oats | Sunflowers | Green/Snap Beans | Eggplant |
| Rye | Sweet Corn | Lima Beans | Flowers |
| Wheat | | Peanuts | Kiwi Fruit |
| | | Peas | Lettuce |
| | | Potatoes | Muskmelons |
| | | Sweet Potatoes | Onion (seedlings) |
| | | Tobacco | Peppers |
| | | | Spinach |
| | | | Squash |
| | | | Strawberries |
| | | | Sugar Beets |
| | | | Table Beets |
| | | | Tomatoes |
| | | | Watermelons |

Crop tolerance is defined as the maximum wind erosion that a growing crop can tolerate, from crop emergence to field stabilization, without an economic loss to stand, yield, or quality.

**Reference:**

USDA-NRCS. 2000. *National Agronomy Manual, Part 502-Wind Erosion, 190-V NAM. 3rd Edition*. Washington, D. C.

## Selecting the correct simulation region, X-length and Y-length

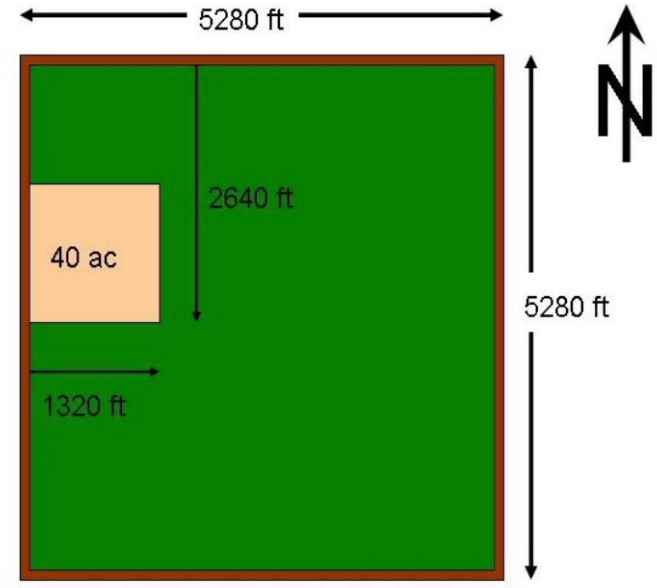
**Skill Building:** The X-length is the **longest** (one direction) distance from a stable boundary to the opposite site of the field running **east-west orientation** angle set at 0. The Y-length is the **longest** (90 degrees to the X-length) distance from a stable boundary to the opposite side of the field running **north-south** orientation angel set at 0. WEPS will use these **unsheltered distances** to calculate the erosion rate. A **stable boundary** stops surface creep and saltation phases of wind erosion. An example of a stable boundary is a grass strip at least 13 ft wide and 1.5 foot high. Consider vegetation width, height, and porosity in declaring a stable boundary. Most windbreaks, drainage ditches, wide fencerows, filter strips or field borders can function as a stable boundary.

The following exercise will assist in selecting the correct distance for the X-length and the Y-length in the Region panel of the main WEPS interface window.

**Scenario:** Evaluate a 40 acre (tan area) field for wind erosion. The remaining land (green) and management is not controlled by the landowner. However, the remaining land may contribute to the wind erosion process on the 40 acre field. The green land (one section in size, 640 ac) has a road on all sides with a 50 ft band of green vegetation (grass 1.5 ft. tall field border). The non-erodible field border is represented in dark brown. Both the 40 acres and the remaining 600 acres are farmed in a winter wheat-summer fallow, conventional tillage rotation.

**Question**: What is the correct X-Length and Y-Length to evaluate or enter in the Region panel on the WEPS interface?

**A.** Y=1320 ft by X=2640 ft,
**B.** Y=3960 ft by X=5280 ft,
**C.** Y=1320 ft by X=1320 ft, or
**D.** Y=5280 ft by X=5280 ft.



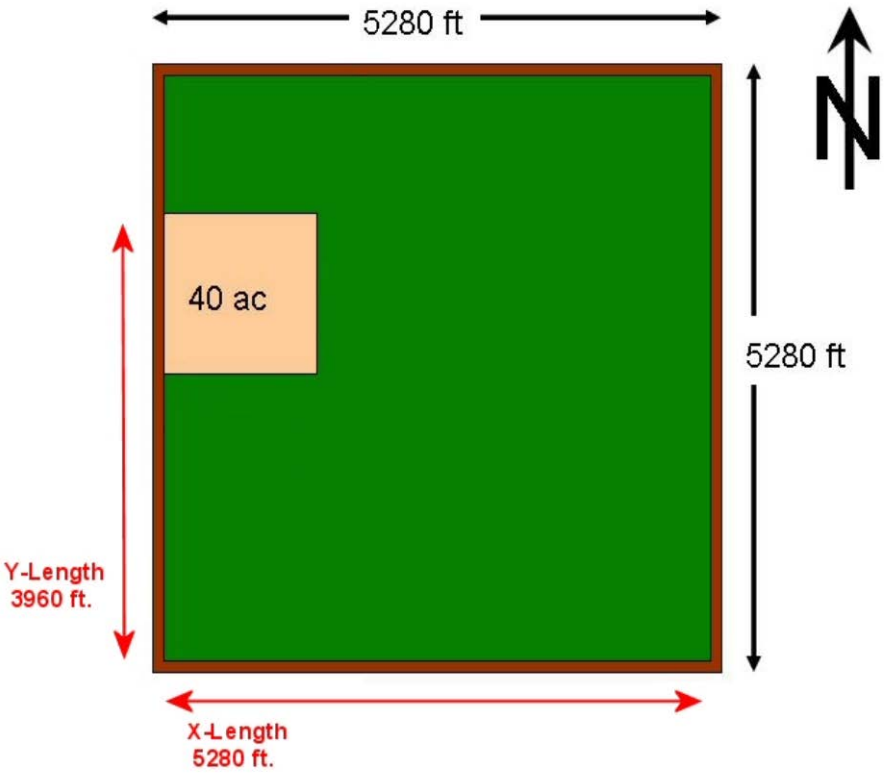

**Answer: B.** Y=3960 ft by X=5280 ft.

Remember that in WEPS, wind direction is simulated to vary from day to day throughout the simulation. Because the management outside the field is not controlled by the same owner for conservation planning purposes, the unsheltered distance is the **longest distance** from a stable boundary through the length of the field to the down-wind edge of the field.

On the X axis the longest distance (X-Length) would start at the East boundary and extend west, all the way though the 40 acre field (5280 ft.).

On the Y axis the longest distance (Y-Length) would start at the South boundary and extend north all the way though the 40 acre field (3960 ft.).

*Therefore, the dimensions (X-Length, L-Length, and acres) entered on the WEPS interface is larger than the actual field for this project.*

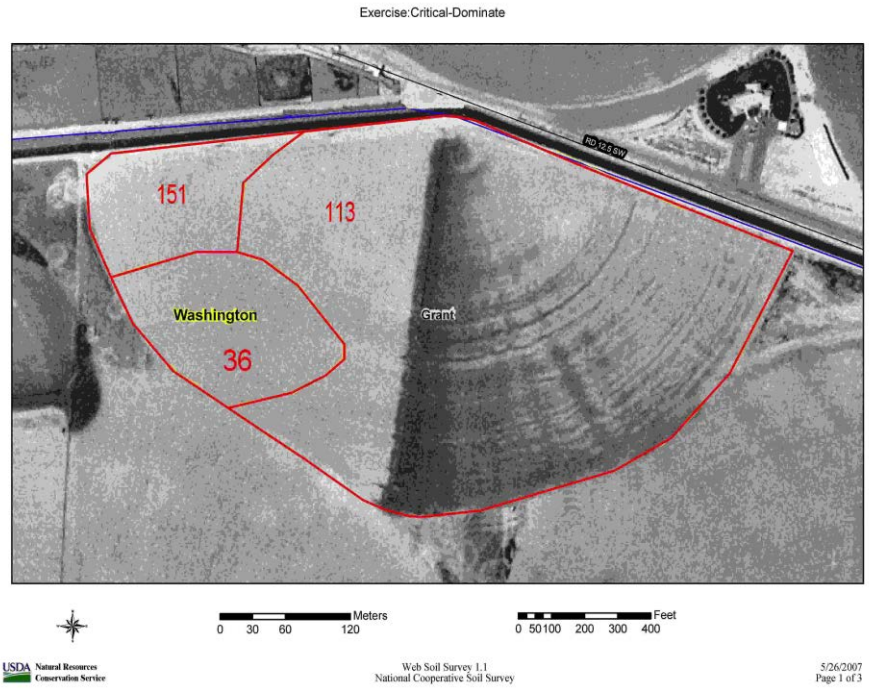


## Selecting the Critical Dominate Soil

WEPS version 1.2.9 is able to estimate wind erosion from only one soil map unit in a field at a time. It is recommended that the user select the most erodible soil of a "manageable size". This is called the "Critical Dominate Soil".

The most erodible soil is the one with the highest percentage of sand or the highest Wind Erosion Equation Soil Erodibility (I value) for a soil. For example, a fine sandy loam is more susceptible to wind erosion than a loam. Bottom-line: Look at the soil map first before running WEPS and use the old Wind Erosion Equation Soil Erodibility I factor or surface texture to get an idea of the soil's Erodibility.

**Example:** Consider the soil map of a field in Grant Co., Washington. There are three map units in the half circle (Figure 1). A good rule of thumb is to use the most erodible soil greater than 10% of the field or greater than 10 acres in size (i.e., a manageable size).



Soil Survey of Grant County, Washington Exercise:Critical-Dominate

Map Unit Legend Summary

Grant County, Washington

| Map Unit Symbol | Map Unit Name | Acres in AOI | Percent of AOI |
|---|---|---|---|
| 36 | Ekrub fine sand, 0 to 25 percent slopes | 4.5 | 11.5 |
| 113 | Royal loamy fine sand, 0 to 10 percent slopes | 30.4 | 77.2 |
| 151 | Taunton loamy fine sand, 0 to 10 percent slopes | 4.4 | 11.3 |

**Figure 1** Soil Map showing the size and location of the map units.

The total of the field is 39.3 acres.

**Question: What soil should be used to estimate the soil loss?**

**Answer:** See Figure 1. The Royal loamy fine sand (map unit 113) and Taunton loamy fine sand (map unit 151), comprise about 88.5% of the area. The Ekrub fine sand (map unit 36) covers about 11.5%. However, the Ekrub fine sand **is the most erodible soil, greater than 10% of the field** and upwind of the damaging westerly spring winds. Therefore, use the Ekrub f.s. to calculate the wind erosion rate in tons/ac /year to plan alternative conservation management systems to meet “T”or crop tolerance...

## Exercise 1 - Wisconsin: A Basic Simulation

**Skill Building:** Introduces basic skills needed to:

1. Perform a simple wind erosion simulation.
2. Adjust the Target yield goal in the runs.
3. Save rotations in the NRCS CMZ (Crop Management Zone) Management Files.

**Scenario:** The **126 acre** field is irrigated with a **circle** system
Farm is in **Portage County Wisconsin**, near **Stevens Point,** in**.** Use the default Climate locations (Cligen and Windgen stations) selected for the county**.**
Crop rotation is: **Peas, green, drilled** and **Bean, green snap mech. harvest.** Viners harvest green beans or peas and return all crop residues to the field. The WEPS evaluation of the cropping system runs **50 rotation cycles** (NRCS mode) for each crop in the crop rotation.

Soil Map Unit is **Mecan_MfB_100_LS.**

Double Click the WEPS short cut button on the desktop. The main interface should open up. Enter your name and email address to track any comment or error messages you send. **Note that the default run location is** *C:\Documents and Settings\your.name\My Documents\My WEPS_Runs.*

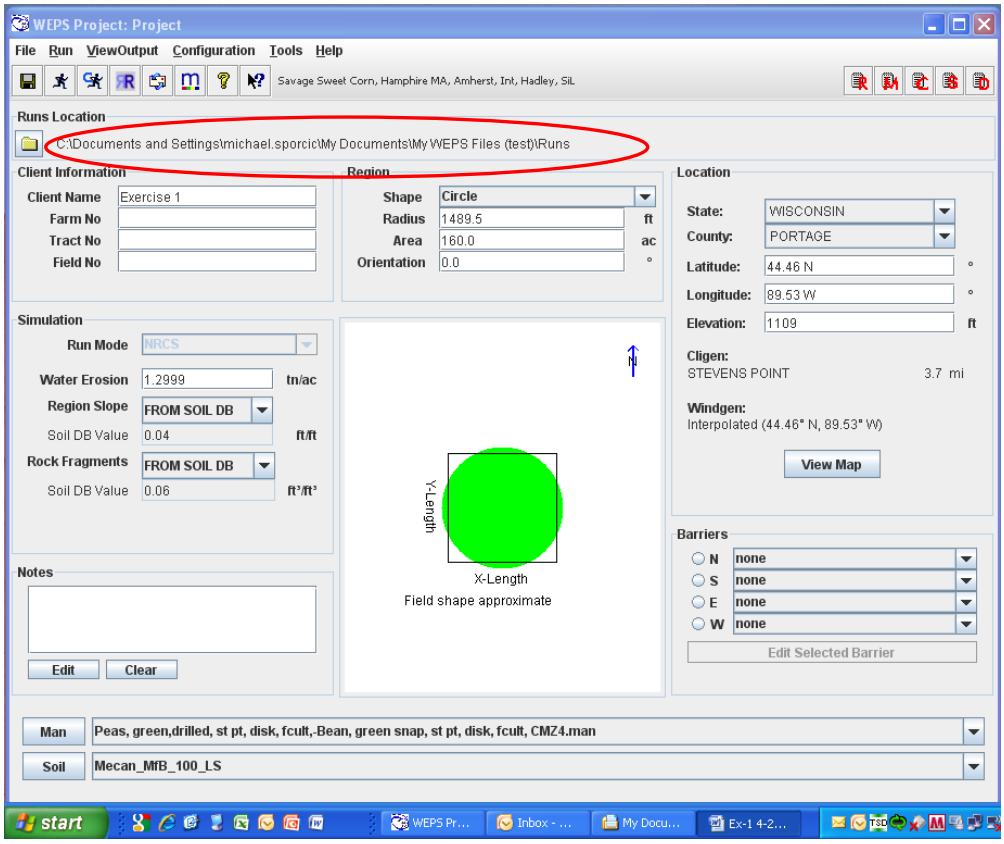



**Figure 1** WEPS main interface with all information selected for the run.

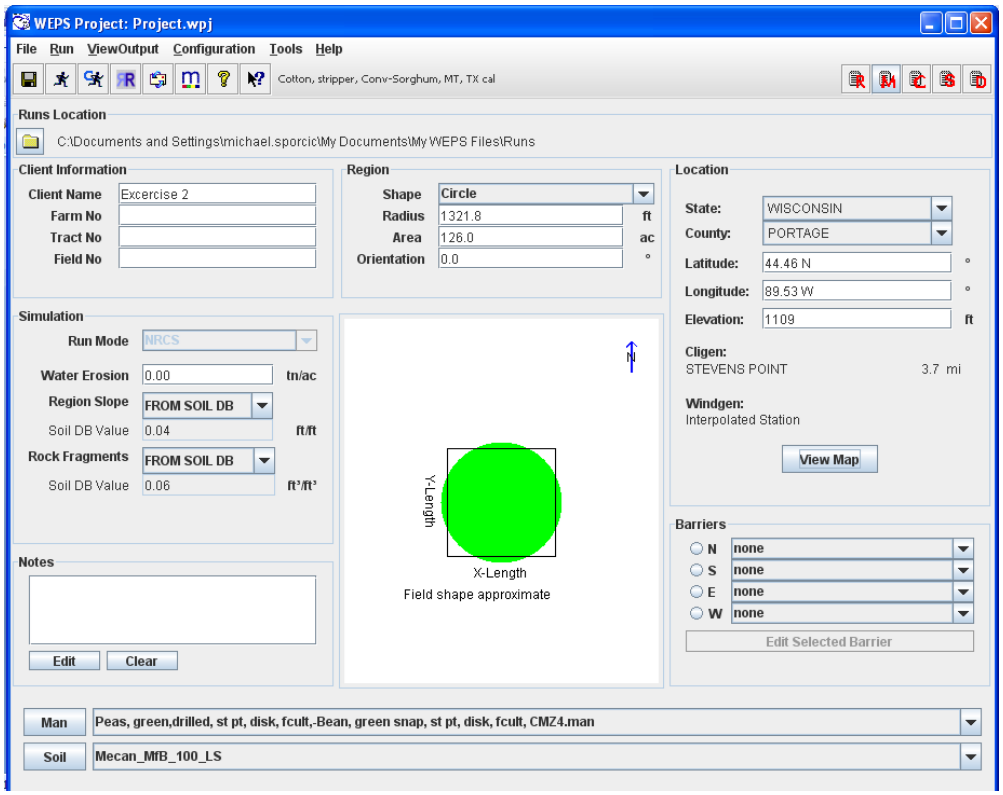



**Figure 1** WEPS main interface with all information selected for the run.

**Step 1**: At **Client Name** enter **Exercise 1 or E1 at Field** enter **Run 1**

**Step 2**: At **Region Shape** Click the down arrow  select **Circle**. At Region Area enter **126** ac.

**Step 3**: At **Location State,** select **Wisconsin**, county select **Portage**. The weather station for CLIGEN is: ***STEVENS POINT*** and for WINDGEN is: **Interpolated Station**.

NOTE: The Central and Eastern regions of the United States use wind station interpolation where three surrounding to wind station's data are combine to make a unique weather record for each run. At this point WEPS has selected the center of Portage Co. Confirm that the location is near and just southeast of Steven Point. Click the View Map button and expand the map to full screen (Fig. 1a).

The Red Cross shows the current location. Check the box by Cligen Station in the pop up window in the lower left corner of the screen. This turns on a layer that shows the Cligen station locations near Stevens Point.

Close the Map Viewer and return to the main WEPS interface screen.

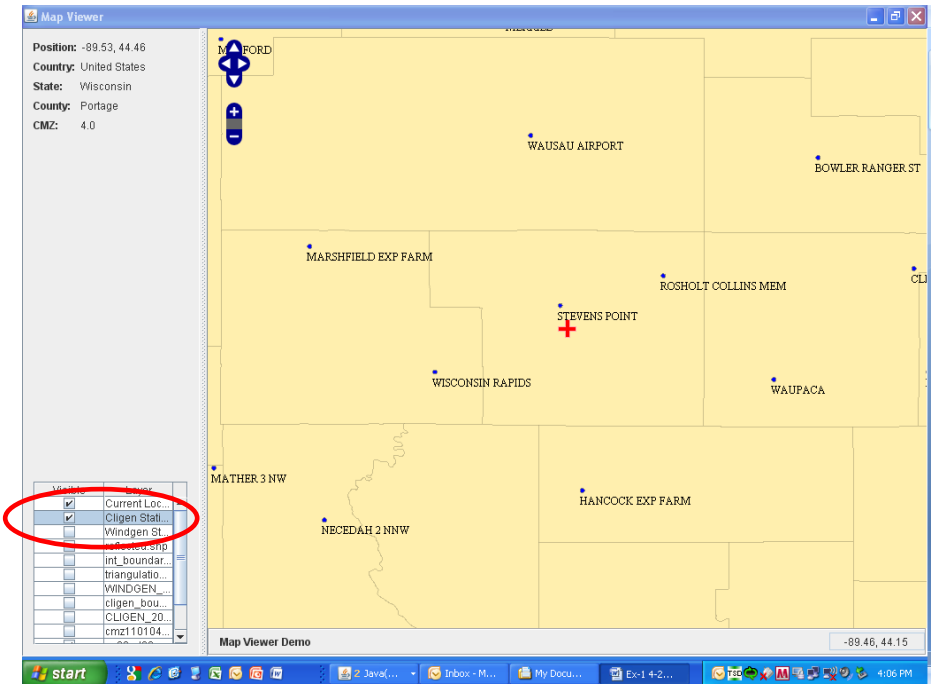



**Figure 1a** Map Viewer in full screen mode and Cligen Station turned on.

1. **Step 4**: Click the down arrow opposite the "Man" button near the bottom of the WEPS screen (fig. 1b). For these exercises, beginning management files are placed in the Exercise folder "man" WEPS db directory. **MAN** *Click* the down arrow "**Man" Tab.** Scroll down to **Templates** Example Management file

   *Note: management files are displayed with .man file extension. The crop management file name appears in the boxed area next to Man when selected.*

2. Click on the Key symbol left of the folder Open Example Mgt. file

3. **Select** *Peas, green, drilled, st pt, disk, fcult,-Bean, green snap, st pt, disk, fcult, CMZ4.man*. (This *management file is saved as a project in My WEPS files.*

4. From the list, select: *Peas, green, drilled, st pt, disk, fcult,-Bean, green snap, st pt, disk, fcult, CMZ4.man*.

**Note: the management files are displayed with .man file extension.** The crop management file name is displayed at the bottom of the WEPS interface when selected.

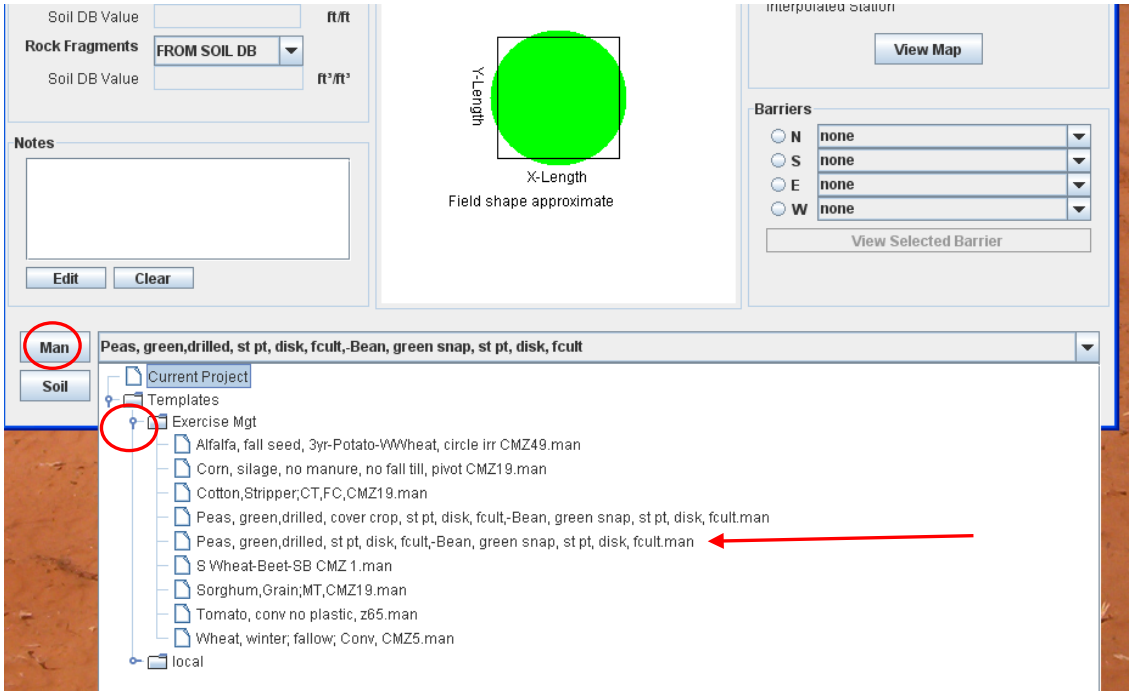



**Figure 1b** How to select a template management file.

**Step 5:** Click the down arrow opposite the "Soil" button near the bottom of the WEPS screen (fig 1c). Select the *Mecan_MfB_100_LS soil*.

**Note: the soil files have an .ifc extension.** When selected, the soil name is displayed near the bottom of the WEPS interface.

Use the down arrow to select a soil from the SSURGO survey database in this directory or other locations determined by the configuration settings.

**SSURGO files have an .mdb extension. If connected to the internet, find the NRCS Soil Data Mart folder and load the soil files straight from the NRCS Soil Data Mar**t.

*Last on the pull down list is a set of generic soil files to use if there is no soil survey* or ***if the soil in the field is different than mapped.***

Use Generic soils for disturbed sights, such as landfill, mining reclamation, and construction sites.

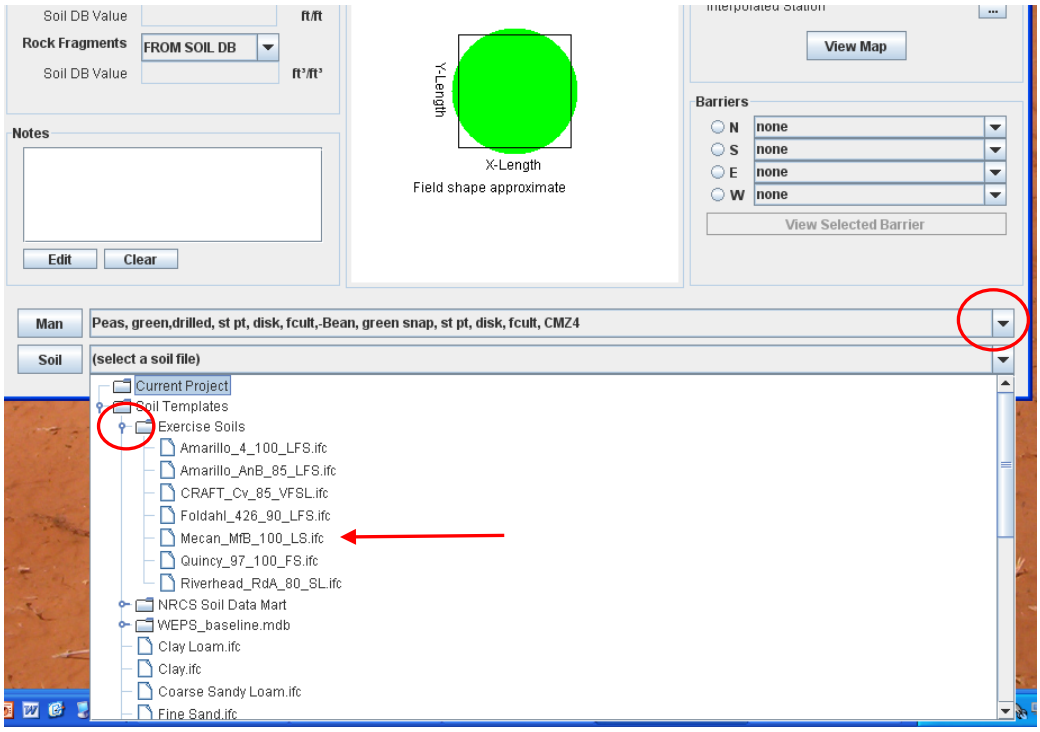



**Figure 1c** Soil selection pull down screen under soils templates exercise soils

**Configuration Note:**

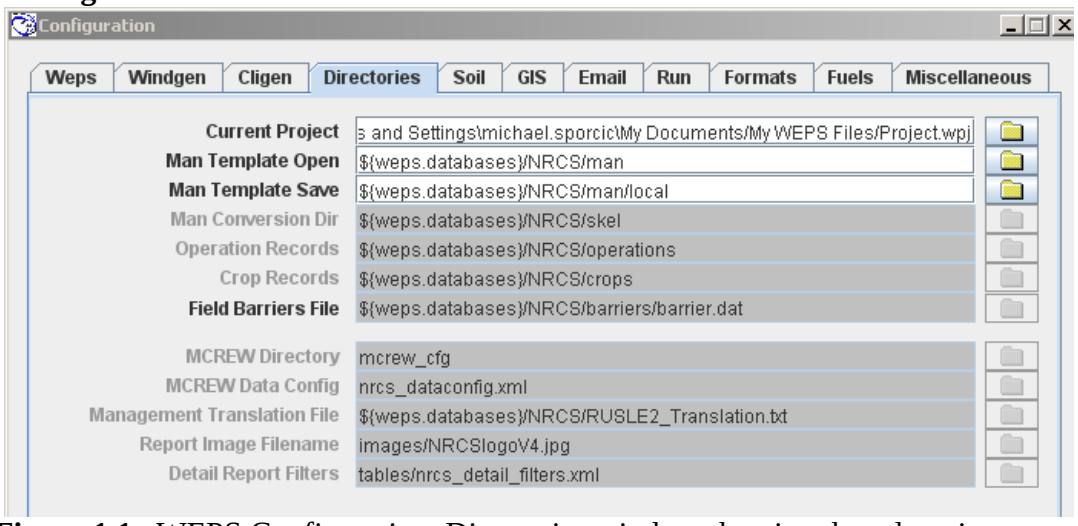



**Figure 1.1.** WEPS Configuration, Directories window showing three locations WEPS users can change:

1. Current Project,
2. Mgt Templates Open
3. Mgt Templates Save.

In most cases WEPS will run fine using the default Configuration locations in the configuration window shown above Figure 1.1. To check how WEPS is configured on the main interface, Click ‘Configuration’ then ‘Directories’.

The location(s) shown in the white boxes let the user know where WEPS will save and look for the data needed to make a run. The yellow folders indicate items the user can change. Grayed out folders show a location, however the user can not change the location. The users can change only yellow folders. For example, to change the location(s), Click the yellow folder, select the directory or file and then "OK" to save the configuration settings and leave the configuration screen.

**Simulation Run:**
Click to see if all required information is entered. See (Figure 1.2).

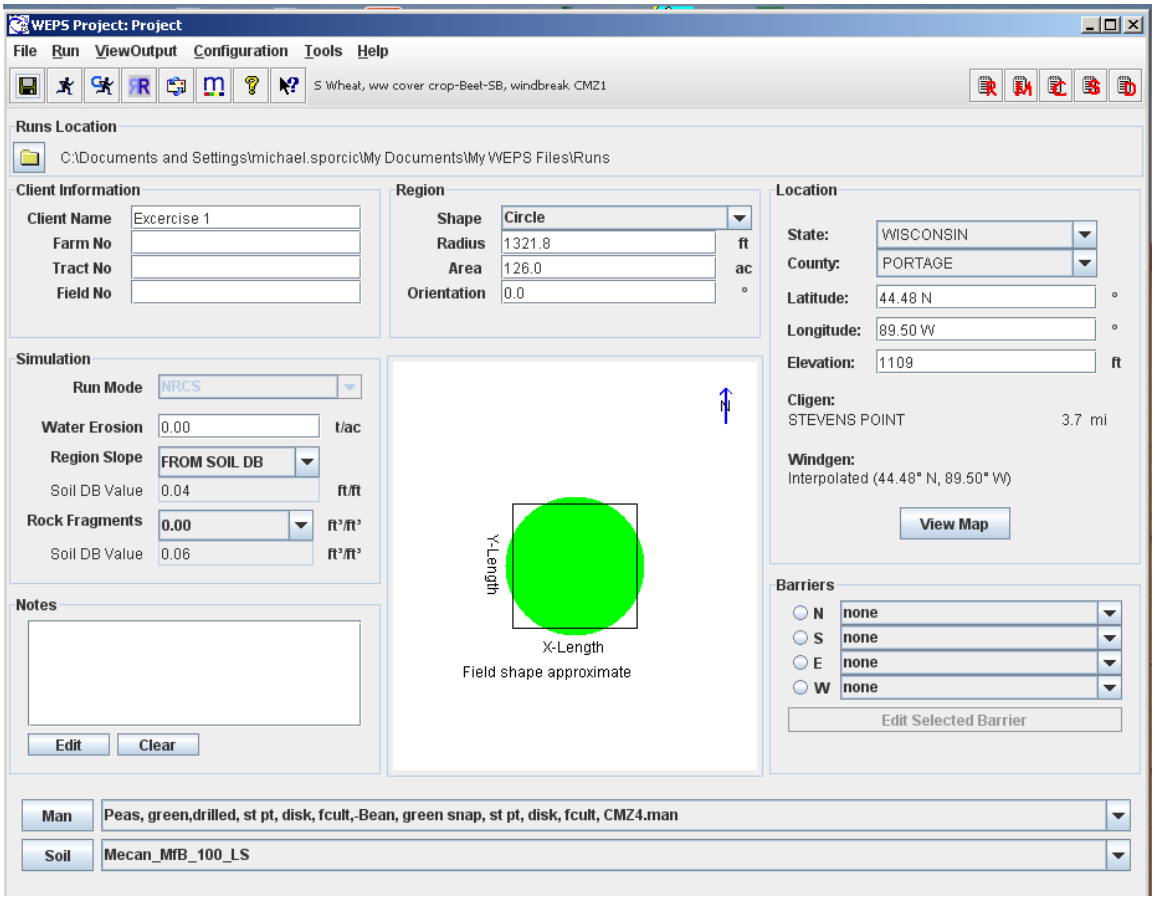



**Figure 1.2** WEPS interface with required information for the initial run of Exercise 1.

To begin the simulation run, click the "Run" button.

WEPS will ask you to enter a name for the run, type in **Peas, green-Beans, green, irr, CMZ4** or **E1 R1** then Click "OK" (Figure 1.3).

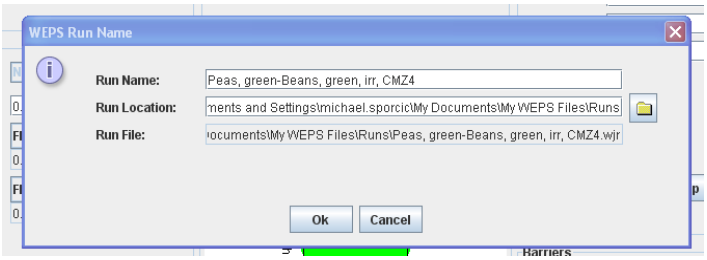



**Figure 1.3** WEPS Run box showing the run name, the run location where it will save the run, and run file with the .wjr extension.

During a simulation run, a window will appear that shows the simulation progress. Upon completion the WEPS Run Summary report window will appear (Figure 1.4). The Average Annual soil loss simulation is tons/ac/year.

Crop residue (correlated with crop yields) can affect erosion, therefore, the user should check to see if yields are as expected. Expected yields for this area are **3400 lbs/ac for green peas** and **8100 lbs/ac for the green beans**. However, WEPS calculated 15688 lbs/acre for peas and 7811 lbs/acre for the beans (see Figure 1.4). The pea yield is too high. *Calibrate the pea yield because the yield error is greater than 5% of the yield goal. (+ or -.5% x YG)*

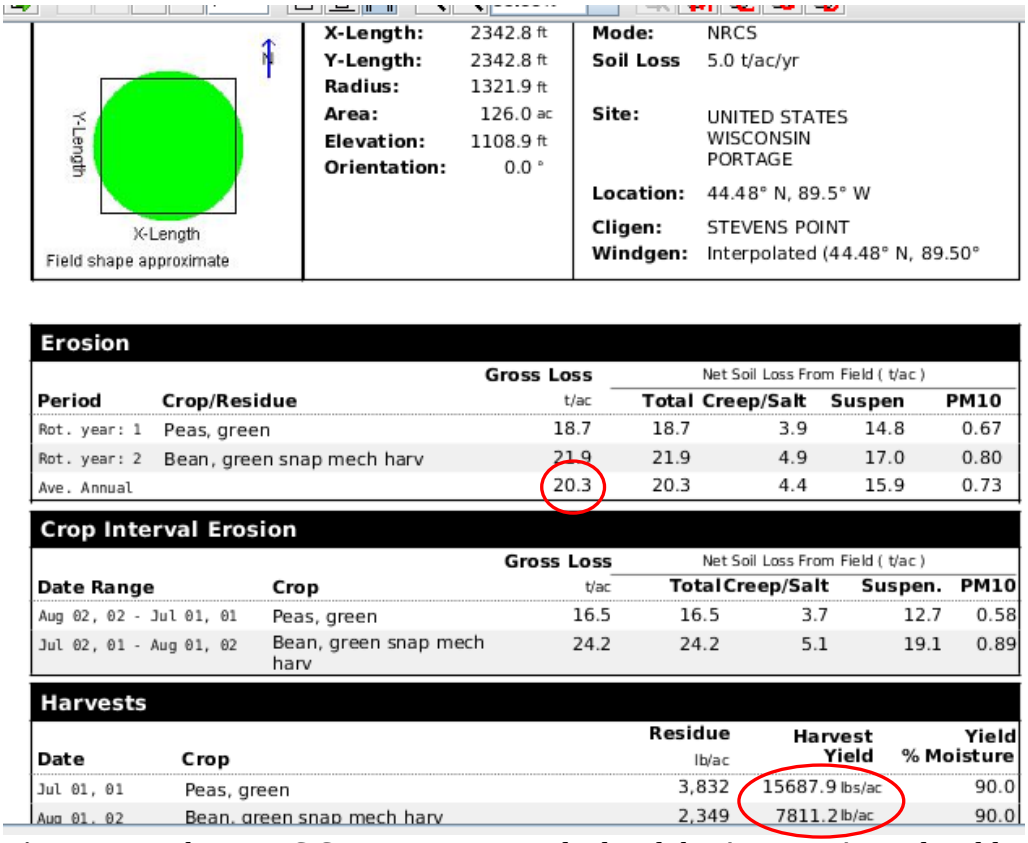



**Figure 1.4.** The WEPS Summary report calculated the Average Annual soil loss and shows the Harvest Yield for each crop.

**Calibration:**

WEPS can recalculate the crop growth based on the actual yield history of the field being evaluated. This is called "Calibration" of the crop. Calibration adjusts the Harvested (Target) Yield simulated to within 5% of the expected or historic yield goal. To calibrate the example run, close the Run Summary so the main WEPS window is displayed.

**Step 1:** On the WEPS main screen, click the "Man" button 

to open the Management Crop Rotation Editor for WEPS (MCREW). MCREW displays a calendar year date ordered list of all management operations and crops for the rotation (Figure 1.5). A more detailed explanation of MCREW use is covered in later exercises.

Click the Yield Calibrate button  on the tool bar. This displays eight additional columns; the first three pertain to the target yield and calibration. Target yield goals are edited on this screen. Remember, target yield is 3400 lbs/ac for peas and 8100 lbs/ac for beans. Change the peas Target yield from 2860 to 3400 lbs/ac.

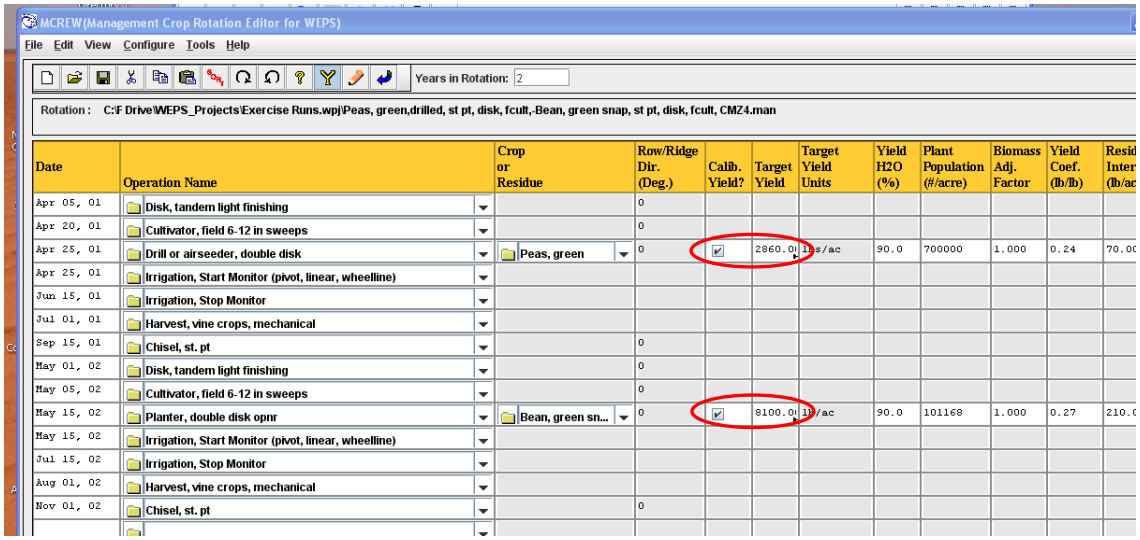



**Figure 1.5.** The WEPS Management Crop Rotation Editor (MCREW) showing the Yield Calibrate and Return buttons.

Click the Return button  to close MCREW and return to the main WEPS screen. Save the changes you made by Clicking on yes to save.

**Step 2:** On the main interface screen, Click "Run" then "Make a Yield Calibration WEPS Run", or Click the Yield Calibration Run button on the main toolbar.
Enter a Run Name.

The default Run Name is the last run name plus a number appended to the name (in this example "_1" is appended). Use the Backspace arrow to remove the _1, add the word "*cal*" to the end of the name and Click "OK" (Figure 1.6).

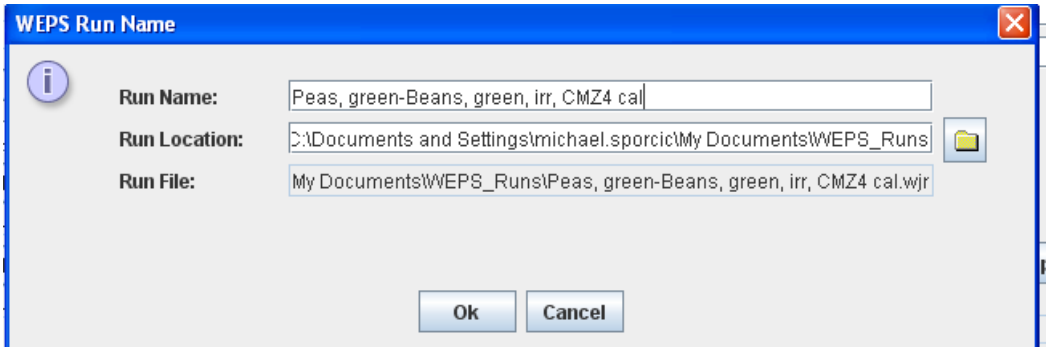



**Figure 1.6.** After Clicking the Calibration Run button, add "cal" to the run name and Click "OK".

WEPS displays a table showing two Calibration factors, one for peas and one for beans (Figure 1.7). For WEPS to produce the expected pea residue for this farm, reduce the pea yields from 15,670 lbs/ac to 3400 lbs/ac.

**The Biomass Adjustment Factor (BAJ) is a number assigned each crop that is a multiplier to adjust how much the crop grows and the residue amount after harvest. A BAF greater than 1 increase the final yield. BAFs less than 1 decrease the final yield of the crop**. Therefore, the pea yield of 3400 lbs /ac has a BAF or 0.3174. The beans did not need to adjust the BAF, so the factor remained

**There are three choices from the BAF screen:**

1. **Use in Current Project**, uses both BAF factors for all peas and bean run in this project by Clicking:
2. **Save As** saves a localized version of the crop file to the local subdirectory in the crop database for use with another local field. It is a good idea to save a copy for the next time the WEPS model is run**. The full path to where the file is stored is: C:\Documents and Settings\All Users\Application Data\USDA\WEPS\Databases\nrcs\crops\local.**
3. **Close** to use the factors in the current run.

Choose "Use in Current Project", *meaning it changed the mgt file in the project directory not the management in any template fil*e.

WEPS will then display a message that "The current project is now using the calibrated management file."

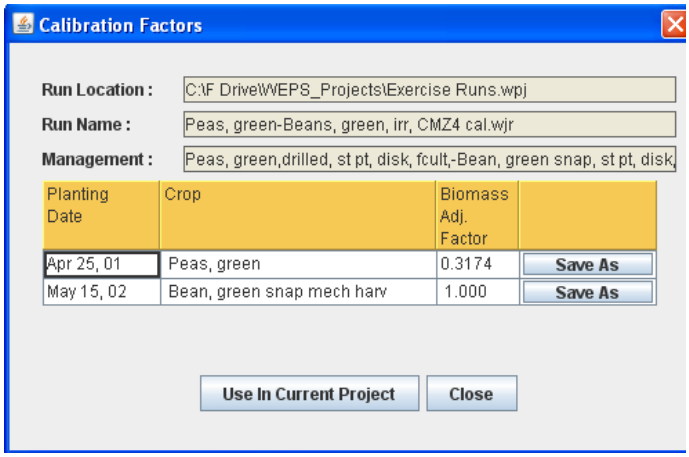



**Figure 1.7**. The Calibration Factors window showing the Biomass Adjustment Factor for each crop.

Upon completion, the WEPS Run Summary report window will appear (Figure 1.8). the simulation reports an Average Annual Gross Soil Loss of about 39 tons/acre. This is above the T-value (Soil Loss Tolerance) of 5 T/ac/yr. Note the Biomass Adjustment Factors appear in the "Notes" box near the bottom of the Run Summary report.

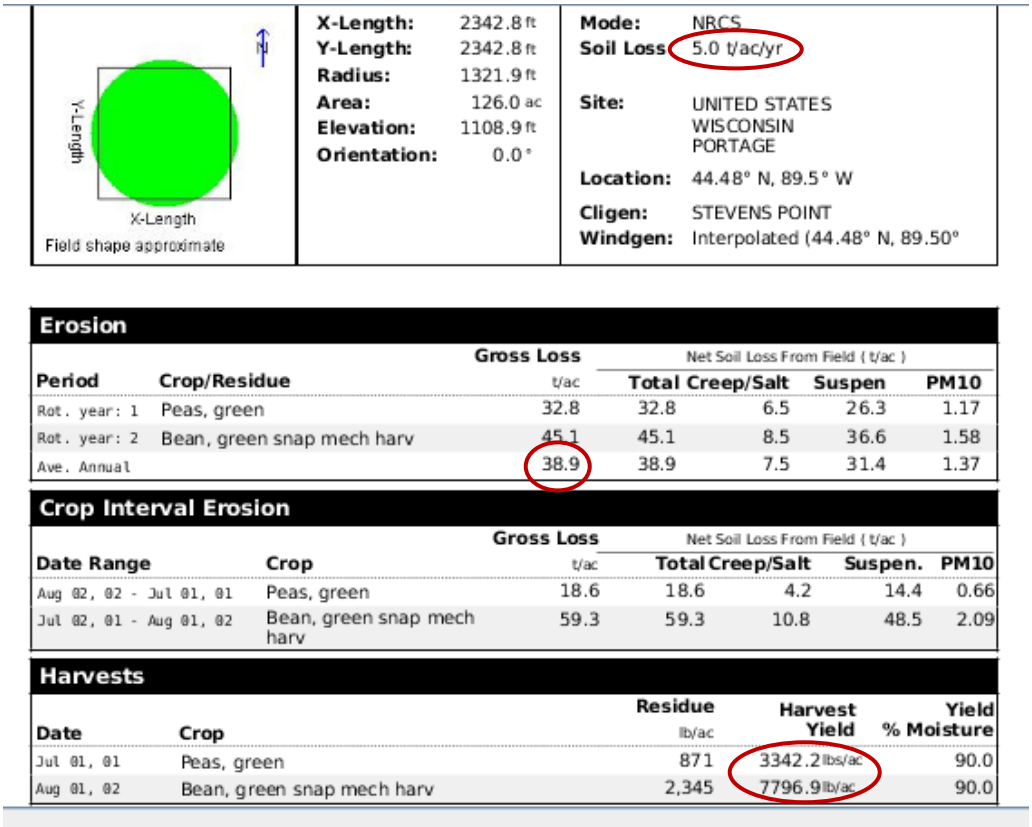



**Figure 1.8** Run Summary report shows the average annual soil loss obtained with the calibrated crops.

**Is the yield within the 5% yield tolerance now needed?** Yes, 3342 lbs/ac of peas is close enough to 3400 and 7797 lbs/ac is close enough to 8100.

**Is the percent ground cover and mass of flat residue after seeding adequate to protect the seedling stages of both crops?**

**Hint:** Click the Detailed Report button at the top of the Summary Report. Near the top of the Detailed Report is a window that allows the user to "Select Report". This should display "**Erosion & Crop Veg, Res & Biomass (details)"** as default. If not select it from the drop down list by clicking the drop down arrow.

The Detailed Report includes a date ordered list of output parameters by periods (every 15 days or the period between management operations). This detailed report allows the user to view the amount of cover and flat residue after seeding each crop (Figure 1.9).

Run: Peas, green-Beans, green, irr, CMZ4 cal
Client: Excercise 1
Fm: Tr: Fld:
fcult, CMZ4
Soil: Mecan_MfB_100_LS

| Date | Operation | Crop | Erosion: Average Total Gross Soil Loss | Crop Vegetation: Canopy Cover | Crop Vegetation: Effective Standing Silhouette | Crop Vegetation: Leaf and Stem Mass | Crop Vegetation: Root Mass | Crop Vegetation: Crop Height | Crop Vegetation: Number Crop Stems | Crop Residue: Surface Cover | Crop Residue: Effective Standing Silhouette | Crop Residue: Flat Mass | Crop Residue: Standing Mass | Crop Residue: Buried Mass | Crop Residue: Buried Mas |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Average Biomass Surface Conditions on Date | | | | | | | | | | | | |
| | | | t/ac | fraction | ft²/ft² | lbs/acre | lbs/acre | in | #/ac | fraction | ft²/ft² | lbs/acre | lbs/acre | lbs/acre | lbs/ac |
| Apr 15-19, 01 | | | 4.7 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.05 | 0.00 | 91 | 0 | 1065 | |
| Apr 20-24, 01 | Cultivator, field 6-12 in sweep | | 0.2 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.05 | 0.00 | 95 | 0 | 1068 | |
| Apr 25-30, 01 | Drill or airseeder, double disk<br>Irrigation, Start Monitor (pivot, | Peas, green | 0.4 | 0.27 | 0.01 | 163 | 238 | 1 | 700027 | 0.05 | 0.00 | 82 | 0 | 1059 | |
| May 1-14, 01 | | | 0.7 | 0.39 | 0.06 | 265 | 311 | 2 | 700027 | 0.04 | 0.00 | 74 | 0 | 989 | |
| May 15-31, 01 | | | 0.0 | 0.52 | 0.17 | 468 | 447 | 15 | 700027 | 0.04 | 0.00 | 63 | 0 | 865 | |
| Jun 1-14, 01 | | | 0.0 | 0.54 | 0.24 | 674 | 555 | 28 | 700027 | 0.03 | 0.00 | 55 | 0 | 755 | |
| Jun 15-30, 01 | Irrigation, Stop Monitor | | 0.0 | 0.53 | 0.29 | 872 | 525 | 29 | 700027 | 0.03 | 0.00 | 47 | 0 | 637 | |
| Jul 1-14, 01 | Harvest, vine crops, mechanic | Peas, green | 1.1 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.36 | 0.00 | 761 | 0 | 605 | |
| Jul 15-31, 01 | | | 1.2 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.30 | 0.00 | 613 | 0 | 519 | |
| Aug 1-14, 01 | | | 0.3 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.26 | 0.00 | 519 | 0 | 460 | |
| Aug 15-31, 01 | | | 0.5 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.22 | 0.00 | 428 | 0 | 400 | |
| Sep 1-14, 01 | | | 0.3 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.20 | 0.00 | 376 | 0 | 362 | |
| Sep 15-30, 01 | Chisel, st. pt | | 0.8 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.06 | 0.00 | 109 | 0 | 550 | |
| Oct 1-14, 01 | | | 1.7 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.06 | 0.00 | 102 | 0 | 513 | |
| Oct 15-31, 01 | | | 2.5 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.05 | 0.00 | 95 | 0 | 485 | |
| Nov 1-14, 01 | | | 4.6 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.05 | 0.00 | 92 | 0 | 476 | |
| Nov 15-30, 01 | | | 9.1 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.05 | 0.00 | 90 | 0 | 473 | |
| Dec 1-14, 01 | | | 0.6 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.05 | 0.00 | 90 | 0 | 473 | |
| Dec 15-31, 01 | | | Trace | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.05 | 0.00 | 89 | 0 | 473 | |
| Rot. yr: 1 | | | 32.8 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | |
| Jan 1-14, 02 | | | 0.0 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.05 | 0.00 | 89 | 0 | 473 | |
| Jan 15-31, 02 | | | 0.9 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.05 | 0.00 | 89 | 0 | 473 | |
| Feb 1-14, 02 | | | 0.0 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.05 | 0.00 | 89 | 0 | 473 | |
| Feb 15-29, 02 | | | 0.0 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.05 | 0.00 | 88 | 0 | 473 | |
| Mar 1-14, 02 | | | 0.0 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.05 | 0.00 | 87 | 0 | 472 | |
| Mar 15-31, 02 | | | 0.6 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.05 | 0.00 | 86 | 0 | 471 | |
| Apr 1-14, 02 | | | 4.4 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.05 | 0.00 | 82 | 0 | 466 | |
| Apr 15-30, 02 | | | 25.2 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.04 | 0.00 | 76 | 0 | 451 | |
| May 1- 4, 02 | Disk, tandem light finishing | | 0.8 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.02 | 0.00 | 29 | 0 | 492 | |
| May 5-14, 02 | Cultivator, field 6-12 in sweep | | 3.6 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.02 | 0.00 | 35 | 0 | 465 | |
| May 15-31, 02 | Planter, double disk opnr<br>Irrigation, Start Monitor (pivot, | Bean, green snap mech harv | 2.0 | 0.29 | 0.04 | 163 | 103 | 2 | 101171 | 0.02 | 0.00 | 31 | 0 | 413 | |
| Jun 1-14, 02 | | | 0.0 | 0.74 | 0.35 | 635 | 427 | 10 | 101171 | 0.02 | 0.00 | 27 | 0 | 361 | |
| Jun 15-30, 02 | | | 0.0 | 0.85 | 0.70 | 1379 | 855 | 22 | 101171 | 0.01 | 0.00 | 22 | 0 | 302 | |
| Jul 1-14, 02 | | | 0.0 | 0.85 | 0.96 | 2076 | 1108 | 23 | 101171 | 0.01 | 0.00 | 19 | 0 | 253 | |
| Jul 15-31, 02 | Irrigation, Stop Monitor | | 0.0 | 0.84 | 1.05 | 2346 | 1082 | 23 | 101171 | 0.01 | 0.00 | 16 | 0 | 208 | |

**Figure 1.9**. The Detailed Report with average soil loss and residue amounts just after planting Peas and Beans.

By examining the Detailed Report table note the Bean residue after planting Peas (Date: Apr 25-30, 01) was 5% (0.05 fraction) surface cover and 76 lbs/ac flat mass. This amount

of bean residues provides enough protection so WEPS estimates an average total gross soil loss after planting the peas to be 1.1 tons/acre (period 4/25-5/14). Therefore, wind erosion abrasion damage to Peas is possible because the crop tolerance for peas is: 1 t/ac. The NRCS National Agronomy Manual has a Crop Tolerance to Blowing Soil table that lists Green/snap beans in the "no more than 1 ton/ac" low tolerance column (See the table in the Exercises Introduction). There is a crop tolerance resource concern with both crops.

The Pea residue after planting Beans (Date: May 15-31, 02) was 2% surface cover and about 31 lbs/ac flat mass (Figure 1.9). For these residue amounts, WEPS estimates an average total gross soil loss after planting of 2.0 tons/acre.

The 39 ton/ac. erosion rate for the two low residue producing crops is too high. Most of the wind erosion occurs after pea harvest; therefore consider a Cover Crop such as winter wheat or rye after the pea and bean harvest.

**Selecting a New Template** – At MCREW use the Man button pull down to select the example management template: **Peas, green, drilled, st pt, disk, fcult,-Bean, green snap, st pt, disk, fcult, both w Rye Cover Crop.man**.. Be sure that Pea yield is 3400 lbs/ac, and the Bean yield is 8100 lbs/ac. Click the calibrated yield button. The 0.3 tons/ac. is the average annual soil loss.

**Erosion**

| Period | Crop/Residue | Gross Loss t/ac | Net Soil Loss From Field ( t/ac ) Total | Creep/Salt | Suspen | PM10 |
|---|---|---|---|---|---|---|
| Rot. year: 1 | Peas, green | 0.4 | 0.4 | 0.1 | 0.3 | 0.02 |
| Rot. year: 2 | Bean, green snap mech harv | 0.2 | 0.2 | 0.1 | 0.1 | Trace |
| Ave. Annual | | 0.3 | 0.3 | 0.1 | 0.2 | 0.01 |

**Crop Interval Erosion**

| Date Range | Crop | Gross Loss t/ac | Net Soil Loss From Field ( t/ac ) Total | Creep/Salt | Suspen. | PM10 |
|---|---|---|---|---|---|---|
| Aug 02, 02 - Jul 01, 01 | Peas, green | 0.3 | 0.3 | 0.1 | 0.2 | 0.01 |
| Jul 02, 01 - Aug 01, 02 | Bean, green snap mech harv | 0.3 | 0.3 | 0.1 | 0.2 | 0.01 |

**Harvests**

| Date | Crop | Residue lb/ac | Harvest Yield | Yield % Moisture |
|---|---|---|---|---|
| Jul 01, 01 | Peas, green | 871 | 3342.4 lbs/ac | 90.0 |
| Aug 01, 02 | Bean, green snap mech harv | 2,373 | 7898.1 lb/ac | 90.0 |

Figure 1.10 shows the soil loss with the cover crops added.

**Ate WEPS main interface: File/Delete Runs** shows 2 projects in the *Current project* folder.

**File/Delete Management Rotation File** shows the management files. The management files are in *My WEPS files/Projects.wpj folder*

**Open MCREW: a**t the **Man line dropdown Open the Current projects.** Note project files are in *My WEPS files/RUNS folder*

## Exercise 2 - Texas: Add a Crop to a Rotation

**Skill Building:**

1. Use a pre-built management file to make the first run.
2. Add a crop too the rotation in the management editor to make a second run.
3. Evaluate a strip tillage system and reduced tillage alternatives to address the erosion problem.

**Location: Lubbock County TX**, south of the airport (use the default location for Lubbock Co.). CLIGEN station is **Lubbock WB AP**. WINDGEN Station is **interpolated**.

**Region:** The field is **(320 acres)** rectangle oriented east and west.

**Management:** Continuous Cotton, stripper is the current crop rotation. A two year rotation of Cotton followed by Milo or Sorghum grain will be evaluated as an alternative. Cotton Research at Texas A & M has grown cotton using Strip tillage and Ridge till. Use MCREW to edit a management template to create and evaluate Cotton, strip tillage and Cotton reduced tillage management as alternatives.

In MCREW the Cotton management file is: ***Cotton, stripper; FC, SCsweep, Bed.man***. Dry land cotton yield is ¾ bale or **375 lbs lint/ac**.

In MCREW the Milo Mulch-till file: ***Sorghum, Grain; MT, CMZ19.man*** will be added. Dry land sorghum yield averages **25 bu/ac**.

Soil is **Amarillo Loamy Fine Sand**. In Exercise Soils this is *Amarillo_4_100_LFS*.

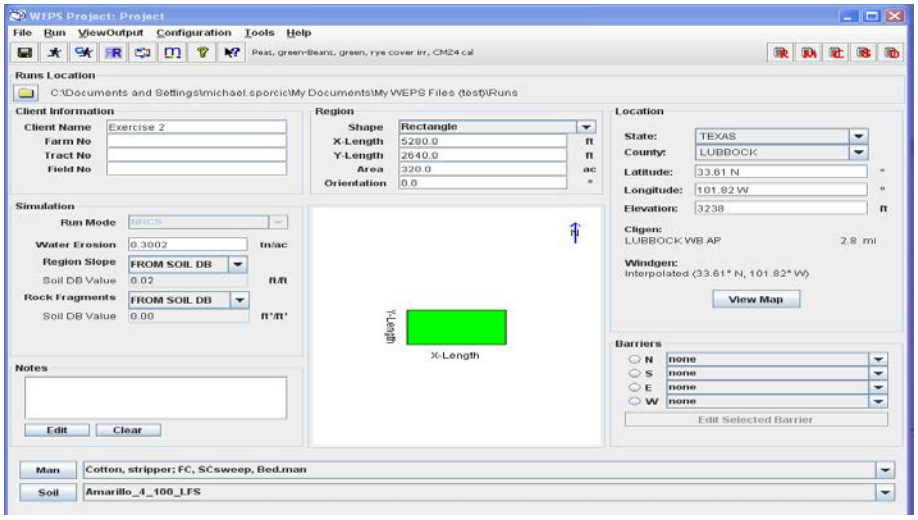



**Figure 1** Beginning screen for Exercise 2

**Getting Started See Figure 1:**

1. Start WEPS. Add the information listed above, except for the management. Show the field as a rectangle with the short side (Y-length = 2640 ft) on the east and west and (X length = 5280 ft.)on the North and South.
2. At MCREW click the pull down black arrow (lower right side) to display the managements in the Example management project folder.
3. Select the ***Cotton, stripper; FC, SCsweep, Bed.man*** file
4. Click the Run button.
5. Type in the Run name of: *Cotton, stripper, Conv, TX* .or (E2_R1). Upon completion, the Run Summary will appear (Figure 2).

**Erosion**

| Period | Crop/Residue | Gross Loss t/ac | Net Soil Loss From Field ( t/ac ) Total | Creep/Salt | Suspen | PM10 |
|---|---|---|---|---|---|---|
| Rot. year: 1 | Cotton, stripper | 42.3 | 42.3 | 11.3 | 30.9 | 0.75 |
| Ave. Annual | | 42.3 | 42.3 | 11.3 | 30.9 | 0.75 |

**Crop Interval Erosion**

| Date Range | Crop | Gross Loss t/ac | Net Soil Loss From Field ( t/ac ) Total | Creep/Salt | Suspen. | PM10 |
|---|---|---|---|---|---|---|
| Oct 21, 01 - Oct 20, 01 | Cotton, stripper | 42.3 | 42.3 | 11.3 | 30.9 | 0.75 |

**Harvests**

| Date | Crop | Residue lb/ac | Harvest Yield | Yield % Moisture |
|---|---|---|---|---|
| Oct 20, 01 | Cotton, stripper | 1,483 | 378.6 lb/ac lint | 7.5 |

**Figure 2** Showing average annual soil loss and the yield of Lint

Continuous Cotton has a 42 ton/ac/yr soil loss. What is the **cotton lint harvest yield listed?** (379 lbs/ac/yr.) The farm yield goal for cotton is **375 lbs/ac lint**. Check the cotton yield for 5% tolerance, 18 lbs/ac (5% x 375= 18 lbs above or below the farm yield). The cotton yield is within 5% of the yield goal so a 1.0 bioadjustment factor is fine.

**What if the soil loss is above the soil loss tolerance (T)?** Consider the management options to lower soil loss.

**What is the total residue (flat mass) at planting time?** Open the Detailed Report  Check the total flat mass of residue at planting on the Erosion & Crop Veg Res & Biomass (details) report.

**Answer:** About 49 lbs/ac and 2% surface cover (Figure 3) at planting.

Run: Cotton, stripper, Conv, TX
Client:
Fm: Tr: Fld:
Management: Cotton, stripper; FC, SCsweep, Bed
Soil: Amarillo_4_100_LFS

| Date | Operation | Crop | Erosion: Average Total Gross Soil Loss (t/ac) | Average Biomass Surface Conditions on Date: Crop Vegetation: Canopy Cover (fraction) | Effective Standing Silhouette (ft²/ft²) | Leaf and Stem Mass (lbs/acre) | Root Mass (lbs/acre) | Crop Height (in) | Number Crop Stems (#/ac) | Crop Residue: Surface Cover (fraction) | Effective Standing Silhouette (ft²/ft²) | Flat Mass (lbs/acre) | Standing Mass (lbs/acre) | Buried Mass (lbs/acre) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Jan 1-14, 01 | | | 1.6 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.12 | 0.01 | 548 | 89 | 839 |
| Jan 15-31, 01 | | | 1.6 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.12 | 0.01 | 519 | 88 | 817 |
| Feb 1-14, 01 | | | 1.6 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.11 | 0.01 | 493 | 87 | 795 |
| Feb 15-28, 01 | Chisel, sweep shovel | | 4.3 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.09 | 0.00 | 393 | 69 | 857 |
| Mar 1-14, 01 | | | 10.2 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.08 | 0.00 | 373 | 68 | 820 |
| Mar 15-31, 01 | Bedder, hipper, disk hiller | | 9.4 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.02 | 0.00 | 73 | 5 | 1087 |
| Apr 1-14, 01 | | | 5.1 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.02 | 0.00 | 70 | 4 | 1007 |
| Apr 15-30, 01 | | | 3.9 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.02 | 0.00 | 66 | 2 | 913 |
| May 1-14, 01 | | | 2.0 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.01 | 0.00 | 62 | 0 | 824 |
| May 15-31, 01 | Planter, double disk opener on 8 inch high beds | Cotton, stripper | 0.2 | 0.02 | 0.00 | 9 | 9 | 0 | 32501 | 0.01 | 0.00 | 59 | 0 | 716 |
| Jun 1-14, 01 | | | 0.1 | 0.09 | 0.00 | 41 | 44 | 1 | 32501 | 0.01 | 0.00 | 54 | 0 | 638 |
| Jun 15-19, 01 | | | 0.0 | 0.16 | 0.00 | 74 | 79 | 1 | 32501 | 0.01 | 0.00 | 52 | 0 | 613 |
| Jun 20-30, 01 | Cultivator, row 3 in ridge | | 0.5 | 0.42 | 0.03 | 236 | 240 | 3 | 32501 | 0.01 | 0.00 | 43 | 0 | 571 |
| Jul 1-14, 01 | | | 0.0 | 0.76 | 0.21 | 658 | 629 | 8 | 32501 | 0.01 | 0.00 | 38 | 0 | 514 |
| Jul 15-31, 01 | Cultivator, row 3 in ridge | | 0.0 | 0.81 | 0.27 | 884 | 817 | 11 | 32501 | 0.01 | 0.00 | 31 | 0 | 444 |
| Aug 1-14, 01 | | | 0.0 | 0.81 | 0.28 | 989 | 894 | 12 | 32501 | 0.01 | 0.00 | 29 | 0 | 394 |
| Aug 15-31, 01 | | | 0.0 | 0.81 | 0.29 | 1118 | 780 | 12 | 32501 | 0.01 | 0.00 | 25 | 0 | 342 |
| Sep 1-14, 01 | | | 0.0 | 0.80 | 0.27 | 1212 | 646 | 12 | 32501 | 0.01 | 0.00 | 22 | 0 | 304 |
| Sep 15-30, 01 | | | 0.0 | 0.71 | 0.20 | 1266 | 527 | 12 | 32501 | 0.00 | 0.00 | 20 | 0 | 269 |
| Oct 1-14, 01 | | | 0.0 | 0.66 | 0.16 | 1255 | 487 | 12 | 32501 | 0.00 | 0.00 | 18 | 0 | 250 |
| Oct 15-19, 01 | | | 0.0 | 0.66 | 0.16 | 1255 | 487 | 12 | 32501 | 0.00 | 0.00 | 18 | 0 | 244 |
| Oct 20-31, 01 | Harvest, cotton | Cotton, stripper | 0.0 | 0.62 | 0.14 | 1130 | 487 | 12 | 29251 | 0.04 | 0.00 | 153 | 0 | 232 |
| Nov 1-14, 01 | | | 0.0 | 0.62 | 0.14 | 1130 | 487 | 12 | 29251 | 0.03 | 0.00 | 143 | 0 | 223 |
| Nov 15-30, 01 | | | 0.0 | 0.62 | 0.14 | 1130 | 487 | 12 | 29251 | 0.03 | 0.00 | 133 | 0 | 214 |
| Dec 1-14, 01 | Shredder, flail or rotary | | 0.5 | 0.00 | 0.01 | 122 | 487 | 2 | 29251 | 0.26 | 0.00 | 1271 | 0 | 210 |
| Dec 15-31, 01 | Chisel, st. pt | | 1.2 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.13 | 0.01 | 581 | 90 | 868 |
| Rot. yr: 1 | | | 42.3 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Ave. Annual | | | 42.3 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |

**Figure 3** Detailed Report showing loss and residue at the planting and vegetative material at harvest.

**What management period has the highest erosion loss?**
**Answer:** After the Chisel, sweep, shovel operation (Mar 1-14, 01), 10 tons/ac (Figure 3).

**How much total residue is after the Shredder, flail or rotary operation?**

**Answer:** The residue after Shredding is 1393 lbs/ac (122 Leaf and Stem Mass + 1271 lbs/ac flat mass + 0 lbs/ac effective standing residue mass) (Figure 2.1). **Notice**: Cotton in this case was not killed by the stripper harvest. Cotton is a perennial, harvesting and shredding **does no**t kill the crop. Frost or tillage will. On Dec 1, after the Chisel, st. pt tillage operation the crop is killed and there are about 90 lbs/ac of standing residue. If a defoliant was used before harvest the leaf residue would have shown up at that time.

Cotton does not produce enough residues to control the erosion Add sorghum to the rotation to see the effect sorghum residue has on the wind erosion rate.

**<u>Add a Crop to a Rotation:</u>** Close any reports so only the main interface window is open.

1. Click on the 'Man' button. Open the MCREW management editor
2. Click the last row in the second column (Operation Name) of the cotton file.
3. Select 'Insert Management'
4. Click the 'Example Mgt Files' directory.
5. Find ***Sorghum, Grain; MT, CMZ19.man***. Select.

**Note**: The sorghum crop is added into the rotation in the second year and the dates are correct because both single management files have all tillage in one year, (not 0 and 1 as with some RUSLE files) with fall tillage. The dates look right and seem reasonable.

Click the Y button to calibrate the yield. For sorghum enter 25 bu/ac. For the cotton yield: enter 375 lbs/ac See if both "Calib. Yield?" boxes are checked.

**Save** the file with a new name. Notice the rotation name (after Rotation) is blue.

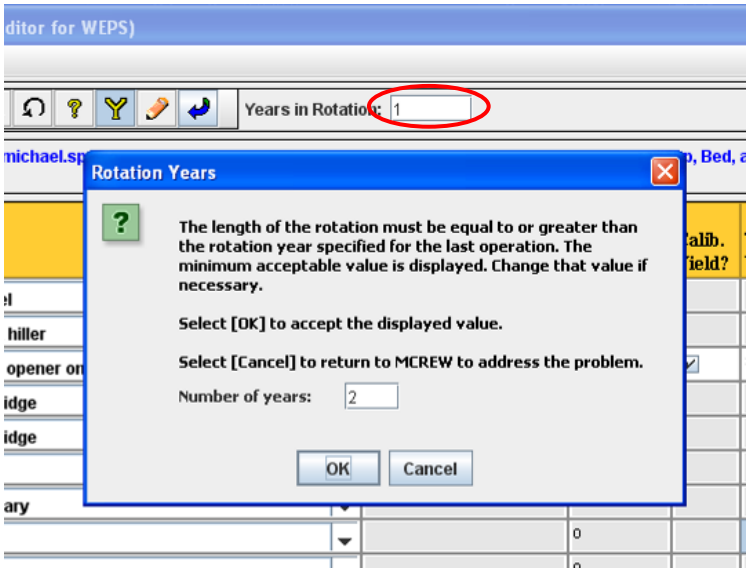



**Figure 4** MCREW will ask for number of rotation years if a crop was added with dates that increase the number of years.

Click 'File' then 'Save as...' Notice MCREW detected only "1" in the year box (Figure 4). Accept the request to change to a 2 year rotation by Clicking OK or change the value in the box to match the number of years in the rotation.

MCREW asks for a new name for the two year rotation. Enter *Cotton, Stripper; FC, SCsweep-Sorghum, MT. Man*, or **E2_R2** and Click 'Save'.

Click the Man Button with MCREW open.
Note WEPS saved the new two year rotation to:

***C:\Documents and Settings\your name\My Documents\WEPS_Project*.** This is a temporary working directory.

**To save this template as a local template management file in MCREW***:*
*Click file 'save as Template, and Click Save.* WEPS will save the name or any name to the local folder in:

***C:\Documents and Settings\All Users\Application\Data\USDA\WEPS\Data\USDA\WEPS\Databases\nrcs\man\local***

Post the local template to a shared server site so others can use the same management (this is optional.)

Make a new run. See if WEPS will give an appropriate sorghum yield in this rotation. Click the Close button to return to the main interface. Click the Run button Call the run: *Cotton, stripper, Conv-Sorghum, MT, TX or **EX 2 Run 2.***
**What is the soil loss?** About 40 ton/ac/yr. See the Run Summary or (Figure 5). The

Average annual soil loss, the cotton and sorghum grain yield is too high!

**Erosion**

| Period | Crop/Residue | Gross Loss t/ac | Net Soil Loss From Field ( t/ac ) Total | Creep/Salt | Suspen | PM10 |
|---|---|---|---|---|---|---|
| Rot. year: 1 | Cotton, stripper | 22.5 | 22.5 | 7.1 | 15.4 | 0.38 |
| Rot. year: 2 | Sorghum, grain | 57.4 | 57.4 | 14.8 | 42.6 | 1.10 |
| Ave. Annual | | 40.0 | 40.0 | 11.0 | 29.0 | 0.74 |

**Crop Interval Erosion**

| Date Range | Crop | Gross Loss t/ac | Net Soil Loss From Field ( t/ac ) Total | Creep/Salt | Suspen. | PM10 |
|---|---|---|---|---|---|---|
| Oct 11, 02 - Oct 20, 01 | Cotton, stripper | 21.9 | 21.9 | 7.0 | 15.0 | 0.37 |
| Oct 21, 01 - Oct 10, 02 | Sorghum, grain | 58.0 | 58.0 | 14.9 | 43.1 | 1.11 |

**Harvests**

| Date | Crop | Residue lb/ac | Harvest Yield | Yield % Moisture |
|---|---|---|---|---|
| Oct 20, 01 | Cotton, stripper | 1,658 | 423.4 lb/ac lint | 7.5 |
| Oct 10, 02 | Sorghum, grain | 2,821 | 49.3 bu/ac | 14.0 |

**Figure 5** (Ex 2 Run 2 Summary) The soil loss and the yields without calibration with cotton and sorghum.

**What is the sorghum yield?** 49.3 bu/ac/yr. See the Run Summary (Figure 5).

**Do we need to calibrate the sorghum?** Yes, the 49 bu/ac is outside the 5% yield tolerance with a 25 bu/ac yield goal. Cotton at 423 lb/ac is too high also.

Close the run summary. Make a new calibrated run with cotton yield of 375 lbs. /ac and sorghum at 25 lbs/ac. SAVE. Click the Calibrate Run button  . Name this run *Cotton, stripper, Conv-Sorghum, MT, TX cal. or **E2_R3cal.*** Click Use in the Current Project. See the Run Summary (Figure 6)

**Erosion**

| Period | Crop/Residue | Gross Loss t/ac | Net Soil Loss From Field ( t/ac ) Total | Creep/Salt | Suspen | PM10 |
|---|---|---|---|---|---|---|
| Rot. year: 1 | Cotton, stripper | 38.1 | 38.1 | 11.7 | 26.3 | 0.65 |
| Rot. year: 2 | Sorghum, grain | 81.1 | 81.1 | 21.0 | 60.1 | 1.55 |
| Ave. Annual | | 59.6 | 59.6 | 16.4 | 43.2 | 1.10 |

**Crop Interval Erosion**

| Date Range | Crop | Gross Loss t/ac | Net Soil Loss From Field ( t/ac ) Total | Creep/Salt | Suspen. | PM10 |
|---|---|---|---|---|---|---|
| Oct 11, 02 - Oct 20, 01 | Cotton, stripper | 36.6 | 36.6 | 11.4 | 25.2 | 0.62 |
| Oct 21, 01 - Oct 10, 02 | Sorghum, grain | 82.6 | 82.6 | 21.4 | 61.2 | 1.57 |

**Harvests**

| Date | Crop | Residue lb/ac | Harvest Yield | Yield % Moisture |
|---|---|---|---|---|
| Oct 20, 01 | Cotton, stripper | 1,443 | 368.4 lb/ac lint | 7.5 |
| Oct 10, 02 | Sorghum, grain | 1,639 | 25.8 bu/ac | 14.0 |

**Figure 6** Shows the 60 tons/ac wind erosion rate with the calibrated yield.

The soil loss is higher now close to 60 tons/ac.

**After planting Cotton how much flat mass is there?**

Click the Detailed Report and select the **Erosion and Crop Veg Res & Biomass Detail screen** (default). At Cotton planting, (May 15-31), about 145 lbs/ac flat mass with an erosion rate of 0.2 tons/ac (Figure 7).

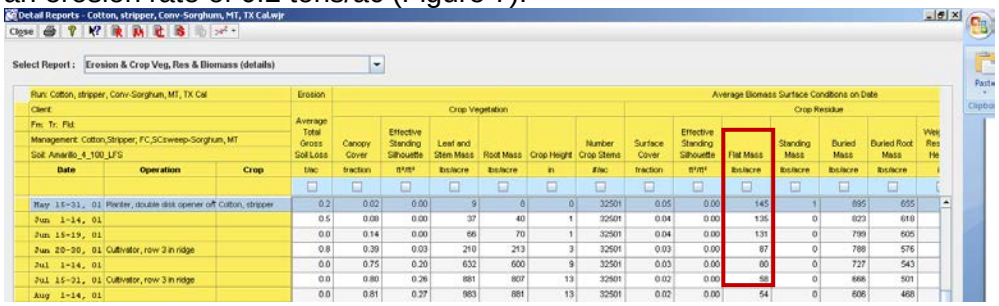



**Figure 7** Detailed Report showing soil loss and flat mass**. What is the date of the first erosion period after sorghum harvest? (Figure 8)** March 15-31 after the Bedder, hipper, disk hiller operation. The wind erosion rate is about 12 tons.

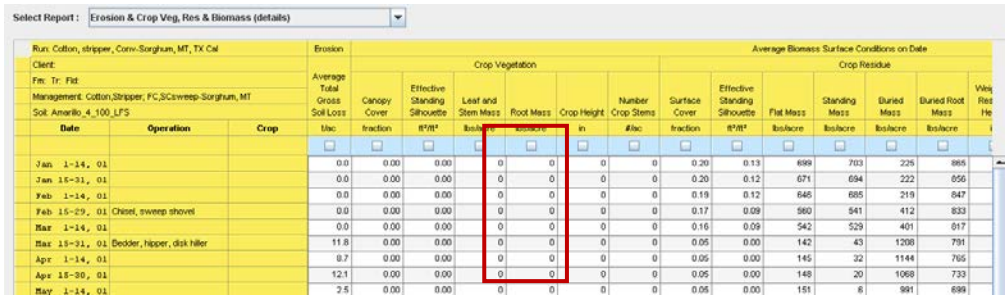



**Figure 8** Detailed Report showing the soil loss after the sorghum harvest.
A 59.6 tons/ac erosion rate is still too high. Try evaluating a reduced tillage alternative...

**<u>Reduced Tillage:</u>**

Glyphosate ready Cotton for weed control, and strip-till works. Standing residue is twice as good at controlling erosion as flat residue. Try using the last run and reduce some of the tillage. Close all the reports until the WEPS main window is open.

1. Click the 'Man' button on the main window. Load the Cotton*, Stripper; FC, SCsweep-Sorghum, MT. Man* (**E2_ R3)** file. Remove most of the tillage operations.

2. Right Click on the operation name and select the next to the last selection on the menu "Delete row(s)". See Figure 9, do this for all the operations **NOT** listed.

3. Change the standard planter for the cotton from: *Planter, double disk, oprn* to *Planter, ridge till*.

4. Click the black down arrow, on the *Planter double disk.oprn* row and select the *Planter, ridge till* operation. See (Figure 9).

5. **Use Shift P** to move to the "Ps". Etc.

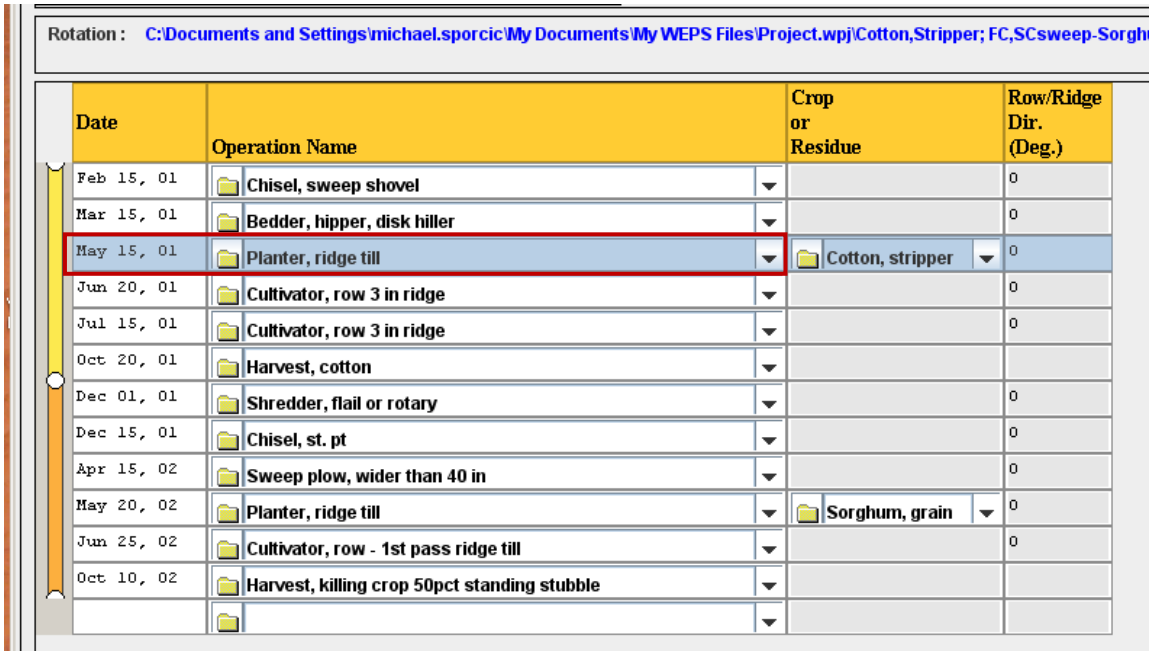



**Figure 9** Selecting the Operation file *Planter, ridge till for the Cotton planting.*

Add all operations shown in Figure 11.

*Right Click,* on the operation column where the new operation is to be inserted then select: “Insert a blank row”.

**Figure 10** shows changing the sprayer *defoliant, aerial operation* to add the *Sprayer, post emergence* operation. Next select the sprayer operation from the list.

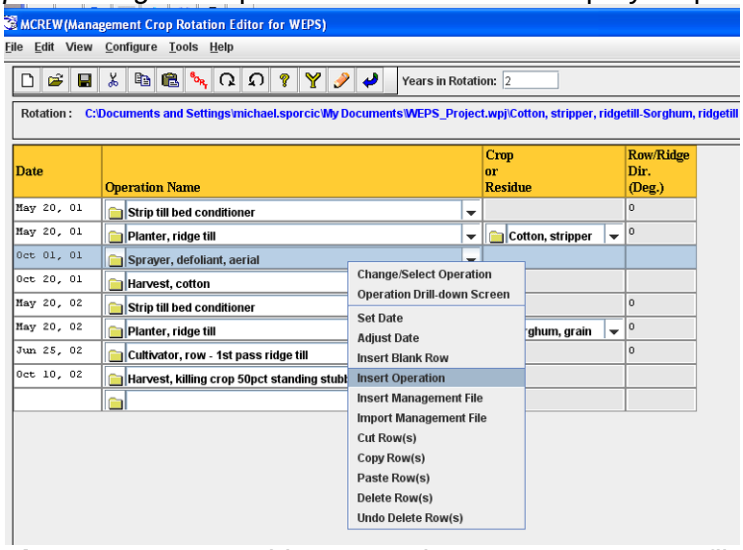



**Figure 10** How to add an operation to a management file after a blank row is inserted.

Change the dates of all operation added to the correct date. The editor will assume the date of the previous operation as added.

Continue working on adding and deleting operations until the file looks like Figure 11. Set the cotton yield to 375 lbs/ac and sorghum yield to 25 bu/ac.

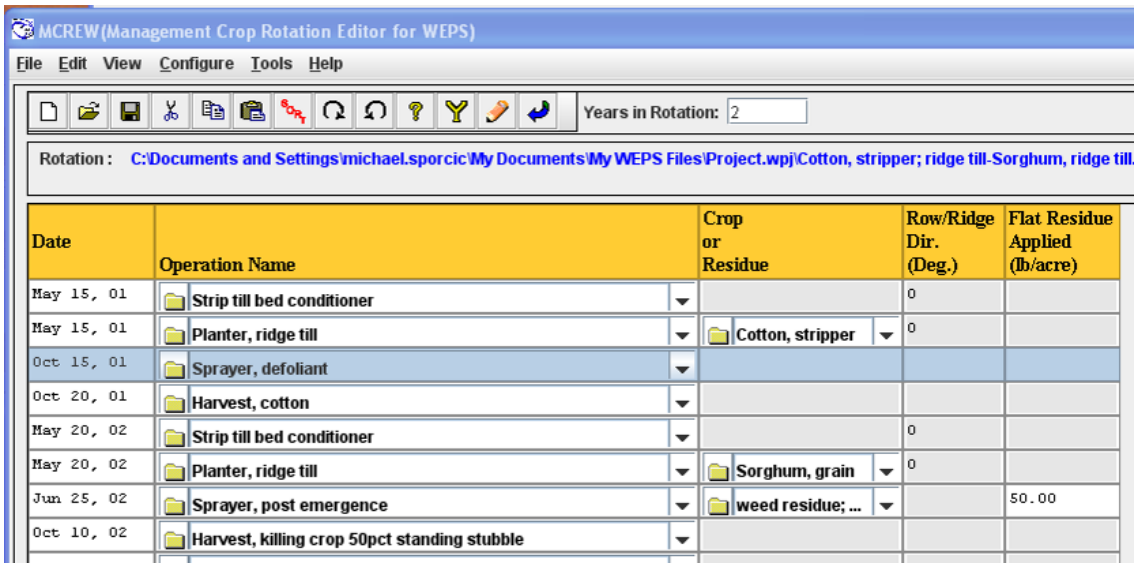



**Figure 11** MCREW window showing all dates and operation needed to make the ridge till alternative.

Save the new file as *Cotton, stripper, strip till-Sorghum, strip till CMZ19,* ***or E2_R4*** and close MCREW to return to the interface.

Make the calibrated run and call it *Cotton, stripper, strip till-Sorghum, strip till CMZ19 cal. or* ***E2_R4cal.***

Calibrate the run since there were major revisions to the tillage.

Click Use in Current Project.

**Note:** if a new management file is worthy of addition to what is known as the Local Management subdirectory follow these steps:

**1)** Start with MCREW. Load the edited and tested management file
**2)** Use the local Biomass Adjustment Factors to match the yield goal
***3) The location to save a Template Management Local file is***

*C:\Documents and Settings\All Users\Application Data\USDA\WEPS\Databases\db\man\NRCS\local*.

**4)** Save the file by Clicking 'File', 'Save as Template', and navigate to the above directory.
**5)** Use the name consistent with any naming conventions the FO chooses to use.
**6)** Click 'Save'.

**Note:** NRCS field offices can save templates to a networked server drive. A WEPS user can create a subdirectory to store runs for an individual farm or customer. This will allow the local work group to have access to any locally made records.

**Erosion**

| Period | Crop/Residue | Gross Loss t/ac | Net Soil Loss From Field ( t/ac ) Total | Creep/Salt | Suspen | PM10 |
|---|---|---|---|---|---|---|
| Rot. year: 1 | Cotton, stripper | 2.2 | 2.2 | 0.6 | 1.6 | 0.04 |
| Rot. year: 2 | Sorghum, grain | 12.8 | 12.8 | 3.0 | 9.7 | 0.25 |
| Ave. Annual | | 7.5 | 7.5 | 1.8 | 5.7 | 0.14 |

**Crop Interval Erosion**

| Date Range | Crop | Gross Loss t/ac | Net Soil Loss From Field ( t/ac ) Total | Creep/Salt | Suspen. | PM10 |
|---|---|---|---|---|---|---|
| Oct 11, 02 - Oct 20, 01 | Cotton, stripper | 1.9 | 1.9 | 0.6 | 1.4 | 0.04 |
| Oct 21, 01 - Oct 10, 02 | Sorghum, grain | 13.1 | 13.1 | 3.1 | 10.0 | 0.25 |

**Harvests**

| Date | Crop | Residue lb/ac | Harvest Yield | Yield % Moisture |
|---|---|---|---|---|
| Oct 20, 01 | Cotton, stripper | 992 | 367.3 lb/ac lint | 7.5 |
| Oct 10, 02 | Sorghum, grain | 1,577 | 23.9 bu/ac | 14.0 |

**Figure 12** Run summary showing annual soil loss of less than 7.5 tons/acre.

**Figure 12** shows the average annual soil loss is close to a 5 tons/acre/year soil loss tolerance using a cotton-sorghum rotation with strip tillage (Figure 12). Leaving cotton stalks standing is very effective at controlling wind erosion. The Detailed Report shows there is 802 lbs/ac flat mass and 22% flat cover of sorghum residue after planting cotton. And 542 lbs/ac flat mass, 13% surface cover of cotton residue after planting sorghum.

Run: Cotton, stripper, striptill-Sorghum, striptill CMZ19.cal
Client:
Fm: Tr: Fld:
Management: , stripper, striptill-Sorghum, striptill CMZ19
Soil: Amarillo_4_100_LFS

| Date | Operation | Crop | Erosion: Average Total Gross Soil Loss t/ac | Crop Vegetation: Canopy Cover fraction | Effective Standing Silhouette ft²/ft² | Leaf and Stem Mass lbs/acre | Root Mass lbs/acre | Crop Height in | Number Crop Stems #/ac | Crop Residue: Surface Cover fraction | Effective Standing Silhouette ft²/ft² | Flat Mass lbs/acre | Standing Mass lbs/acre | Buried Mass lbs/acre | Buried Root Mass lbs/acre | Weighted Residue Height in |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Jan 1-14, 01 | | | 0.0 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.25 | 0.12 | 949 | 672 | 49 | 850 | 23 |
| Jan 15-31, 01 | | | 0.0 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.24 | 0.12 | 914 | 664 | 49 | 840 | 23 |
| Feb 1-14, 01 | | | 0.0 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.24 | 0.11 | 881 | 654 | 48 | 831 | 23 |
| Feb 15-29, 01 | | | 0.0 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.23 | 0.11 | 847 | 647 | 47 | 818 | 23 |
| Mar 1-14, 01 | | | 0.0 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.22 | 0.11 | 809 | 636 | 46 | 802 | 23 |
| Mar 15-31, 01 | | | 0.0 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.21 | 0.11 | 762 | 623 | 45 | 777 | 23 |
| Apr 1-14, 01 | | | 0.0 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.20 | 0.10 | 720 | 608 | 43 | 752 | 23 |
| Apr 15-30, 01 | | | 0.0 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.19 | 0.10 | 676 | 591 | 42 | 719 | 23 |
| May 1-14, 01 | | | 0.0 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.18 | 0.09 | 631 | 568 | 40 | 683 | 23 |
| May 15-31, 01 | Strip till bed conditioner Planter, ridge till | Cotton, stripper | 0.2 | 0.02 | 0.00 | 9 | 8 | 0 | 32501 | 0.22 | 0.02 | 802 | 170 | 159 | 637 | 23 |
| Jun 1-14, 01 | | | 1.2 | 0.08 | 0.00 | 37 | 39 | 1 | 32501 | 0.23 | 0.01 | 829 | 73 | 149 | 600 | 23 |
| Oct 20-31, 01 | Harvest, cotton | Cotton, stripper | 0.0 | 0.00 | 0.02 | 1063 | 464 | 14 | 29251 | 0.14 | 0.00 | 509 | 0 | 75 | 326 | 23 |
| Nov 1-14, 01 | | | 0.0 | 0.00 | 0.02 | 1016 | 464 | 14 | 29251 | 0.14 | 0.00 | 488 | 0 | 72 | 316 | 23 |
| Nov 15-30, 01 | | | 0.0 | 0.00 | 0.02 | 976 | 464 | 14 | 29251 | 0.13 | 0.00 | 469 | 0 | 70 | 308 | 23 |
| Dec 1-14, 01 | | | Trace | 0.00 | 0.02 | 949 | 464 | 14 | 29251 | 0.13 | 0.00 | 456 | 0 | 69 | 304 | 23 |
| Dec 15-31, 01 | | | 0.2 | 0.00 | 0.02 | 921 | 464 | 14 | 29251 | 0.12 | 0.00 | 440 | 0 | 68 | 300 | 23 |
| Rot. yr: 1 | | | 2.2 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Jan 1-14, 02 | | | 0.2 | 0.00 | 0.02 | 902 | 464 | 14 | 29251 | 0.12 | 0.00 | 429 | 0 | 67 | 297 | 23 |
| Jan 15-31, 02 | | | 0.2 | 0.00 | 0.02 | 881 | 464 | 14 | 29251 | 0.12 | 0.00 | 416 | 0 | 66 | 294 | 23 |
| Feb 1-14, 02 | | | 0.4 | 0.00 | 0.02 | 862 | 464 | 14 | 29251 | 0.11 | 0.00 | 403 | 0 | 65 | 290 | 23 |
| Feb 15-29, 02 | | | 1.5 | 0.00 | 0.02 | 842 | 464 | 14 | 29251 | 0.11 | 0.00 | 389 | 0 | 63 | 285 | 23 |
| Mar 1-14, 02 | | | 1.5 | 0.00 | 0.02 | 824 | 464 | 14 | 29251 | 0.11 | 0.00 | 375 | 0 | 62 | 279 | 23 |
| Mar 15-31, 02 | | | 4.8 | 0.00 | 0.02 | 803 | 464 | 14 | 29251 | 0.10 | 0.00 | 356 | 0 | 60 | 271 | 23 |
| Apr 1-14, 02 | | | 1.2 | 0.00 | 0.02 | 786 | 464 | 14 | 29251 | 0.10 | 0.00 | 339 | 0 | 57 | 262 | 23 |
| Apr 15-30, 02 | | | 1.8 | 0.00 | 0.02 | 770 | 464 | 14 | 29251 | 0.09 | 0.00 | 321 | 0 | 54 | 252 | 23 |
| May 1-14, 02 | | | 0.8 | 0.00 | 0.02 | 755 | 464 | 14 | 29251 | 0.09 | 0.00 | 302 | 0 | 52 | 241 | 23 |
| May 15-19, 02 | | | Trace | 0.00 | 0.02 | 750 | 464 | 14 | 29251 | 0.09 | 0.00 | 295 | 0 | 51 | 236 | 23 |
| May 20-31, 02 | Strip till bed conditioner Planter, ridge till | Sorghum, grain | 0.2 | 0.01 | 0.00 | 6 | 5 | 2 | 100004 | 0.13 | 0.02 | 542 | 548 | 137 | 651 | 14 |
| Jun 1-14, 02 | | | Trace | 0.17 | 0.02 | 112 | 85 | 5 | 100004 | 0.12 | 0.02 | 434 | 516 | 129 | 593 | 14 |

**Figure 13** Surface cover (13%) needed after planting to nearly meet tolerable soil loss (T).

# Exercise 3 - South Dakota: Templates and Add Irrigation 6/17/12

**Skill Building:**

1. Call up a template management run with fallow, make a run, calibrate the run
2. Replace the fallow with sorghum, make two more runs (one calibration),
3. Add irrigation.
4. How to change orientation in a field operation
5. Remove the winter wheat leaves over winter with a special operation. Winter wheat is prone to have the leaves freeze dry off over winter.

**Scenario:**

1. Region Shape: **160 ac square** (X= 2640 ft; Y=x2640 ft.)
2. Orientation: **The field orientation** is 45 degrees from North
3. Location: **South Dakota**.
4. County **Haakon County**
5. **CLIGEN** station is Milesville
6. **WINDGEN** station is **interpolated**
7. Critical dominate Soil Map Unit is **CRAFT_Cv_85_VFSL**.
8. Existing cropping system is **Winter Wheat-Fallow.**
9. Consider adding **sorghum dry land or corn if irrigated.**
10. Management includes a **fall chisel at a 45 degree angle** to the field borders after the winter wheat harvest
11. From the Conservation Plan Inventory the average crop yield goals are:
    **Winter Wheat - 40 bu/ac/yr Sudangrass - 1.5 ton/ac/yr.**
12. The example crop management file is *Wheat, winter; fallow; Conv, CMZ5.man***.**

Change the field Orientation to 45.0 degrees. The green field orientation will rotate right. -45 (negative 45) will rotate the field orientation to the left 45 degrees

Click the Man black down arrow icon, select Templates/Example Management/*WWheat-fallow, Conv, CMZ5.man*.

An alternative way to open the template file is the 'Man' button. Open the MCREW Management editor by Click 'File', then 'Open Copy of Template' and load *WWheat-fallow, Conv, CMZ5.man* into the editor. Highlight all operations, right click the Row/Ridge Dir. (Deg.) column, **Set to 45 deg**.

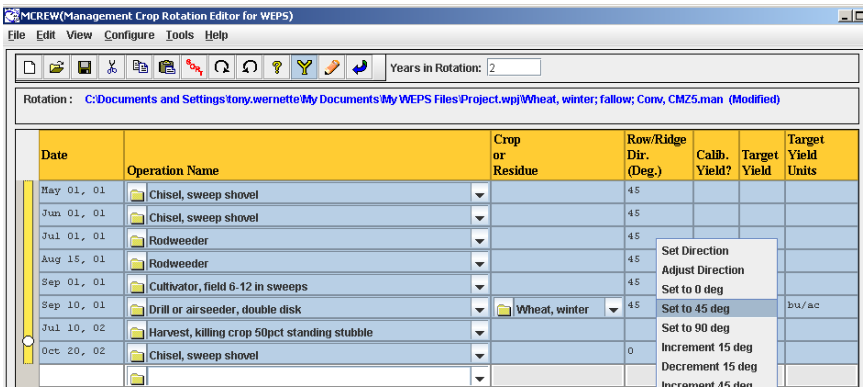
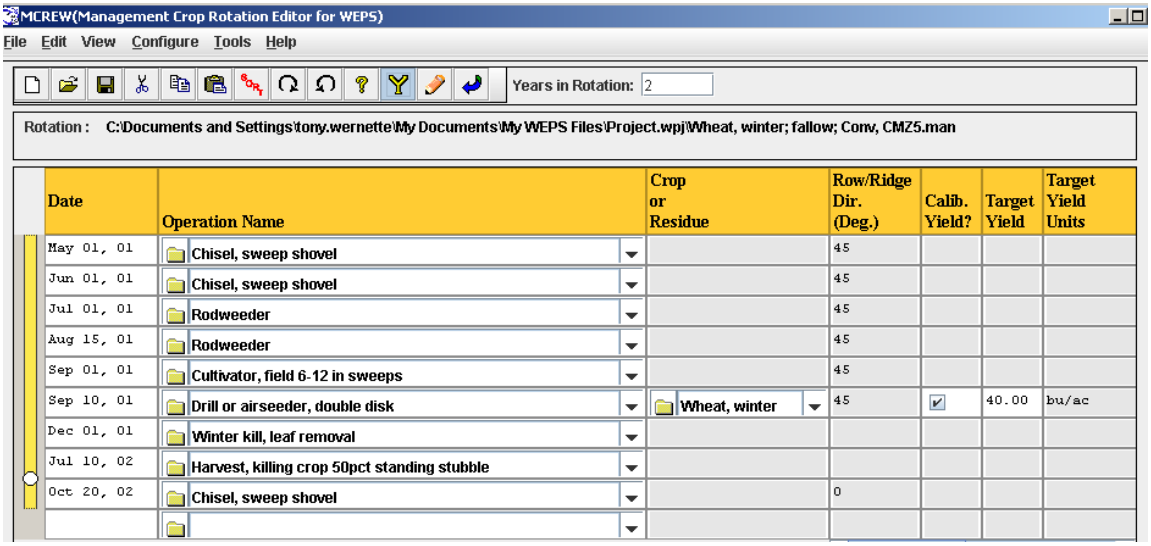



**Figure 1** Showing the base management with all operations except the harvest and Fall Chisel highlighted and the set to 45 selected.

Note: All degree settings, including field orientation and tillage direction, are measured from 0 degrees (i.e., North). The fall chisel (Oct 20, 02) direction should be **0** or North because the field angle is 45 degrees. The answer will be different you do not make these changes.

**Right click** the harvest row on July 10 year 2 and insert an operation. Add the 'winters kill leaf removal' operation. Change the date to December 1 year 1. Figure 2 shows what the corrected management file should look like.




| Date | Operation Name | Crop or Residue | Row/Ridge Dir. (Deg.) | Calib. Yield? | Target Yield | Target Yield Units |
|---|---|---|---|---|---|---|
| May 01, 01 | Chisel, sweep shovel | | 45 | | | |
| Jun 01, 01 | Chisel, sweep shovel | | 45 | | | |
| Jul 01, 01 | Rodweeder | | 45 | | | |
| Aug 15, 01 | Rodweeder | | 45 | | | |
| Sep 01, 01 | Cultivator, field 6-12 in sweeps | | 45 | | | |
| Sep 10, 01 | Drill or airseeder, double disk | Wheat, winter | 45 | ☑ | 40.00 | bu/ac |
| Dec 01, 01 | Winter kill, leaf removal | | | | | |
| Jul 10, 02 | Harvest, killing crop 50pct standing stubble | | | | | |
| Oct 20, 02 | Chisel, sweep shovel | | 0 | | | |
| | | | | | | |

**Figure 2** The winter wheat-fallow file with the winter kill, leaf removal operation added.

Click the Yield Calibrate button to turn on the yield function, check to see that 40 bu/ac is the yield, and click the Return button to return to the main interface and save the management file.

From the exercise soil directory. Select **Craft_Cv_85_VFSL.ifc soil**

**Step 2:** Make a Yield Calibration WEPS Run and name the run *WWheat-Follow, Conv, CMZ5 cal*. The soil loss is **38 ton/ac** and the Biomass Adjustment Factor is **0.766.** Use this Biomass Adjustment Factor in the project. In MCREW click the yield calibration see if the BAF is 0.766.

**Erosion**

| Period | Crop/Residue | Gross Loss t/ac | Net Soil Loss From Field ( t/ac ) Total | Creep/Salt | Suspen | PM10 |
|---|---|---|---|---|---|---|
| Rot. year: 1 | | 68.8 | 68.8 | 16.9 | 51.9 | 1.52 |
| Rot. year: 2 | Wheat, winter | 7.1 | 7.1 | 1.5 | 5.7 | 0.17 |
| Ave. Annual | | 38.0 | 37.9 | 9.2 | 28.8 | 0.84 |

**Crop Interval Erosion**

| Date Range | Crop | Gross Loss t/ac | Net Soil Loss From Field ( t/ac ) Total | Creep/Salt | Suspen. | PM10 |
|---|---|---|---|---|---|---|
| Jul 11, 02 - Jul 10, 02 | Wheat, winter | 75.9 | 75.9 | 18.3 | 57.5 | 1.69 |

**Harvests**

| Date | Crop | Residue lb/ac | Harvest Yield | Yield % Moisture |
|---|---|---|---|---|
| Jul 10, 02 | Wheat, winter | 3,941 | 38.4 bu/ac | 10.9 |

**Figure 3** Showing WW-Fallow rotation soil loss with the VFSL soil and winter leaf removal.

**Add Sudangrass**

Replace the fallow with a short Sudangrass forage crop. **Note** *that forage crops are not calibrated. WEPS will grow the crop without calibration. This may change in future versions, but for now (Version 1.2.9) do not calibrate forage crops.*

Open up the management editor again. Make a new management file called *Wheat, winter-Sudangrass, forage, Conv, CMZ5.man*, by clicking 'File', 'Save as...' and type the new name and click 'Save'.

Reverse the order of the crop sequence by clicking the roll back button, and then click the sort button.

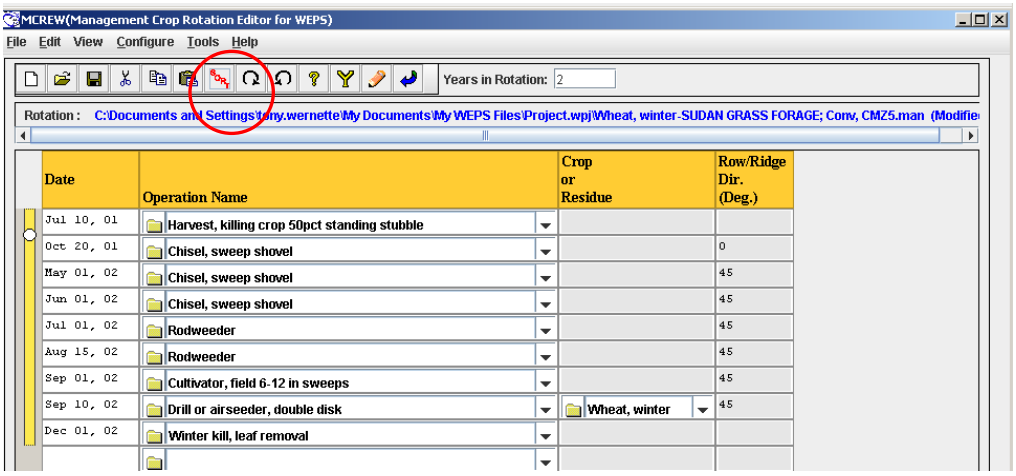



**Figure 4** Showing what the sequence of operations look like before sorting

**Edit the file to add in the Sudangrass. Planting time for Sudangrass is April 15.**

- Add a chisel and a field cultivator to the file before planting Sudangrass.
- Add two days between each operation.
- Change the date of the second year spring chisel from 'May 01, 02' to 'Apr 11, 02'
- Right click the May 1 date cell on the *Chisel Sweep shovel opm.* Use 'Calendar Date' to change the date.
- Change the operation to a *Chisel, sweep shovel*. *Right Click* on the operation name and select "Change Operation".
- Right click the date on the next line (June 1), change the date to 'Apr 13, 02'.
- Change the operation to *Cultivator, field 6-12 in sweeps*.
- On the next line, change the date to 'Apr 15, 02' and operation to *Drill or air seeder, double disk*.
- Add the Sudangrass hay crop. The name is *Sorghum, forage*. Sudangrass is a type of sorghum.
- Change the 'Aug 15, 02' hay harvest date to 'Sep 01, 02'
- Change the operation to *Harvest, hay, no growth*.
- Set all tillage operations to 45 degrees except the Oct 20, 01' chisel stays at 0 degrees.
- See figure 5.
- Finally 'Save' the management.

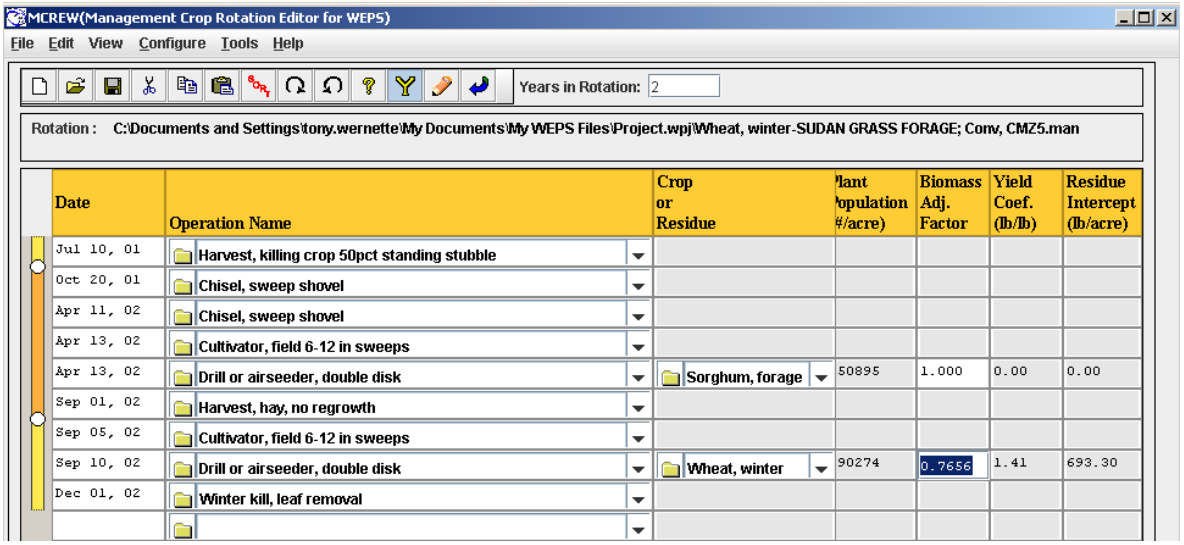



**Figure 5** Showing how the management should look with Sorghum hay added to the run...

Make the run and call it *Winter Wheat-Sudangrass, forage, Conv, CMZ5*. In the MCREW management editor screen see the S Bio Adj. Factor column. Check that winter wheat has a BAF of 0.766 value. Do not calibrate the run.

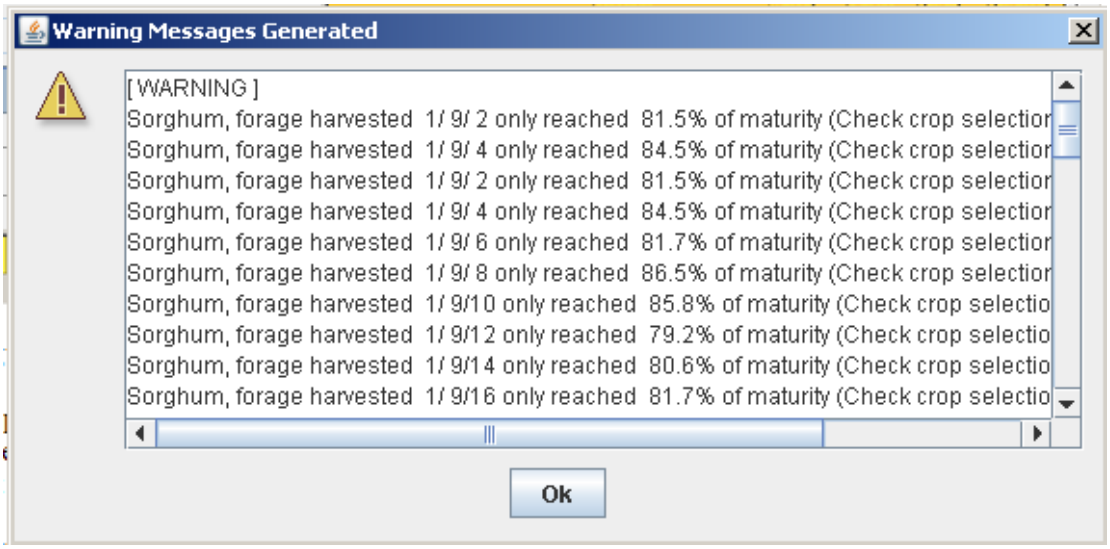
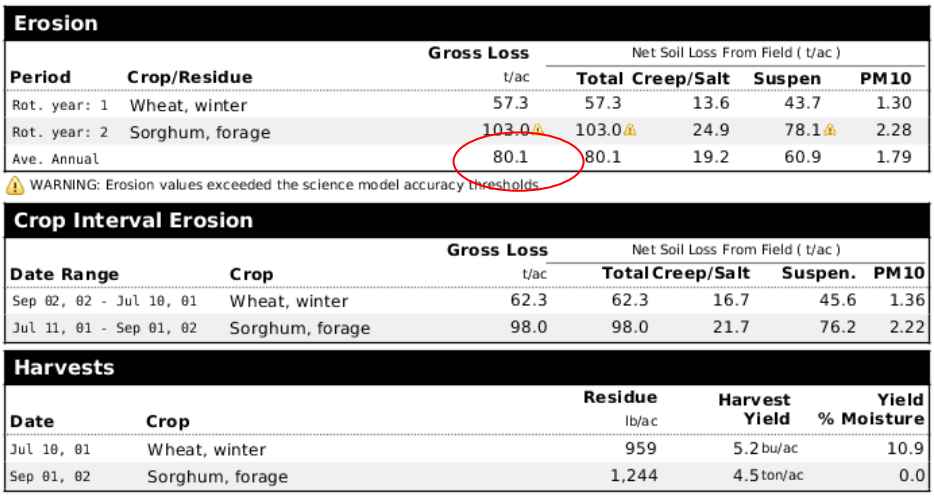



**Figure 6** Warning Message Generated by the Sorghum crop.

*The Sorghum generates warnings that the sorghum does not reach maturity. That is OK because annual hay is harvested before it matures to increase the feed quality of the forage. Click OK.*

Soil loss is now **80tons/ac/yr. See (Figure 7)**



**Erosion**

| Period | Crop/Residue | Gross Loss t/ac | Net Soil Loss From Field ( t/ac ) Total | Creep/Salt | Suspen | PM10 |
|---|---|---|---|---|---|---|
| Rot. year: 1 | Wheat, winter | 57.3 | 57.3 | 13.6 | 43.7 | 1.30 |
| Rot. year: 2 | Sorghum, forage | 103.0 | 103.0 | 24.9 | 78.1 | 2.28 |
| Ave. Annual | | 80.1 | 80.1 | 19.2 | 60.9 | 1.79 |

WARNING: Erosion values exceeded the science model accuracy thresholds

**Crop Interval Erosion**

| Date Range | Crop | Gross Loss t/ac | Net Soil Loss From Field ( t/ac ) Total | Creep/Salt | Suspen. | PM10 |
|---|---|---|---|---|---|---|
| Sep 02, 02 - Jul 10, 01 | Wheat, winter | 62.3 | 62.3 | 16.7 | 45.6 | 1.36 |
| Jul 11, 01 - Sep 01, 02 | Sorghum, forage | 98.0 | 98.0 | 21.7 | 76.2 | 2.22 |

**Harvests**

| Date | Crop | Residue lb/ac | Harvest Yield | Yield % Moisture |
|---|---|---|---|---|
| Jul 10, 01 | Wheat, winter | 959 | 5.2 bu/ac | 10.9 |
| Sep 01, 02 | Sorghum, forage | 1,244 | 4.5 ton/ac | 0.0 |

**Figure 7** Showing the soil loss with the sorghum forage added to the crop rotation.

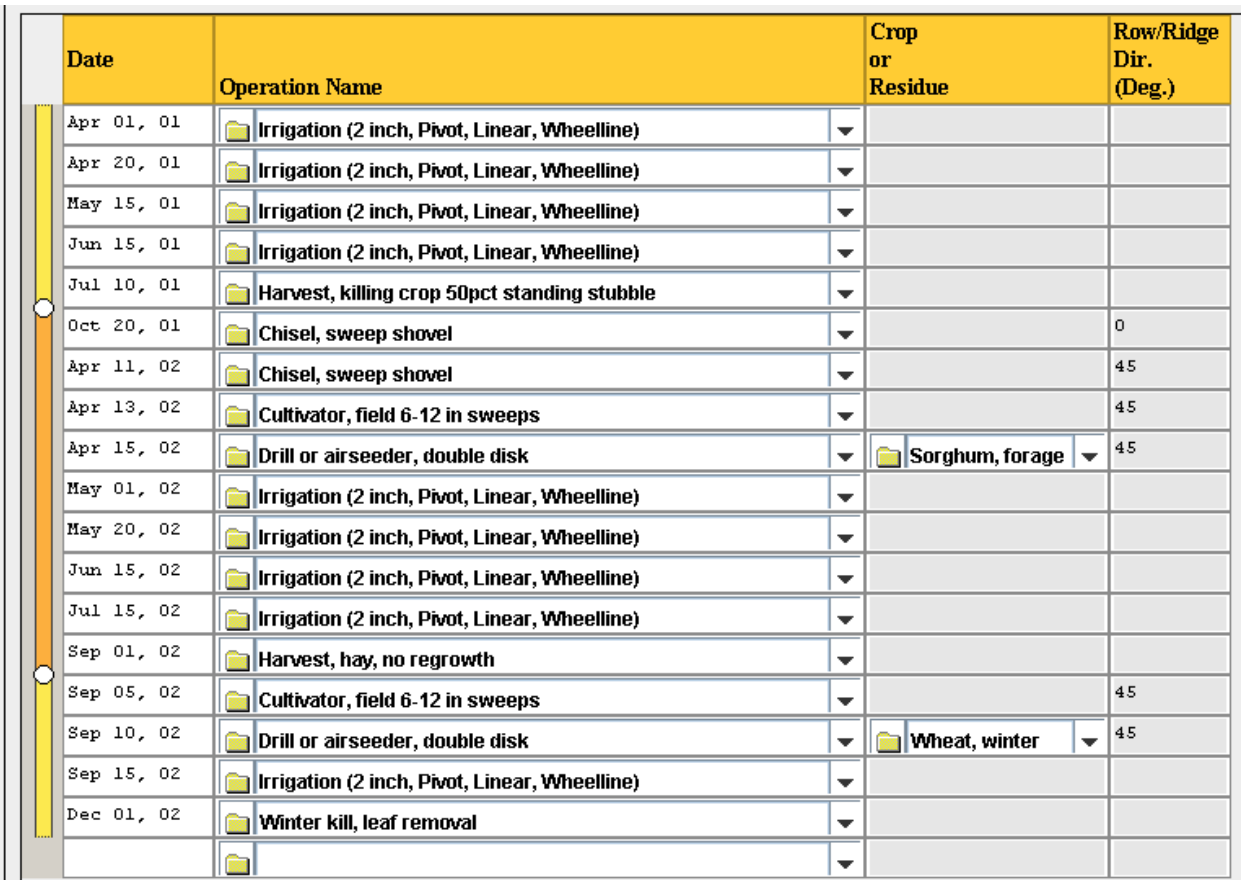
**Note:** The winter wheat yield is now: 5.2 bu/ac. The sorghum hay is taking all the moisture for the winter wheat crop. This is not a good rotation.

### Add Supplemental Irrigation

The producer can irrigate about 12 inches of water per year to the crops and would like to see the effect of irrigation on crop yield. This is a relatively easy question to answer.

**Step 1:** Open up the last management ran: *Wheat, winter-Sudangrass, forage, Conv, CMZ5.man*.

- Save a new version of this rotation by clicking ‘File’, ‘Save as...’
- Add irrigation to the name: *Wheat, winter-Sudangrass, forage, Conv, irr supplemental, CMZ5.man*.
- Right click the first line in the Operation Name column and insert an operation. Select, *Irrigation (2 inch, Pivot, Linear, Wheel line)*, and change the date to ‘Apr 01’ and year to ‘01’.
- Use the copy-paste function by right clicking on the irrigation operation just created and click ‘Copy Row(s)’. Now right click in the same row and click ‘Paste Row(s)’.
- Repeat this for four irrigation operations and change the dates to ‘Apr 01’, ‘Apr 20’, ‘May 15’, and ‘Jun 15’ in year ‘01’.
- The wheat also needs irrigation on ‘Sep 15’, of year ‘02’. Use the copy row function to add the irrigation for the Sudangrass.
- **The completed management window should look like Figure 8**.



| Date | Operation Name | Crop or Residue | Row/Ridge Dir. (Deg.) |
|---|---|---|---|
| Apr 01, 01 | Irrigation (2 inch, Pivot, Linear, Wheelline) | | |
| Apr 20, 01 | Irrigation (2 inch, Pivot, Linear, Wheelline) | | |
| May 15, 01 | Irrigation (2 inch, Pivot, Linear, Wheelline) | | |
| Jun 15, 01 | Irrigation (2 inch, Pivot, Linear, Wheelline) | | |
| Jul 10, 01 | Harvest, killing crop 50pct standing stubble | | |
| Oct 20, 01 | Chisel, sweep shovel | | 0 |
| Apr 11, 02 | Chisel, sweep shovel | | 45 |
| Apr 13, 02 | Cultivator, field 6-12 in sweeps | | 45 |
| Apr 15, 02 | Drill or airseeder, double disk | Sorghum, forage | 45 |
| May 01, 02 | Irrigation (2 inch, Pivot, Linear, Wheelline) | | |
| May 20, 02 | Irrigation (2 inch, Pivot, Linear, Wheelline) | | |
| Jun 15, 02 | Irrigation (2 inch, Pivot, Linear, Wheelline) | | |
| Jul 15, 02 | Irrigation (2 inch, Pivot, Linear, Wheelline) | | |
| Sep 01, 02 | Harvest, hay, no regrowth | | |
| Sep 05, 02 | Cultivator, field 6-12 in sweeps | | 45 |
| Sep 10, 02 | Drill or airseeder, double disk | Wheat, winter | 45 |
| Sep 15, 02 | Irrigation (2 inch, Pivot, Linear, Wheelline) | | |
| Dec 01, 02 | Winter kill, leaf removal | | |
| | | | |

**Figure 8** Showing how the management should look with the irrigation added.

**Note:** This example shows how to use supplemental irrigation. To use full irrigation to meet crop consumptive use, put a *Start Monitor (Pivot, Linear, Wheel line)* operation just after planting and an *Irritation, Stop Monitor* operation 15 days before harvest. This will auto-irrigate the crop during the growing season similar to the way Exercise 1 was run.

Change the Simulation Region “Shape” to **circle**, and type in **120 ac**

**Step 2:** Return to the main interface and make the run without calibration (Biomass Adjustment Factor set to 1.0 for wheat) to see how much additional yield the producer may get with the supplemental irrigation.

Call the run: *Wheat, winter-Sudangrass, forage, Conv, irr supplemental, CMZ5*.

**Erosion**

| Period | Crop/Residue | Gross Loss t/ac | Net Soil Loss From Field ( t/ac ) Total | Creep/Salt | Suspen | PM10 |
|---|---|---|---|---|---|---|
| Rot. year: 1 | Wheat, winter | 0.0 | 0.0 | 0.0 | 0.0 | 0.00 |
| Rot. year: 2 | Sorghum, forage | 0.2 | 0.2 | 0.1 | 0.2 | Trace |
| Ave. Annual | | 0.1 | 0.1 | Trace | 0.1 | Trace |

**Crop Interval Erosion**

| Date Range | Crop | Gross Loss t/ac | Net Soil Loss From Field ( t/ac ) Total | Creep/Salt | Suspen. | PM10 |
|---|---|---|---|---|---|---|
| Sep 02, 02 - Jul 10, 01 | Wheat, winter | 0.1 | 0.1 | 0.0 | 0.1 | 0.00 |
| Jul 11, 01 - Sep 01, 02 | Sorghum, forage | 0.1 | 0.1 | 0.0 | 0.1 | 0.00 |

**Harvests**

| Date | Crop | Residue lb/ac | Harvest Yield | Yield % Moisture |
|---|---|---|---|---|
| Jul 10, 01 | Wheat, winter | 5,714 | 61.1 bu/ac | 10.9 |
| Sep 01, 02 | Sorghum, forage | 2,361 | 7.8 ton/ac | 0.0 |

**Figure 9** Showing the non-calibrated supplemental irrigated run**.**

34 bu/ac is not close to the 60 bu/ac winter wheat expected yield. Run and calibrate yield to the 60 bu/ac needed. The soil loss should decrease from the 4.7 t/ac to 0.1 t/ac**. (figure 9).**

The Sudangrass will likely be harvested twice instead of one time. This is a good alternative if the price of hay can pay for the irrigation system. A strip-till or no-till, chem.-fallow system or Wind strip cropping may be good alternatives.

## Exercise 4 - Minnesota: Simulate a Cover Crop &Windbreak

**Skill Building:**

1. Start with the management template (main screen)
2. Add a fall winter wheat cover crop to protect the sugar beets during the first 40 days of growth.
3. Add a winter wheat cover crop after sugar beet harvest i.e. WEPS (version 1) can grow only one crop at a time.
4. Build a "work around" for these special management rotations.
5. Explore how to add a windbreak and see the effect on the annual wind erosion
6. Understanding Crop Tolerance to wind erosion

**Scenario:** Start the WEPS interface and enter the following information for the field:

1. **Region Shape** *Click* Select **Rectangle** long oriented east and west.
2. Field simulation area is (**X**-length **E-W** is 2640,) **press Enter** (**Y**-length **N-S** = is 1320**); press Enter** (80 ac.) should appear *(See Figure 1.Field Facts):*

3. **Location: State-** *Click* Minnesota

4. **County:** *Click* **Clay**,
   - CLIGEN station- **FARGO WB AIRPORT**
   - WINDGEN Station is **interpolated**.

4 **Soil Tab *Click*** Soil Templates/Exercise Soils: *Fodahl_426_90_LFS*.ifc. Note: The Conservation Plan field soil inventory determined the critical dominant soil is: **426 Foldahl loamy fine sand.** (13.4% or the most erodible by wind see Figure 1).

5 At the "**Man"** tab Man *Click* Templates/ Example Mgt. files. Select the crop rotation:

S Wheat-Beet-SB CMZ 1.man, (**Spring Wheat-Sugar beet-Soybean)**

Sugar beets are replanted one out of three years because of abrasion and "helicoptering" of the young beet plants by blowing soil.

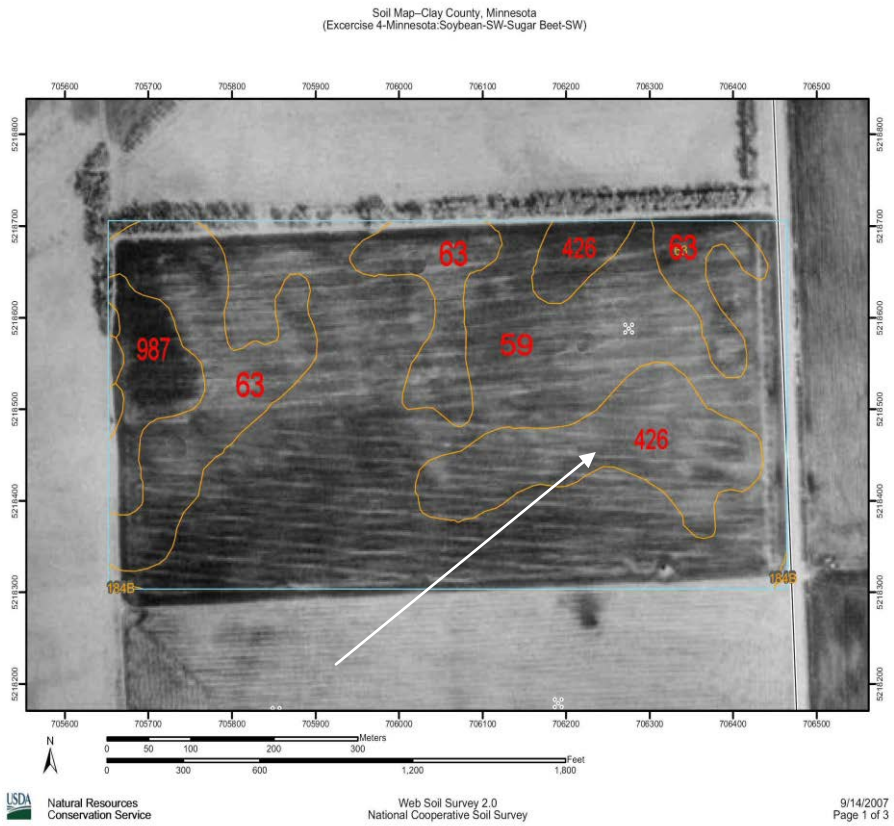



**Figure 1** Foldahl loamy fine sand (426) and the wind break on the north side of the 80 acre field.

From the Conservation Plan Inventory the average crop yield goals are:

- Spring Wheat: 45 bu/ac.
- Sugar beet: 20 ton/ac.
- Soybean: 40 bu/ac

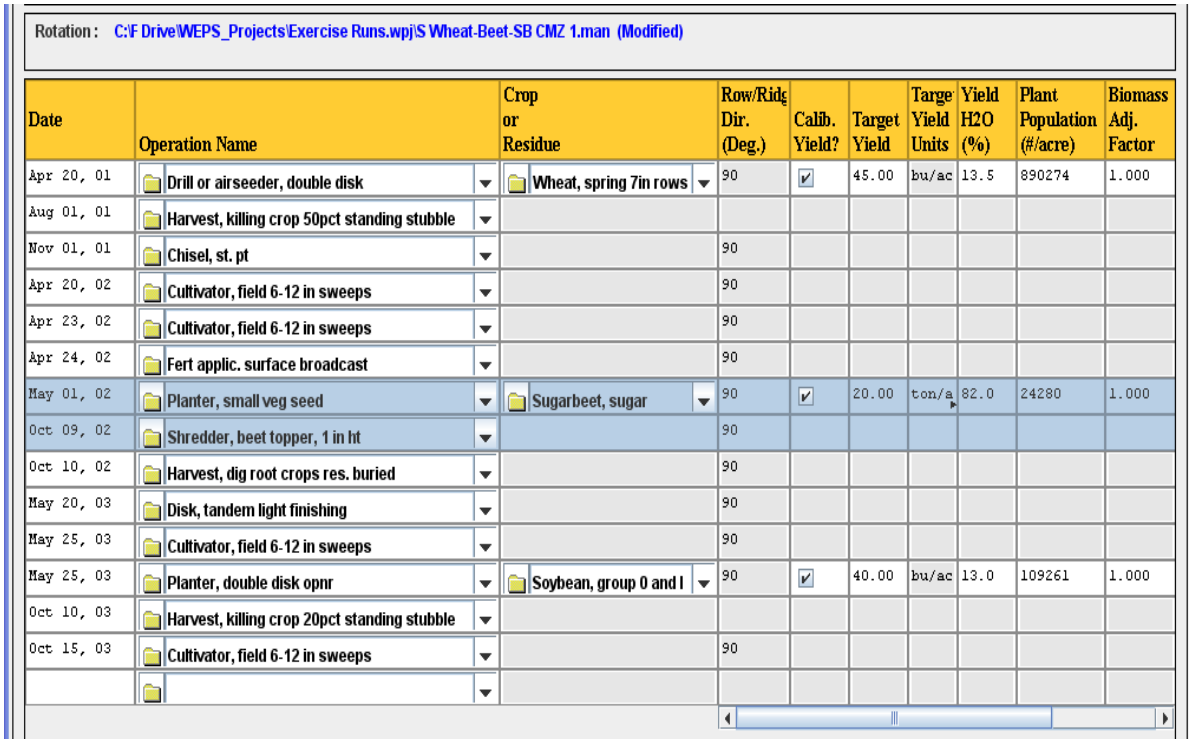
6 At "**Man"** tab Man *Click* Open MCREW *Click* the Yield Calibrate button Type/match the farm's crop yield goal for each crop to the Target Yield column. *Under the Calib. Yield*? See if the check mark is on.

7 With MCREW Editor open under the Row/Ridge Dir Change all tillage directions to 90 degrees (parallel to the long dimension). **See Figure 2**

*Click* the Cursor on the first line under the ROW/Ridge Dir (Deg) column
Hold down the **Shift button**
*Click* the Cursor on the last line.
*Right Click* and *Click* Set to 90 deg

8. *Click* the 'Return' button return to the main interface

Older versions of the management file may contain the "*Shredder, flail or rotary*" operation. It will need to be changed to the newer "*Shredder, beet topper*" operation.



Rotation : C:\F Drive\WEPS_Projects\Exercise Runs.wpj\S Wheat-Beet-SB CMZ 1.man (Modified)

| Date | Operation Name | Crop or Residue | Row/Ridg Dir. (Deg.) | Calib. Yield? | Target Yield | Targe Yield Units | Yield H2O (%) | Plant Population (#/acre) | Biomass Adj. Factor |
|---|---|---|---|---|---|---|---|---|---|
| Apr 20, 01 | Drill or airseeder, double disk | Wheat, spring 7in rows | 90 | ☑ | 45.00 | bu/ac | 13.5 | 890274 | 1.000 |
| Aug 01, 01 | Harvest, killing crop 50pct standing stubble | | | | | | | | |
| Nov 01, 01 | Chisel, st. pt | | 90 | | | | | | |
| Apr 20, 02 | Cultivator, field 6-12 in sweeps | | 90 | | | | | | |
| Apr 23, 02 | Cultivator, field 6-12 in sweeps | | 90 | | | | | | |
| Apr 24, 02 | Fert applic. surface broadcast | | 90 | | | | | | |
| May 01, 02 | Planter, small veg seed | Sugarbeet, sugar | 90 | ☑ | 20.00 | ton/a | 82.0 | 24280 | 1.000 |
| Oct 09, 02 | Shredder, beet topper, 1 in ht | | 90 | | | | | | |
| Oct 10, 02 | Harvest, dig root crops res. buried | | 90 | | | | | | |
| May 20, 03 | Disk, tandem light finishing | | 90 | | | | | | |
| May 25, 03 | Cultivator, field 6-12 in sweeps | | 90 | | | | | | |
| May 25, 03 | Planter, double disk opnr | Soybean, group 0 and I | 90 | ☑ | 40.00 | bu/ac | 13.0 | 109261 | 1.000 |
| Oct 10, 03 | Harvest, killing crop 20pct standing stubble | | | | | | | | |
| Oct 15, 03 | Cultivator, field 6-12 in sweeps | | 90 | | | | | | |
| | | | | | | | | | |

**Figure 2** Showing the correct management for the run. Note the Degs. are 90.

**IMPORTANT!** If the Management file background is not **blue** open MCREW again, Click File Save as same as above add .cal at the end of the file name.
*Click* the 'Return' button to return the main interface

The current Run is on the Man line with a **blue** background and cal at the end of the file name. Close MCREW Save Current Management File ***Click*** ***Yes*.**
***Click*** **the Calibrate Run** , to calibrate the run.
At the Run Name type in a new run name: *S Wheat-Beet-SB CMZ 1.cal. man***.**
*Click* OK (WEPS will run 150 years) WAIT until Done!
*Click Use in Current Project. Click OK* or Close.

8 Note the Following in the RUN SUMMARY : (Figure 3)
Average Annual soil Loss is: 21 tons/ac/yr
Check to see if Harvest Yields are within 5% of Target yield (1 ton and 2 bu)

9 Record the **Biomass Adjustment Factor (BAF)** for each crop and the yield
SW BAF is 1.225
S Beets BAF is 1.075
Soys BAF is 1.150

**Erosion**

| Period | Crop/Residue | Gross Loss t/ac | Net Soil Loss From Field ( t/ac ) Total | Creep/Salt | Suspen | PM10 |
|---|---|---|---|---|---|---|
| Rot. year: 1 | Wheat, spring 7in rows | 0.7 | 0.7 | 0.2 | 0.5 | 0.02 |
| Rot. year: 2 | Sugarbeet, sugar | 25.1 | 25.1 | 7.3 | 17.8 | 0.57 |
| Rot. year: 3 | Soybean, group 0 and I | 39.8 | 39.8 | 10.9 | 28.9 | 0.97 |
| Ave. Annual | | 21.9 | 21.9 | 6.1 | 15.7 | 0.52 |

**Crop Interval Erosion**

| Date Range | Crop | Gross Loss t/ac | Net Soil Loss From Field ( t/ac ) Total | Creep/Salt | Suspen. | PM10 |
|---|---|---|---|---|---|---|
| Oct 11, 03 - Aug 01, 01 | Wheat, spring 7in rows | 0.7 | 0.7 | 0.3 | 0.5 | 0.02 |
| Aug 02, 01 - Oct 10, 02 | Sugarbeet, sugar | 1.6 | 1.6 | 0.5 | 1.0 | 0.04 |
| Oct 11, 02 - Oct 10, 03 | Soybean, group 0 and I | 63.3 | 63.3 | 17.6 | 45.7 | 1.51 |

**Harvests**

| Date | Crop | Residue lb/ac | Harvest Yield | Yield % Moisture |
|---|---|---|---|---|
| Aug 01, 01 | Wheat, spring 7in rows | 3,294 | 43.6 bu/ac | 13.5 |
| Oct 10, 02 | Sugarbeet, sugar | 0 | 19.9 ton/ac | 82.0 |
| Oct 10, 03 | Soybean, group 0 and I | 2,219 | 38.9 bu/ac | 13.0 |

**Figure 3** Note the yield and soil loss for the run.

The conservation plan inventory identified sugar beet plant damage by wind erosion as a resource concern.

*Click* **Open the Detailed Report**. *Click* Scroll down to find the soil loss for the period just after the beets are planted.

Fm: Tr: Fld:
Management: S Wheat-Beet-SB CMZ 1
Soil: Foldahl_426_90_LFS

| Date | Operation | Crop | Average Total Gross Soil Loss t/ac | Canopy Cover fraction | Effective Standing Silhouette ft²/ft² | Leaf and Stem Mass lbs/acre | Root Mass lbs/acre | Cr |
|---|---|---|---|---|---|---|---|---|
| Mar 15-31, 02 | | | | | | | | |
| Apr 1-14, 02 | | | 0.0 | 0.00 | 0.00 | 0 | 0 | |
| Apr 15-19, 02 | | | 0.0 | 0.00 | 0.00 | 0 | 0 | |
| Apr 20-22, 02 | Cultivator, field 6-12 in sweep | | 0.0 | 0.00 | 0.00 | 0 | 0 | |
| Apr 23-23, 02 | Cultivator, field 6-12 in sweep | | 0.0 | 0.00 | 0.00 | 0 | 0 | |
| Apr 24-30, 02 | Fert applic. surface broadcast | | 0.2 | 0.00 | 0.00 | 0 | 0 | |
| May 1-14, 02 | Planter, small veg seed | Sugarbeet, sugar | 0.2 | 0.00 | 0.00 | 1 | 1 | |
| May 15-31, 02 | | | 0.4 | 0.05 | 0.00 | 42 | 25 | |
| Jun 1-14, 02 | | | 0.5 | 0.43 | 0.13 | 501 | 607 | |
| Jun 15-30, 02 | | | 0.0 | 0.77 | 0.48 | 1304 | 3424 | |
| Jul 1-14, 02 | | | 0.0 | 0.85 | 0.76 | 2221 | 6523 | |
| Jul 15-31, 02 | | | 0.0 | 0.88 | 1.00 | 3099 | 9371 | |
| Aug 1-14, 02 | | | 0.0 | 0.89 | 1.10 | 3463 | 10501 | |

**Figure 4** Detailed Report showing the erosion rates after planting circled.

**What is the sum of soil lost just after planting the beets?**

**Answer:** The first three periods sum to 1.1 ton/ac **(Figure 4)**
Sugar beet have a 0.0 - 0.5 ton/ac or very low crop tolerance to abrasion from Saltation. (See Crop Tolerance Table 1 in the Introduction).

**Does this run meet the quality criteria for the resource concerns identified?** No, the crop tolerance erosion rate for sugar beet is less than the erosion rate at planting emergence and the soil loss is greater than T.

**Close the Detailed Report (X)**

**Alternative 1: Evaluate the North windbreak. Run WEPS with a windbreak**

From the Conservation Plan Inventory a single row elm windbreak was noted on the North field border. The trees are 25 foot tall and 20 feet in width. Porosity is 50% leaf on during the critical period.

**In the 'Barriers' panel on the right side of the main interface:**
*Click* the radio button  next to the 'N' (see Figure 5). Notice that a yellow bar appears on the north side of the X & Y simulation area placing a barrier on the north side (N) of the field.
*Click* the down arrow  next to the barrier in the 'Barrier' panel.

***Scroll down*, *Click*** select '**Tree 1r decd 20yr leaf on**'. Notice the barrier bar is red and a barrier type is selected (Figure 5).

*Click* the '**Edit Selected Barrier**' 

a window appears to describe the Elm tree windbreak on the North field edge

Width is 20 ft; Height is 25 ft;
Porosity fraction in April is (50%) *Type in exactly* 0.50!

*Click* *'OK'*. Notice the N barrier has '<mod>' added in front of the name indicating the barrier properties were modified by the user.

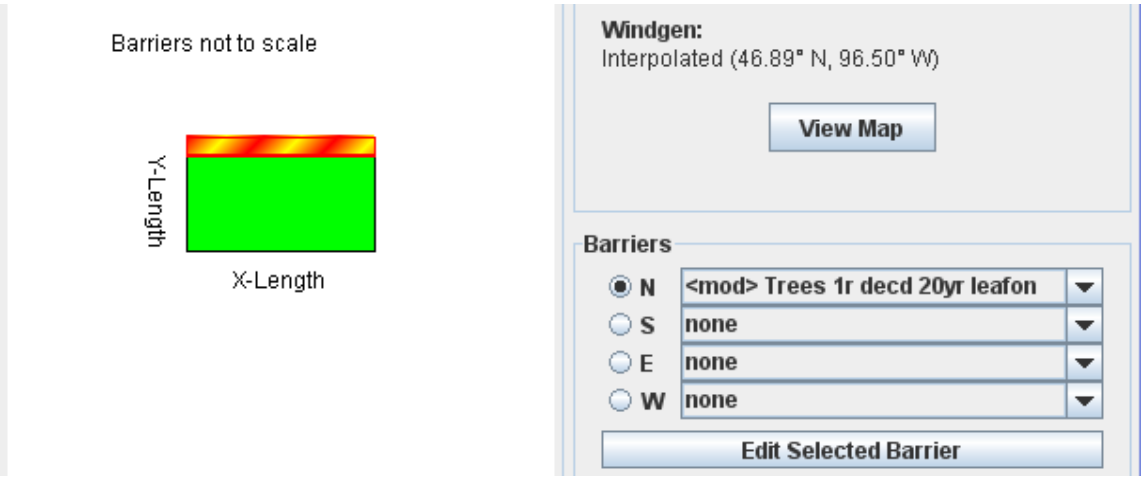



**Figure 5** Windbreak added to the north side of the field and the record modified.

On the main tool bar name the run *S Wheat-Beet-SB, windbreak CMZ 1 cal*. or E4 R2 W break.cal.

Hit the Run button, *Click OK! (Runs for 150 years)* **Wait this is Slow.**

**Erosion**

| Period | Crop/Residue | Gross Loss t/ac | Net Soil Loss From Field ( t/ac ) Total | Creep/Salt | Suspen | PM10 |
|---|---|---|---|---|---|---|
| Rot. year: 1 | Wheat, spring 7in rows | 0.5 | 0.4 | 0.1 | 0.3 | 0.01 |
| Rot. year: 2 | Sugarbeet, sugar | 16.9 | 15.9 | 5.1 | 10.9 | 0.36 |
| Rot. year: 3 | Soybean, group 0 and I | 28.6 | 25.3 | 6.8 | 18.5 | 0.67 |
| Ave. Annual | | 15.3 | 13.9 | 4.0 | 9.9 | 0.35 |

**Crop Interval Erosion**

| Date Range | Crop | Gross Loss t/ac | Net Soil Loss From Field ( t/ac ) Total | Creep/Salt | Suspen. | PM10 |
|---|---|---|---|---|---|---|
| Oct 11, 03 - Aug 01, 01 | Wheat, spring 7in rows | 0.5 | 0.4 | 0.1 | 0.3 | 0.01 |
| Aug 02, 01 - Oct 10, 02 | Sugarbeet, sugar | 1.2 | 1.0 | 0.2 | 0.8 | 0.03 |
| Oct 11, 02 - Oct 10, 03 | Soybean, group 0 and I | 44.3 | 40.2 | 11.6 | 28.6 | 1.00 |

**Harvests**

| Date | Crop | Residue lb/ac | Harvest Yield | Yield % Moisture |
|---|---|---|---|---|
| Aug 01, 01 | Wheat, spring 7in rows | 3,294 | 43.6 bu/ac | 13.5 |
| Oct 10, 02 | Sugarbeet, sugar | 0 | 19.9 ton/ac | 82.0 |
| Oct 10, 03 | Soybean, group 0 and I | 2,219 | 38.9 bu/ac | 13.0 |

**Figure 6** Soil losses with the windbreak.

**Scroll down in the run summary Note:** The windbreak reduced average annual soil loss from 22 tons (about 7 tons) to 15 t/ac. comparing figures 3 & 6. Multiplying 80 acres by 7 ton/acre with the Elm windbreak saves about 560 tons of soil per year on a field basis. Also notice that the Total Net Soil Loss from Field Total (13.9 ton/ac) is lower than the gross loss 15.3 t/ac. This is because during storms with a southerly wind, soil is deposited in front of the windbreak before leaving the field.

*Close the Run Summary Report (X)*

**Open the Detailed Report**.  . Scroll down to find the soil loss 30 days after the beets are planted. Under the Erosion column note a 0.9 t/ac soil loss after planting sugar beets is still too high for beet seedlings (Figure 7)

Fm: Tr: Fld:
Management: S Wheat-Beet-SB CMZ 1
Soil: Foldahl_426_90_LFS

| Date | Operation | Crop | Total Gross Soil Loss | Canopy Cover | Effective Standing Silhouette | Leaf and Stem Mass | Root Mass | Crop Heigh |
|---|---|---|---|---|---|---|---|---|
| | | | t/ac | fraction | ft²/ft² | lbs/acre | lbs/acre | in |
| Apr 23-23, 02 | Cultivator, field 6-12 in sweep | | 0.0 | 0.00 | 0.00 | 0 | 0 | |
| Apr 24-30, 02 | Fert applic. surface broadcast | | 0.1 | 0.00 | 0.00 | 0 | 0 | |
| May 1-14, 02 | Planter, small veg seed | Sugarbeet, sugar | 0.2 | 0.00 | 0.00 | 1 | 1 | |
| May 15-31, 02 | | | 0.3 | 0.05 | 0.00 | 42 | 25 | |
| Jun 1-14, 02 | | | 0.4 | 0.43 | 0.13 | 501 | 607 | 1 |
| Jun 15-30, 02 | | | 0.0 | 0.77 | 0.48 | 1304 | 3424 | 1 |
| Jul 1-14, 02 | | | 0.0 | 0.85 | 0.76 | 2221 | 6523 | 2 |
| Jul 15-31, 02 | | | 0.0 | 0.88 | 1.00 | 3099 | 9371 | 2 |
| Aug 1-14, 02 | | | 0.0 | 0.89 | 1.10 | 3463 | 10501 | 2 |

**Figure 7** Soil loss for sugar beets after the windbreak was added**.**

**Alternative 2 Add a Winter Wheat Cover crop**
Sugar beets can blow out once every 3 years after planting and the farmer wants to sow beets into a living winter wheat cover crop to reduce stand loss. This requires a special crop file and special operations to evaluate adding a Winter Wheat cover crop that grows simultaneous with beets. The NRCS State Agronomist must contact the National Wind Erosion Specialist to develop these files.

**Figure 8** Shows 6 inch tall winter wheat cover crop killed by spray after beet emergence.

*WEPS can only grow one crop at a time.* First model the winter wheat cover crop for the first 40 days, then switch to the sugar beets that are growing with the winter wheat cover crop. After the sugar beets and wheat grow for 40 days, postemerge spray to kill the winter wheat cover crop with Sethoxidim or Glyphosate (RR beets).

Click the 'Man' button [Man] to open MCREW, and make sure you have the original management file loaded: *S Wheat-Beet-SB CMZ 1.man*. (E 4 Run 1) Click 'File', 'Save as...' and rename the file *S Wheat, ww cover crop-Beet-SB, CMZ1.man*.

*Click* the 'Man' button [Man] to open MCREW, and make sure the Calibrated management S *Wheat-Beet-SB CMZ 1cal.man* is loaded
*Click* 'File', 'Save as' to save as a project! In the File name box name the project file: *S Wheat, ww cover crop-Beet-SB, CMZ1.man*.

*Click* Save! The Rotation line in MCREW will show this new file name. Open MCREW.

*Click* on one operation. Hold Shift and highlight all operations from Apr 24, 02 Fert. Applic. Back to the Harvest of the spring wheat on Aug 01, 01 to delete 3 rows
***Right Click*** left Click open pop up window and with Delete Rows delete all (3) operations
***Right Click*** *Insert Blank Row* 3 times after wheat harvest.

*Click* the down arrow [▼] Under NRCS operations on each line to Add 3 operations::
*Click* Chisel, st. pt; *(Chisel, st. pt.opm)*
*Click* Cultivator, field 6-12 in sweeps; (*Cultivator, field 6-12 in sweeps.opm)*
*Click* Drill or air seeder, double disk. (*Drill or air seeder double disk.opm)*

*Click* on Date then ***Right Click*** select calendar date. *Click* date desired. *Click* OK
***Repeat for each operation line*** *to match all the dates shown in Figure 9.*

Under the crop or residue column *Click* **the down arrow** pick *wheat winter cover crop*.
*This file is a standard winter wheat file that will grow about 100 lbs/ac biomass during the winter months and will provide about 1300 lbs/ac cover or more when the sugar beets are planted.*

*Place the cursor on the date to change the dates of all operations added.* The editor will assume the date of the previous operation as added.

*Click* the operation cell on 'May 01, 02'
*Click* open the operation zip file change the **Planter, small veg seed** to *Planter, into growing cover.opm*, **(Planter, into growing cover.)**
*This is a special planter operation that shows tilled ground on the planting date, but does not call in a growing sugar beet crop yet.*

In the next line **Operation name column** *Right Click* Insert an operation, *Sprayer, kill cover in growing crop*.

With the cursor on date *Right Click.* Open the calendar Change the date *'Jun 10, 02'*, 40 days after planting the cover crop. *Click* OK.
In the Crop or Residue column, *Click* find and select, *Sugar beet, growing after cover crop kill crop.* This is a modified Sugar beet file that will show some biomass growth in the roots and leaves on the date the beets are planted.

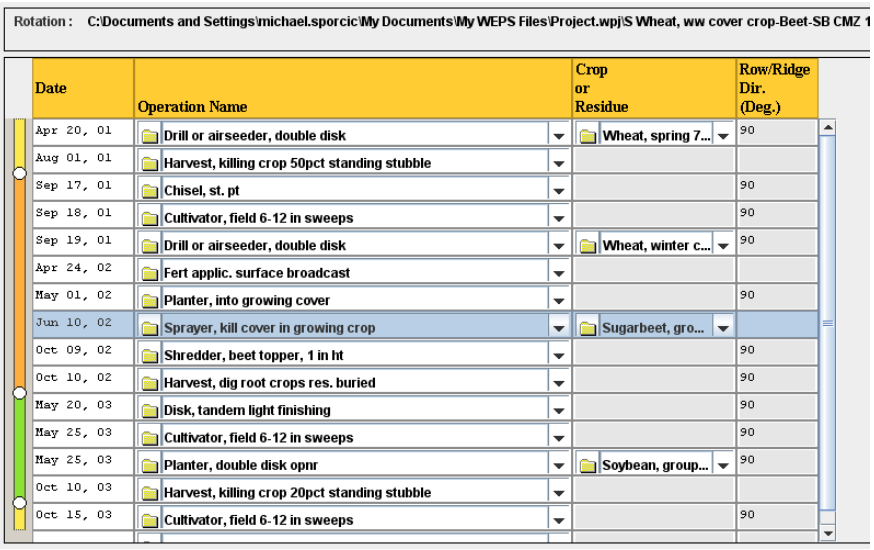



**Figure 9** Winter Wheat cover crop planted in the fall after Spring Wheat

*This logic is necessary when a growing cover crop is planted with a crop and then killed after both crops grow together (in this case 40 days for the sugar beets).*

*Check to see if all operations have the row direction set to 90 degrees*

.

*Click* the Yield Calibrate button and make sure the Winter Wheat cover crop line is unchecked because this is a forage crop and WEPS must control the cover crop growth. Do not calibrate the cover crop since it is not grown to maturity.

*Click* the 'Return' button to return the main interface.

**Step 2:** Leave the windbreak on the north side of the field in place. *Click* 'Calibrate Run' button to make a Calibration WEPS Run, call it:
*S Wheat, ww cover crop-Beets-SB, windbreak, CMZ 1 cal*.

**Erosion**

| Period | Crop/Residue | Gross Loss t/ac | Net Soil Loss From Field ( t/ac ) Total | Creep/Salt | Suspen | PM10 |
|---|---|---|---|---|---|---|
| Rot. year: 1 | Wheat, spring 7in rows | 0.8 | 0.7 | 0.3 | 0.5 | 0.02 |
| Rot. year: 2 | Sugarbeet, growing after covercrop kill | 4.3 | 4.0 | 1.4 | 2.6 | 0.09 |
| Rot. year: 3 | Soybean, group 0 and I | 9.7 | 8.4 | 2.4 | 6.0 | 0.23 |
| Ave. Annual | | 4.9 | 4.4 | 1.3 | 3.0 | 0.11 |

**Crop Interval Erosion**

| Date Range | Crop | Gross Loss t/ac | Net Soil Loss From Field ( t/ac ) Total | Creep/Salt | Suspen. | PM10 |
|---|---|---|---|---|---|---|
| Oct 11, 03 - Aug 01, 01 | Wheat, spring 7in rows | 0.4 | 0.3 | 0.1 | 0.3 | 0.01 |
| Aug 02, 01 - Oct 10, 02 | Sugarbeet, growing after covercrop kill | 0.5 | 0.5 | 0.2 | 0.3 | 0.01 |
| Oct 11, 02 - Oct 10, 03 | Soybean, group 0 and I | 13.8 | 12.3 | 3.7 | 8.5 | 0.32 |

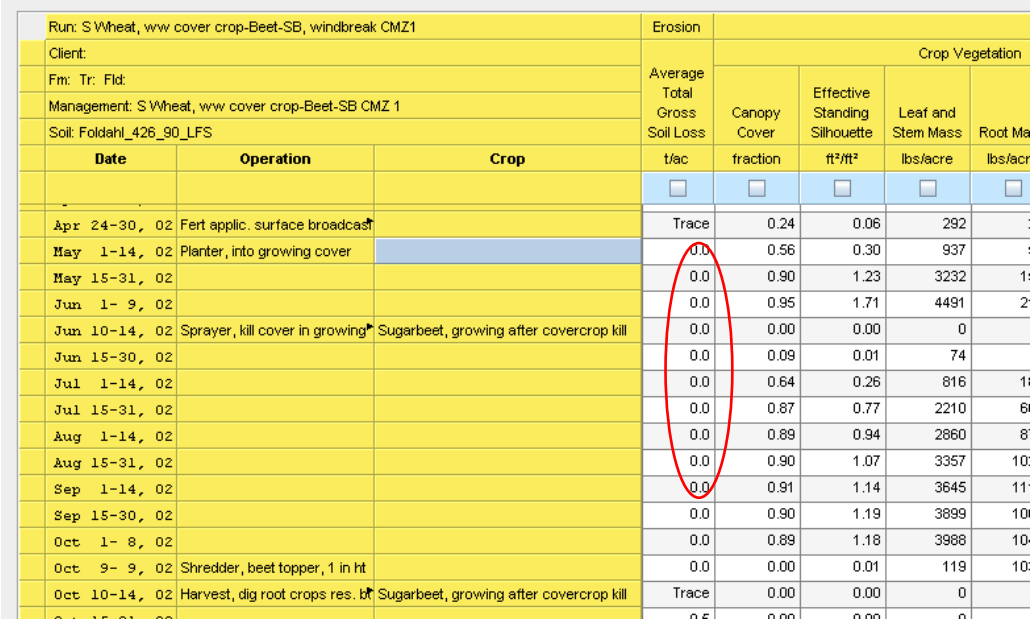
**Harvests**

| Date | Crop | Residue lb/ac | Harvest Yield | Yield % Moisture |
|---|---|---|---|---|
| Aug 01, 01 | Wheat, spring 7in rows | 3,305 | 43.8 bu/ac | 13.5 |
| Oct 10, 02 | Sugarbeet, growing after covercrop kill | 0 | 20.1 ton/ac | 82.0 |
| Oct 10, 03 | Soybean, group 0 and I | 2,237 | 39.2 bu/ac | 13.0 |

**Figure 10** Soil loss with the cover crop added and the windbreak.

**Note:** The beet biomass adjustment factor changed from 1.075 to 1.45, the others remained the same. WEPS adjusted the beet BAF to produce the 20 ton/ac yield. However, what effect does growing the winter wheat cover have on beets?. If moisture is short, beets may yield less**.** ***Click*** **"**Use in the Current Project" to save the new factors.

Open the Detailed Report: **What is the (ATG) soil loss after planting the sugar beets?** 0 t/ac/yr.



| Run: S Wheat, ww cover crop-Beet-SB, windbreak CMZ1 | | | Erosion | Crop Vegetation | | | |
|---|---|---|---|---|---|---|---|
| Client: | | | Average Total Gross Soil Loss | Canopy Cover | Effective Standing Silhouette | Leaf and Stem Mass | Root Ma |
| Fm: Tr: Fld: | | | | | | | |
| Management: S Wheat, ww cover crop-Beet-SB CMZ 1 | | | | | | | |
| Soil: Foldahl_426_90_LFS | | | | | | | |
| **Date** | **Operation** | **Crop** | t/ac | fraction | ft²/ft² | lbs/acre | lbs/acr |
| Apr 24-30, 02 | Fert applic. surface broadcast | | Trace | 0.24 | 0.06 | 292 | |
| May 1-14, 02 | Planter, into growing cover | | 0.0 | 0.56 | 0.30 | 937 | |
| May 15-31, 02 | | | 0.0 | 0.90 | 1.23 | 3232 | 1 |
| Jun 1- 9, 02 | | | 0.0 | 0.95 | 1.71 | 4491 | 2 |
| Jun 10-14, 02 | Sprayer, kill cover in growing | Sugarbeet, growing after covercrop kill | 0.0 | 0.00 | 0.00 | 0 | |
| Jun 15-30, 02 | | | 0.0 | 0.09 | 0.01 | 74 | |
| Jul 1-14, 02 | | | 0.0 | 0.64 | 0.26 | 816 | 1 |
| Jul 15-31, 02 | | | 0.0 | 0.87 | 0.77 | 2210 | 6 |
| Aug 1-14, 02 | | | 0.0 | 0.89 | 0.94 | 2860 | 8 |
| Aug 15-31, 02 | | | 0.0 | 0.90 | 1.07 | 3357 | 10 |
| Sep 1-14, 02 | | | 0.0 | 0.91 | 1.14 | 3645 | 11 |
| Sep 15-30, 02 | | | 0.0 | 0.90 | 1.19 | 3899 | 10 |
| Oct 1- 8, 02 | | | 0.0 | 0.89 | 1.18 | 3988 | 10 |
| Oct 9- 9, 02 | Shredder, beet topper, 1 in ht | | 0.0 | 0.00 | 0.01 | 119 | 10 |
| Oct 10-14, 02 | Harvest, dig root crops res. bl | Sugarbeet, growing after covercrop kill | Trace | 0.00 | 0.00 | 0 | |

**Figure 11** The fall cover crop of winter wheat eliminated plant damage to the beets and is predicted to keep wind erosion below crop tolerance (0-0.5 t/ac).

**Note:** The winter wheat cover crop reduced the wind erosion from 0.9 ton/ac to 0.0 for the sugar beet crop (Figure 10). This can save about $170/ac in reseeding cost and on lost yield potential.

***What about the combined effect of the north windbreak and winter wheat cover crop?***

With the windbreak in place and the winter wheat cover crop planted after the spring wheat, the 4.6 t/ac soil loss **does** meet the soil loss resource need.

The Detailed Report indicates soil loss is still above T with the highest wind erosion occurring after sugar beet harvest.

## Exercise 5 - Washington: Alfalfa Hay Calibration, Potato, Winter Wheat

**Skill Building:**

1. Simulates growing a forage crop cut for hay and adding another year of alfalfa under irrigation.
2. Irrigation can be:
    - added in preset amounts
    - added in a custom amounts,
    - applied as needed as the plant uses water

Many circles on a quarter section of land (160 acres) have 120 acres "under the iron". The circle includes an end gun that turns on and off in the corners as the pivot moves around the circle, allowing the producer to irrigate 130 acres. The erosive winds in spring are from the west and the tillage/planting direction is north and south. Potatoes are a high-dollar cash rental crop that must be rotated for disease and nematode control.

**Scenario:**

1. **Region Shape:** Circle **Area:** 130 ac. A pivot irrigation system with an end gun irrigates **130 acres**
2. **Orientation**: North 0 degrees
3. Location: **Washington**.
4. **Grant County** near **Moses Lake**
5. **CLIGEN Station is: Ephrata CAA AP.**
6. **Reset the Windgen Station.** Open the Map Viewer, Click the checkbox in the visible column that corresponds to 'Windgen Station…', and then double Click the **WINDGEN Station: Moses Lake/Grant Co**.
7. From the Exercise Soils folder, select the soil ***Quincy_97_100_FS.ifc***
8. Existing 5 year Crop Rotation is: **Alfalfa 3 yrs.-Potato-Winter Wheat**. If the alfalfa stand is good and the hay price is strong, they cut the hay for 4 years.
9. From the Example Mgt folder select ***Alfalfa, fall seed, 3yr-Potato-WWheat, circle irr CMZ49.ma*** file

From the Conservation Plan inventory the annual average yield goals are:

- **Alfalfa: 6.5 tons/acre,** cut 4 times on 30 day intervals
- **Potato: 30 tons/acre,** or 600 cwt/acre.
- **Winter wheat: 100 bushels/acre**.

WEPS can simulate crops cut multiple times in a growing season. However, *WEPS cannot calibrate forage crops in the same way as grain crops.* ***Do not calibrate the forage crops with WEPS.*** Any forage cutting with lower yield should not affect the erosion rate since there is more than enough cover to control erosion during a subsequent cutting. If the hay yield is low, do not reject the run unless there is substantial erosion occurring in the 2-week management period that includes the cutting.

Calibration is **important** for almost all other crops. Saving a calibrated crop to a local crop folder for use in future runs can save run time on later evaluations.

Edit the management file:

1. Click the management button on the main interface:
2. Click the Yield Calibrate button and check the yields for all the crops and make sure that all match the inventory (**Alfalfa, 6.5 ton/ac; Potato, 600 cwt/ac; W. wheat 100 bu/ac).**
3. **Do not** put a check mark in the "Calib. Yield?" column for Alfalfa. Click the Return button to save the management file and return to the main interface. (See Figure 1)

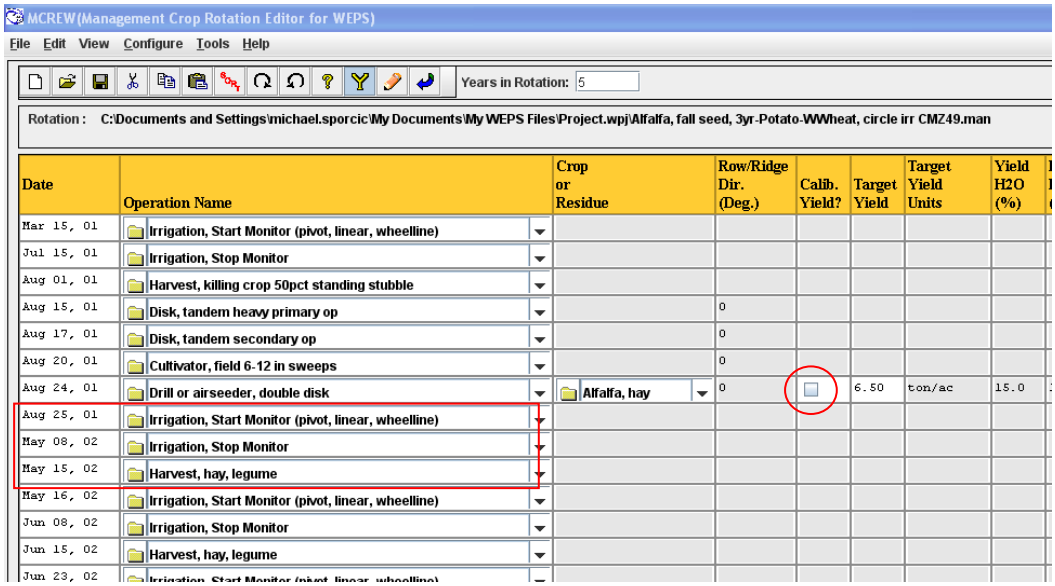



**Figure 1.** Do not check the Calibrate Yield box for forage crops

**Notice** the set up for alfalfa irrigations and harvests. Each harvest has an *Irrigation, Start Monitor (Pivot, Linear, and Wheel line); Irrigation, Stop Monitor;* and *Harvest, hay, legume* operation associated with the harvest (Figure 1). The date for the irrigation stop monitor is set to 7 days before harvest to allow the soil surface to dry out to cure the hay. Click to make a calibration run. Name the run *Alfalfa 3yr-Potato-WWheat, circle irr CMZ 49 cal*. *This is a 5 yr. rotation, so it will take several minutes to calibrate the run.*

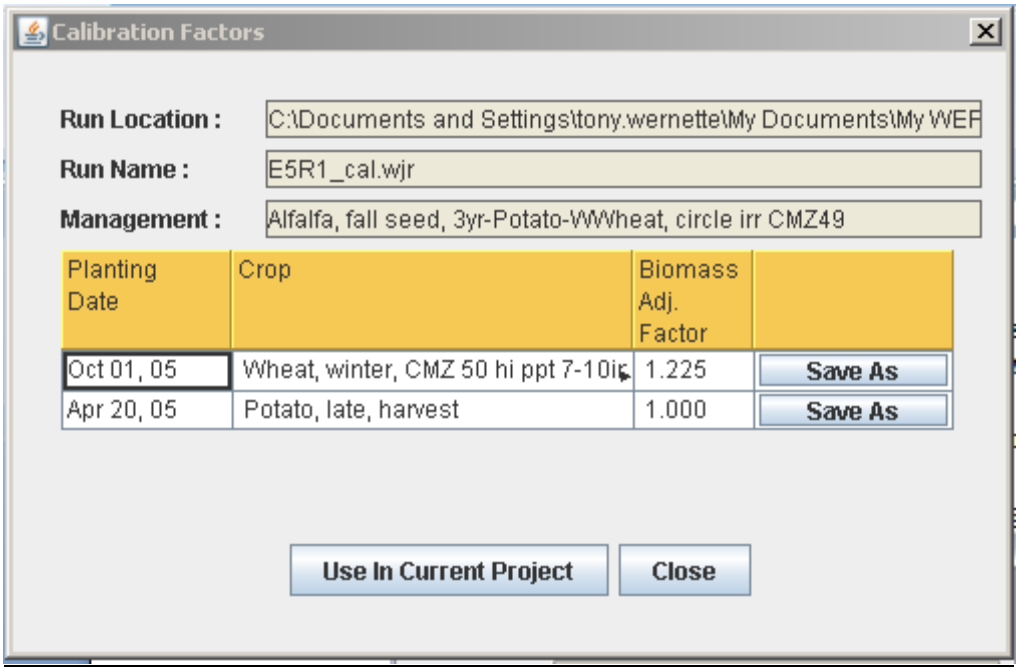
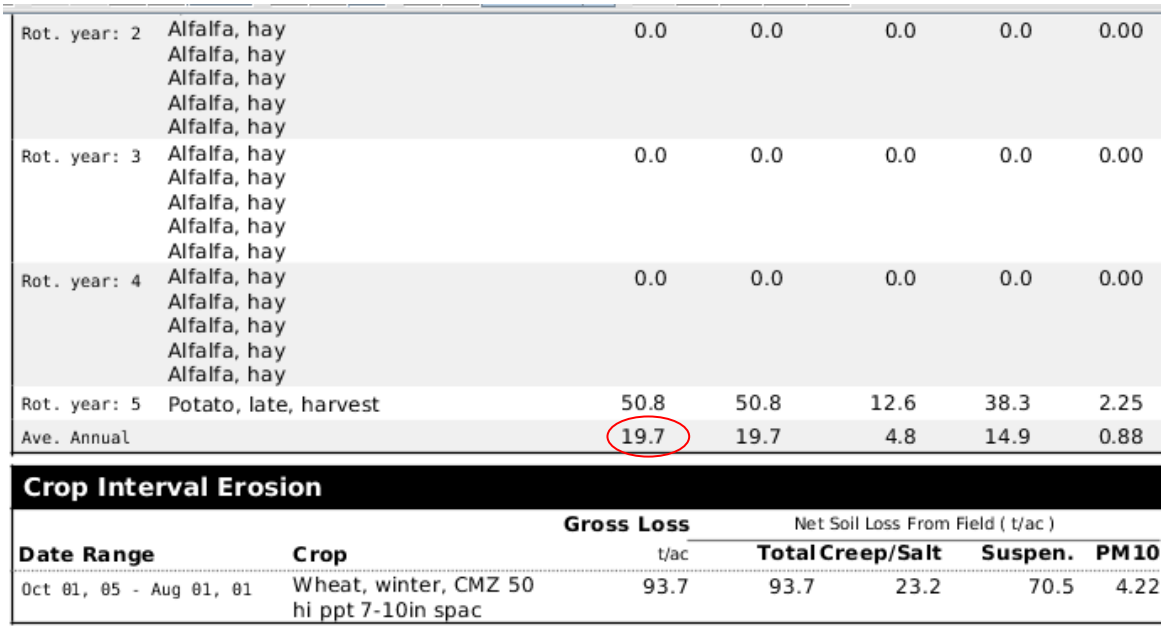



**Figure 2** Local calibration factors for Winter wheat and Potato

To save these calibrated crops for future runs, use the 'Save as...' option to store the Biomass Adjustment Factors for Winter wheat and Potato to a record in the local crops folder (Figure 2).

Click 'Use in Current Project'.



| | | | | | | |
|---|---|---|---|---|---|---|
| Rot. year: 2 | Alfalfa, hay<br>Alfalfa, hay<br>Alfalfa, hay<br>Alfalfa, hay<br>Alfalfa, hay | 0.0 | 0.0 | 0.0 | 0.0 | 0.00 |
| Rot. year: 3 | Alfalfa, hay<br>Alfalfa, hay<br>Alfalfa, hay<br>Alfalfa, hay<br>Alfalfa, hay | 0.0 | 0.0 | 0.0 | 0.0 | 0.00 |
| Rot. year: 4 | Alfalfa, hay<br>Alfalfa, hay<br>Alfalfa, hay<br>Alfalfa, hay<br>Alfalfa, hay | 0.0 | 0.0 | 0.0 | 0.0 | 0.00 |
| Rot. year: 5 | Potato, late, harvest | 50.8 | 50.8 | 12.6 | 38.3 | 2.25 |
| Ave. Annual | | 19.7 | 19.7 | 4.8 | 14.9 | 0.88 |

**Crop Interval Erosion**

| Date Range | Crop | Gross Loss t/ac | Net Soil Loss From Field ( t/ac ) Total | Creep/Salt | Suspen. | PM10 |
|---|---|---|---|---|---|---|
| Oct 01, 05 - Aug 01, 01 | Wheat, winter, CMZ 50 hi ppt 7-10in spac | 93.7 | 93.7 | 23.2 | 70.5 | 4.22 |

**Figure 3** Predicted average annual soil loss for calibration run

Look at the crop yields in the Run Summary (Figure 4).

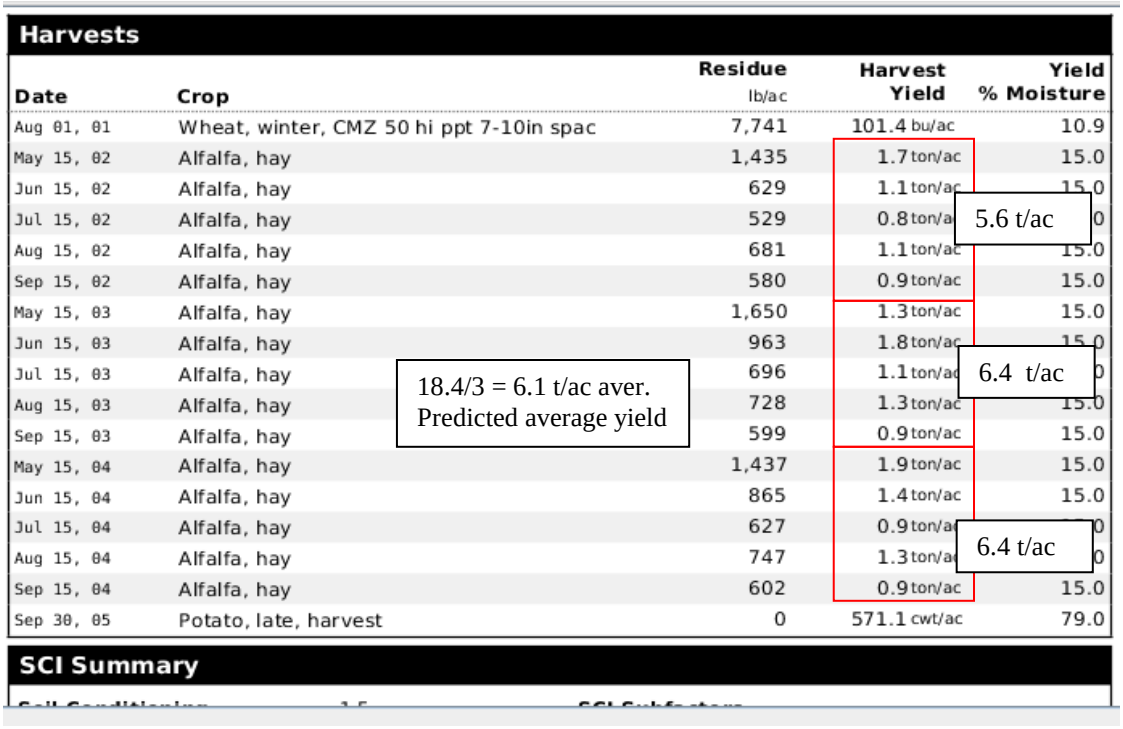
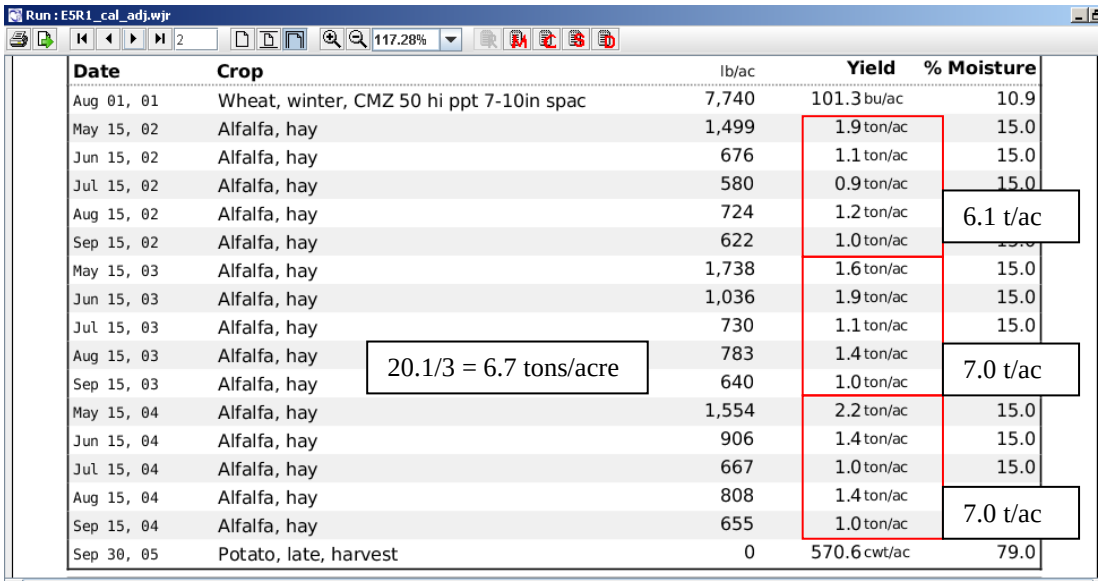



**Figure 4.** Predicted yields for Winter wheat, Potato and each Alfalfa cutting

WEPS cannot calibrate each cutting of hay per year. To adjust the average yield for all years adjust the Biomass Adjustment Factor manually. For this example, add up the yields for each of the three years and divide by 3 to determine the predicted average yield ((5.6 + 6.4 + 6.4)/3 = 6.1 tons/acre/ year). Divide the reported average yield goal by the predicted average yield to determine an appropriate manual Biomass Adjustment Factor (6.5/6.1 = 1.066).

Open the MCREW management editor yield-screen, and enter the manual Biomass Adjustment Factor for Alfalfa (1.066). Click to save the management file and return to the main interface.

Make a second run using the manual Biomass Adjustment Factor for Alfalfa. Use the same run name same as before with *Adj*. added to the end of the file name to indicate the Alfalfa yields were adjusted manually. The adjusted alfalfa yield is about 6.7 tons/acre, which is within 5 % of the reported yield (Figure 5).




| Date | Crop | lb/ac | Yield | % Moisture |
|---|---|---|---|---|
| Aug 01, 01 | Wheat, winter, CMZ 50 hi ppt 7-10in spac | 7,740 | 101.3 bu/ac | 10.9 |
| May 15, 02 | Alfalfa, hay | 1,499 | 1.9 ton/ac | 15.0 |
| Jun 15, 02 | Alfalfa, hay | 676 | 1.1 ton/ac | 15.0 |
| Jul 15, 02 | Alfalfa, hay | 580 | 0.9 ton/ac | 15.0 |
| Aug 15, 02 | Alfalfa, hay | 724 | 1.2 ton/ac | |
| Sep 15, 02 | Alfalfa, hay | 622 | 1.0 ton/ac | |
| May 15, 03 | Alfalfa, hay | 1,738 | 1.6 ton/ac | 15.0 |
| Jun 15, 03 | Alfalfa, hay | 1,036 | 1.9 ton/ac | 15.0 |
| Jul 15, 03 | Alfalfa, hay | 730 | 1.1 ton/ac | 15.0 |
| Aug 15, 03 | Alfalfa, hay | 783 | 1.4 ton/ac | |
| Sep 15, 03 | Alfalfa, hay | 640 | 1.0 ton/ac | |
| May 15, 04 | Alfalfa, hay | 1,554 | 2.2 ton/ac | 15.0 |
| Jun 15, 04 | Alfalfa, hay | 906 | 1.4 ton/ac | 15.0 |
| Jul 15, 04 | Alfalfa, hay | 667 | 1.0 ton/ac | 15.0 |
| Aug 15, 04 | Alfalfa, hay | 808 | 1.4 ton/ac | |
| Sep 15, 04 | Alfalfa, hay | 655 | 1.0 ton/ac | |
| Sep 30, 05 | Potato, late, harvest | 0 | 570.6 cwt/ac | 79.0 |

**Figure 5.** Increased Alfalfa yields with a 1.066 manual Biomass Adjustment Factor

**Erosion**

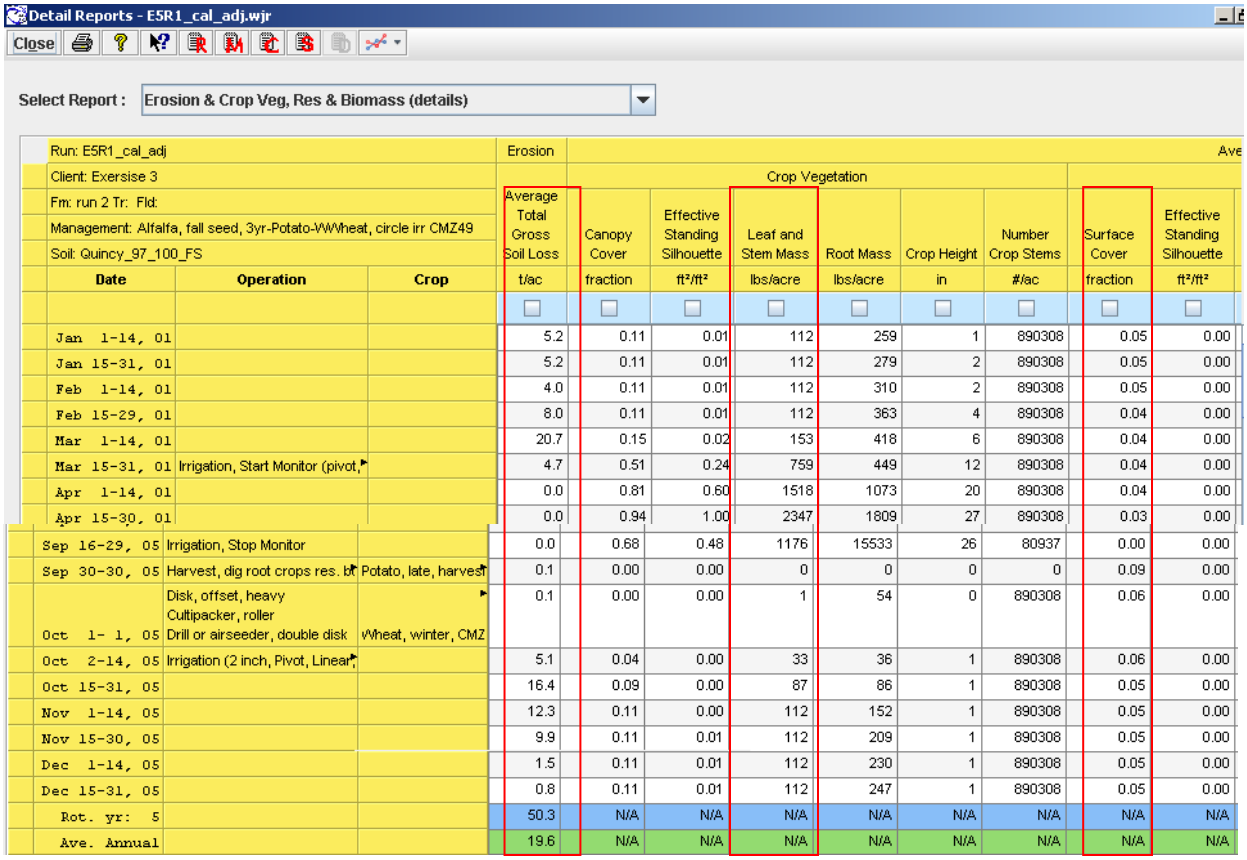
| Period | Crop/Residue | Gross Loss t/ac | Net Soil Loss From Field ( t/ac ) Total | Creep/Salt | Suspen | PM10 |
|---|---|---|---|---|---|---|
| Rot. year: 1 | Wheat, winter, CMZ 50 hi ppt 7-10in spac | 47.7 | 47.7 | 11.5 | 36.2 | 2.15 |
| Rot. year: 2 | Alfalfa, hay<br>Alfalfa, hay<br>Alfalfa, hay<br>Alfalfa, hay<br>Alfalfa, hay | 0.0 | 0.0 | 0.0 | 0.0 | 0.00 |
| Rot. year: 3 | Alfalfa, hay<br>Alfalfa, hay<br>Alfalfa, hay<br>Alfalfa, hay<br>Alfalfa, hay | 0.0 | 0.0 | 0.0 | 0.0 | 0.00 |
| Rot. year: 4 | Alfalfa, hay<br>Alfalfa, hay<br>Alfalfa, hay<br>Alfalfa, hay<br>Alfalfa, hay | 0.0 | 0.0 | 0.0 | 0.0 | 0.00 |
| Rot. year: 5 | Potato, late, harvest | 50.3 | 50.3 | 12.5 | 37.8 | 2.23 |
| Ave. Annual | | 19.6 | 19.6 | 4.8 | 14.8 | 0.88 |

**Figure 6** Adjusted soil loss with decreased Alfalfa yields

The Potato and Winter wheat years have a combined predicted soil loss of 98 tons/acre (50.3 + 47.7) (figure 6).

**Why is that?**

Open the detailed report for Erosion & Crop Veg, Res & Biomass, to view the predicted soil loss from Potato harvest overwinter to spring following Winter wheat planting (Figure 7).




Run: E5R1_cal_adj
Client: Exersise 3
Fm: run 2 Tr: Fld:
Management: Alfalfa, fall seed, 3yr-Potato-WWheat, circle irr CMZ49
Soil: Quincy_97_100_FS

| Date | Operation | Crop | Erosion | Crop Vegetation | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Average Total Gross Soil Loss | Canopy Cover | Effective Standing Silhouette | Leaf and Stem Mass | Root Mass | Crop Height | Number Crop Stems | Surface Cover | Effective Standing Silhouette |
| | | | t/ac | fraction | ft²/ft² | lbs/acre | lbs/acre | in | #/ac | fraction | ft²/ft² |
| Jan 1-14, 01 | | | 5.2 | 0.11 | 0.01 | 112 | 259 | 1 | 890308 | 0.05 | 0.00 |
| Jan 15-31, 01 | | | 5.2 | 0.11 | 0.01 | 112 | 279 | 2 | 890308 | 0.05 | 0.00 |
| Feb 1-14, 01 | | | 4.0 | 0.11 | 0.01 | 112 | 310 | 2 | 890308 | 0.05 | 0.00 |
| Feb 15-29, 01 | | | 8.0 | 0.11 | 0.01 | 112 | 363 | 4 | 890308 | 0.04 | 0.00 |
| Mar 1-14, 01 | | | 20.7 | 0.15 | 0.02 | 153 | 418 | 6 | 890308 | 0.04 | 0.00 |
| Mar 15-31, 01 | Irrigation, Start Monitor (pivot, | | 4.7 | 0.51 | 0.24 | 759 | 449 | 12 | 890308 | 0.04 | 0.00 |
| Apr 1-14, 01 | | | 0.0 | 0.81 | 0.60 | 1518 | 1073 | 20 | 890308 | 0.04 | 0.00 |
| Apr 15-30, 01 | | | 0.0 | 0.94 | 1.00 | 2347 | 1809 | 27 | 890308 | 0.03 | 0.00 |
| Sep 16-29, 05 | Irrigation, Stop Monitor | | 0.0 | 0.68 | 0.48 | 1176 | 15533 | 26 | 80937 | 0.00 | 0.00 |
| Sep 30-30, 05 | Harvest, dig root crops res. bf | Potato, late, harvest | 0.1 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.09 | 0.00 |
| Oct 1- 1, 05 | Disk, offset, heavy<br>Cultipacker, roller<br>Drill or airseeder, double disk | Wheat, winter, CMZ | 0.1 | 0.00 | 0.00 | 1 | 54 | 0 | 890308 | 0.06 | 0.00 |
| Oct 2-14, 05 | Irrigation (2 inch, Pivot, Linear | | 5.1 | 0.04 | 0.00 | 33 | 36 | 1 | 890308 | 0.06 | 0.00 |
| Oct 15-31, 05 | | | 16.4 | 0.09 | 0.00 | 87 | 86 | 1 | 890308 | 0.05 | 0.00 |
| Nov 1-14, 05 | | | 12.3 | 0.11 | 0.00 | 112 | 152 | 1 | 890308 | 0.05 | 0.00 |
| Nov 15-30, 05 | | | 9.9 | 0.11 | 0.01 | 112 | 209 | 1 | 890308 | 0.05 | 0.00 |
| Dec 1-14, 05 | | | 1.5 | 0.11 | 0.01 | 112 | 230 | 1 | 890308 | 0.05 | 0.00 |
| Dec 15-31, 05 | | | 0.8 | 0.11 | 0.01 | 112 | 247 | 1 | 890308 | 0.05 | 0.00 |
| Rot. yr: 5 | | | 50.3 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Ave. Annual | | | 19.6 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |

**Figure 7.** Predicted soil loss, Leaf and Stem Mass and Surface Cover after Potato harvest

**Answer:** Potato harvest leaves very little residue on the soil surface. The planting date for Winter wheat after potatoes is late in the fall. Wheat does not produce sufficient leaf and stem mass to protect the soil surface from erosion until April the following spring. This increases the predicted average annual soil loss to 19.6 tons/acre for the system.

**Add 1 more year of Alfalfa to the rotation**

Open the MCREW management editor. ***Scroll down*** the operation list to the 'Mar 15, 04', *Irrigation, Start Monitor (Pivot, Linear, Wheelline).* ***Drag the mouse*** to highlight down to (not including) the Disk on 'Apr 10, 05'. The section should be blue. Right Click in the Operation column and select "Copy Row(s)". ***Right Click*** the Disk operation on 'Apr 10, 05' and paste the rows, by selecting "Paste Row(s)". There is a complete set of operations for year 4 of alfalfa, but the dates still have year 4 instead of year 5, and March 15, 04 is pink. With the group of cells still highlighted, ***right Click*** the date column and select "Increment Year". Then highlight the Disk on 'Apr 10, 05' (it should be red) though the end of the file. **Right Click** the date column and increment the year. Now the potato year should be '06. This added a year to the rotation so now change the "Years in Rotation" box at the top of the editor screen from 5 to 6 (Figure 8).

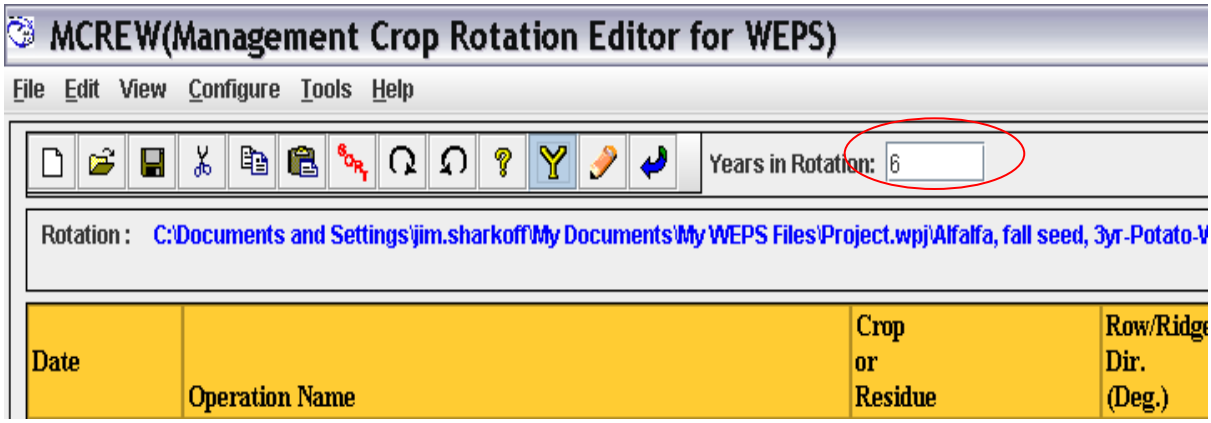



**Figure 8**. Revised Years in Rotation

Check that all the dates are sequential and correct, Click 'File', Save as...', and name the management file *Alfalfa, fall seed, 4yr-Potato-WWheat, circle irr CMZ49*.

Close MCREW and return to the main interface, Click run **without** calibration, because the correct Biomass Adjustment Factors for Alfalfa (1.066), Potato (1.075), and the Winter wheat (1.225) was saved in the previous run. Name this run ***Alfalfa 4yr-Potato-WWheat, circle irr CMZ 49***.

**Erosion**

| Period | Crop/Residue | Gross Loss t/ac | Net Soil Loss From Field ( t/ac ) Total | Creep/Salt | Suspen | PM10 |
|---|---|---|---|---|---|---|
| Rot. year: 1 | Wheat, winter, CMZ 50 hi ppt 7-10in spac | 37.6 | 37.6 | 9.4 | 28.1 | 1.68 |
| Rot. year: 2 | Alfalfa, hay<br>Alfalfa, hay<br>Alfalfa, hay<br>Alfalfa, hay<br>Alfalfa, hay | 0.0 | 0.0 | 0.0 | 0.0 | 0.00 |
| Rot. year: 3 | Alfalfa, hay<br>Alfalfa, hay<br>Alfalfa, hay<br>Alfalfa, hay<br>Alfalfa, hay | 0.0 | 0.0 | 0.0 | 0.0 | 0.00 |
| Rot. year: 4 | Alfalfa, hay<br>Alfalfa, hay<br>Alfalfa, hay<br>Alfalfa, hay<br>Alfalfa, hay | 0.0 | 0.0 | 0.0 | 0.0 | 0.00 |
| Rot. year: 5 | Alfalfa, hay<br>Alfalfa, hay<br>Alfalfa, hay<br>Alfalfa, hay<br>Alfalfa, hay | 0.0 | 0.0 | 0.0 | 0.0 | 0.00 |
| Rot. year: 6 | Potato, late, harvest | 47.8 | 47.8 | 11.3 | 36.4 | 2.08 |
| Ave. Annual | | 14.2 | 14.2 | 3.5 | 10.8 | 0.63 |

**Figure 9** Predicted soil loss for Alfalfa (4), Potato, Winter wheat

The predicted average annual soil loss decreased to 14 tons/acre/year because there is 0.0 tons soil loss for another year of Alfalfa with the soil loss for Potato-Winter wheat. Fourteen tons still exceeds the soil loss for a T of 5 t/ac/yr for compliance by (2T), or 10 tons/acre/year.

**Are there any other alternatives?**

Open the Detailed Report and select Boundary Loss (summary) (Figure 10).

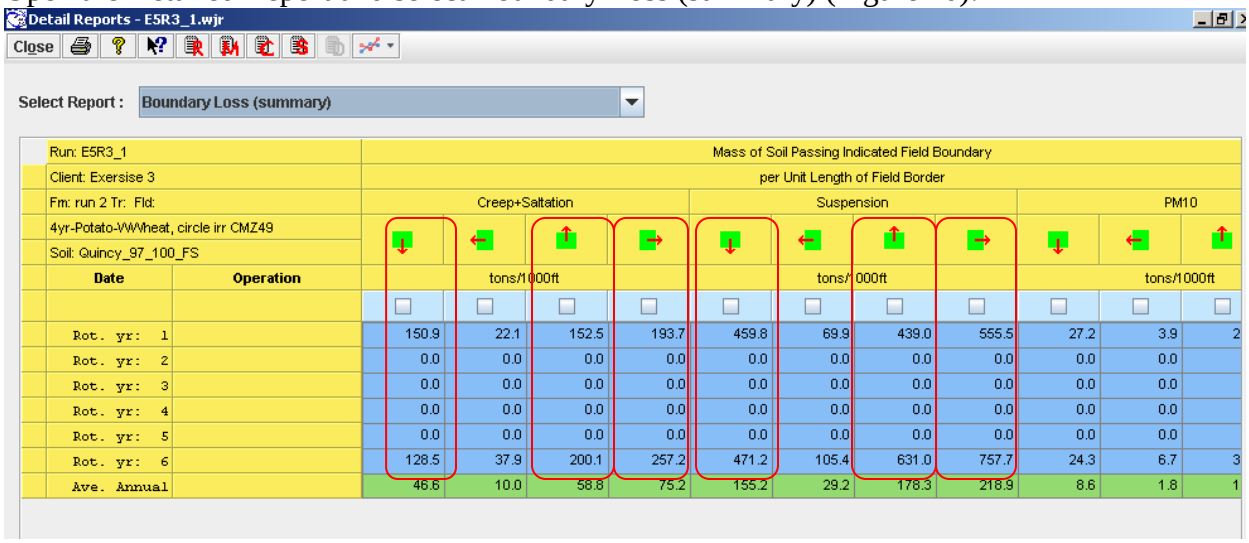



**Figure 10** Predicted soil mass passing indicated field boundaries

The predicted mass of soil passing the north and south field boundaries between Potato and Winter wheat (2,568 tons/1,000 ft) is greater than the mass of soil passing the eastern field boundary (1,761 tons/1,000 ft) (Figure 8), and tillage and planting operations for Winter wheat are currently planned north and south.

**Modify Winter wheat tillage and planting operations, and Row/Ridge direction**

Close the Detailed Report screen and open the MCREW management editor to change the following:

Change the first tillage operation on Oct 1, 06 from *Disk, offset, heavy* to *Chisel, st. pt. 15 in deep*, and set the Row/Ridge direction to minus 45 degrees (northwest to southeast) by selecting Decrement 45 degrees.

Change the Row/Ridge direction to minus 45 degrees (northwest to southeast) for the second tillage operation *Cultipacker, roller*, on Oct 1, 06 by selecting Decrement 45 degrees.

Change the date of the Winter wheat drilling operation to Oct 2, 06; change the drill from *Drill or air seeder, double disk* to *Drill, deep furrow 7 to 10 in spacing*.

Change the Row/Ridge direction to -45 degrees (northwest to southeast), by selecting Decrement 45 degrees. This drilling operation should leave 4-inch ridges at a -45 degree angle to control the wind from the south west direction.

Change the date for the first irrigation to Oct 03, 06.

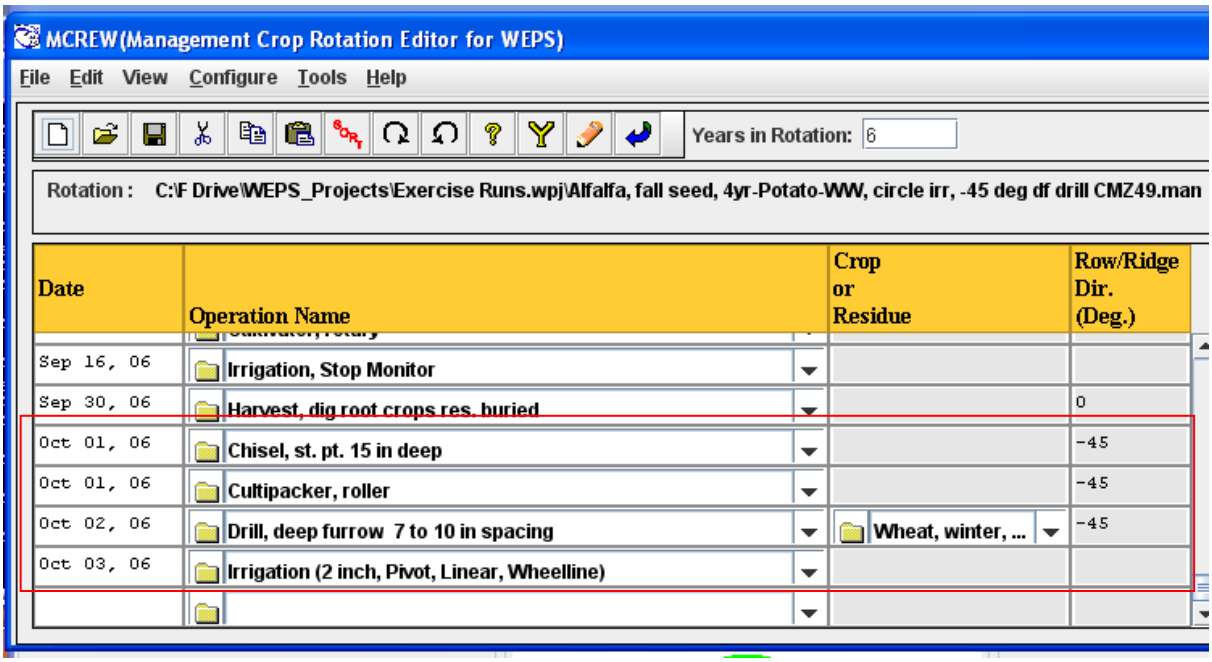



**Figure 11** Shows the changes to the W Wheat planting to get the need roughness to achieve T.

Click File, Save as, and name the revised management scenario ***Alfalfa 4yr-Potato-WWheat, circle irr -45 deg dfdrill,CMZ 49.***

Close the MCREW management editor and return to the main interface.

Click the **calibrate** run button, add deep furrow drill to the run name, then add -45 deg. Click OK to make the run.

## Run Summary

NRCS Natural Resources Conservation Service

E5R3_-45

**Crop Interval Erosion**

| Date Range | Crop | Gross Loss t/ac | Net Soil Loss From Field ( t/ac ) Total | Creep/Salt | Suspen. | PM10 |
|---|---|---|---|---|---|---|
| Oct 01, 06 - Aug 01, 01 | Wheat, winter, CMZ 50 hi ppt 7-10in spac | 20.8 | 20.8 | 5.2 | 15.6 | 0.91 |
| Aug 02, 01 - Sep 15, 05 | Alfalfa, hay | 0.0 | 0.0 | 0.0 | 0.0 | 0.00 |
| Sep 16, 05 - Sep 30, 06 | Potato, late, harvest | 7.2 | 7.2 | 1.4 | 5.8 | 0.26 |

**Harvests**

| Date | Crop | Residue lb/ac | Harvest Yield | Yield % Moisture |
|---|---|---|---|---|
| Aug 01, 01 | Wheat, winter, CMZ 50 hi ppt 7-10in spac | 7,659 | 100.1 bu/ac | 10.9 |
| May 15, 02 | Alfalfa, hay | 1,470 | 1.9 ton/ac | 15.0 |
| Jun 15, 02 | Alfalfa, hay | 679 | 1.2 ton/ac | 15.0 |
| Jul 15, 02 | Alfalfa, hay | 562 | 0.8 ton/ac | 15.0 |
| Aug 15, 02 | Alfalfa, hay | 731 | 1.2 ton/ac | 15.0 |
| Sep 15, 02 | Alfalfa, hay | 631 | 1.0 ton/ac | 15.0 |
| May 15, 03 | Alfalfa, hay | 1,810 | 1.6 ton/ac | 15.0 |

**Figure 12.** Run Summary with Deep Furrow Drill at -45 degrees.

The Winter wheat Biomass Adjustment Factor should increase to 1.225 to get within 5 % of 100 bushels per acre, and the predicted crop interval erosion for potato should decrease to 7.2 tons/acre/year (Figure 12). The average annual wind erosion rate for the crop rotation is 4.7 t/ac/yr. or less than (T) .

**Figure 13.** After potato harvest (left) and after drilling winter wheat (right)

## Exercise 6 - New York: Tomato, Rye Cover Crop, and Plastic Mulch

**Skill Building:** The picture below (Figure 1) is an example of plastic mulch with a rye cover crop (inter-furrow) and onions. Often it is barren between the rows. *The current version of WEPS cannot directly model temporary barriers (between the rows) or two crops growing at the same time like the one shown below in Figure 1. However, WEPS can simulate cover crops between the rows.*


**Figure 1** showing onions grown over black plastic with inter rows planted to rye cover crop.

**Skill Building: Start with a template rotation.**

1. Add rye for winter cover and then plastic mulch to the basic run. Cover crops can be sown in the fall or spring and plastic mulch added near or at planting the crop (tomatoes in this example).

2. In WEPS Plastic mulch is added under operations as a special residue. Any crop can be grown with plastic mulch in place.

3. A green cover crop can be used as residue when tomatoes are planted by inserting a 'kill crop' operation before planting the tomatoes. Even though the rye is still growing, WEPS will not show rye growth.

4. WEPS will credit the amount of rye biomass as dead residue when the tomatoes are planted thus providing the intended wind erosion protection.

**Scenario:**

1. Location: **Suffolk Co., New York**. CLIGEN station is **Riverhead Research** and the WINGEN station is **interpolated**.
2. Simulation region is **600 ft for the X-Length** and **1000 feet for the Y-Length.**
3. Field Size is: 13.8 acres.
4. Field orientation is: **-15.0 degrees** from true North (i.e., 345 degrees).
5. Soil is **Plymouth Loamy Sand** (***Plymouth_PIA_85_LS.ifc***)
6. Tomato target yield is **300 cwt./ac**.
7. Field is tilled parallel to the long side of the field.
8. One Resource concern: The producer indicates that in some years there is wind and soil abrasion damage to the young tomato transplants if he does not place plastic mulch on the beds. Another concern is blossom end rot a bacterial disease on tomato fruit that begins when the fruit skin is cracked or broke open by wind abrasion.

Click the Soil pull down button and select the soil ***(Plymouth_PIA_85_LS.ifc)***.

Click the Management "Man" pull down button and select the ***Tomato, Conv, no plastic Z65.man*** file from the Example Mgt files subfolder. This is the management without the rye cover crop or the plastic mulch applied. This management file was not calibrated to give correct crop yields. Click the Yield Calibrate button  Scroll to the Biomass Adjustment Factor (BAF) column. If the BAF number in the column is other than 1.0, this indicates that the crop and the management file are calibrated. If the BAF is missing, enter **0.906** for the tomato.

**Step 2:** Check the management window to see if the tillage is parallel to the orientation of the field.

**What is the row/ridge direction value of all tillage?** 0 degrees from true North.

**What is the value we are looking for?** -15 degrees. The field is oriented -15 degrees from true North (i.e., $345^{o}$).

Click the header of the 'Row/Ridge Highlight to highlight all the rows in the management file by Dir. (Deg.)' column.

Right Click the column and Click 'Decrement 15 deg'. This will set all the tillage to be the same as the field orientation mentioned in inventory (i.e., -15). Leave the editor and save the changes to the current file (see Figure 2).

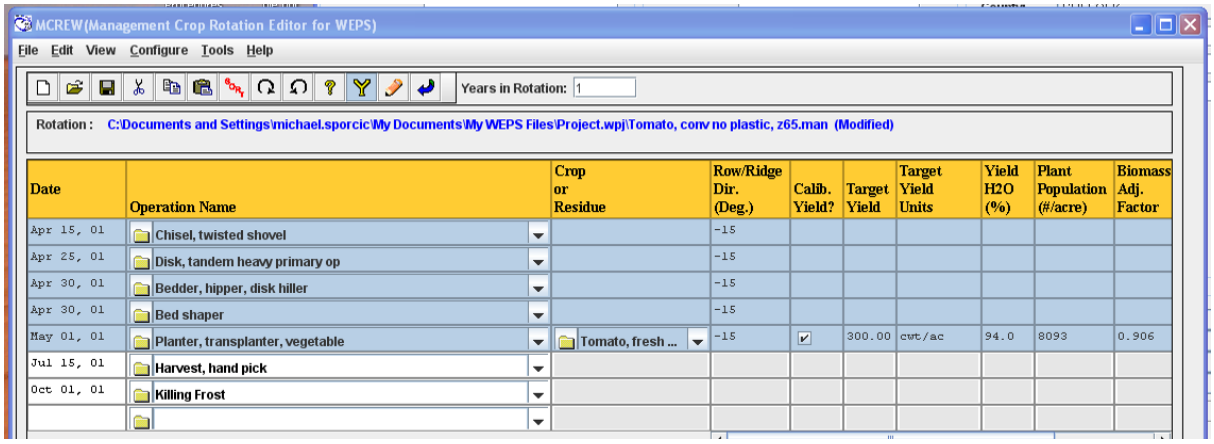



**Figure 2** showing the -15 Deg. needed to make the tillage parallel to the long side of the field and the Bio Adj. Factor set at 0.906

Make the run and save it as ***Tomato, Conv, no plastic, Z65*** without calibration.
**Is the yield close? Answer:** Yes, at 300 cwt./ac, see Figure 3.

**Erosion**

| Period | Crop/Residue | Gross Loss t/ac | Net Soil Loss From Field ( t/ac ) Total | Creep/Salt | Suspen | PM10 |
|---|---|---|---|---|---|---|
| Rot. year: 1 | Tomato, fresh mkt | 9.4 | 9.4 | 4.7 | 4.7 | 0.15 |
| Ave. Annual | | 9.4 | 9.4 | 4.7 | 4.7 | 0.15 |

**Crop Interval Erosion**

| Date Range | Crop | Gross Loss t/ac | Net Soil Loss From Field ( t/ac ) Total | Creep/Salt | Suspen. | PM10 |
|---|---|---|---|---|---|---|
| Jul 16, 01 - Jul 15, 01 | Tomato, fresh mkt | 9.4 | 9.4 | 4.7 | 4.7 | 0.15 |

**Harvests**

| Date | Crop | Residue lb/ac | Harvest Yield | Yield % Moisture |
|---|---|---|---|---|
| Jul 15, 01 | Tomato, fresh mkt | 2,335 | 290.5 cwt/ac | 94.0 |

**SCI Summary**

| | | | |
|---|---|---|---|
| **Soil Conditioning** | -1.0 | **SCI Subfactors** | |
| **Energy Calculator:** | 3.5 gal diesel/ac | **OM** | -0.59 |
| **Average Annual STIR:** | 152.8 | **FO:** | -0.51 |
| **Wind Erosion Soil** | 9.4 t/ac | **ER:** | -2.70 |
| **Water Erosion Soil** | 0.0 t/ac | | |

**Figure 3** showing the 9.4 t/ac output and the 290.5 cwt/ac yield.

**What is the erosion rate?** 9.4 ton/ac.

9.4 t/ac is above T and the abrasion tolerance for tomatoes (see Crop Tolerance Table 1 in the Exercises Introduction). So the tomatoes need protection with a rye cover crop.

**Add in the Rye Cover Crop after Tomato Harvest**

**Step 1:** Right Click the killing frost operation row and change the operation to Drill or air seeder, double disk.

Select Rye, winter cover for the crop to be planted. Change the date to Aug. 1, 01. Insert a light disk 5 days after harvest (Disk, tandem light finishing, Jul 20, 01).

Change the Row/Ridge Dir. to -15 degrees. Save the file with a new name. Save the file with a new name by Clicking 'File', 'Save as...', and enter **Tomato, rye cover crop z65.man**. Click the blue Return button  .

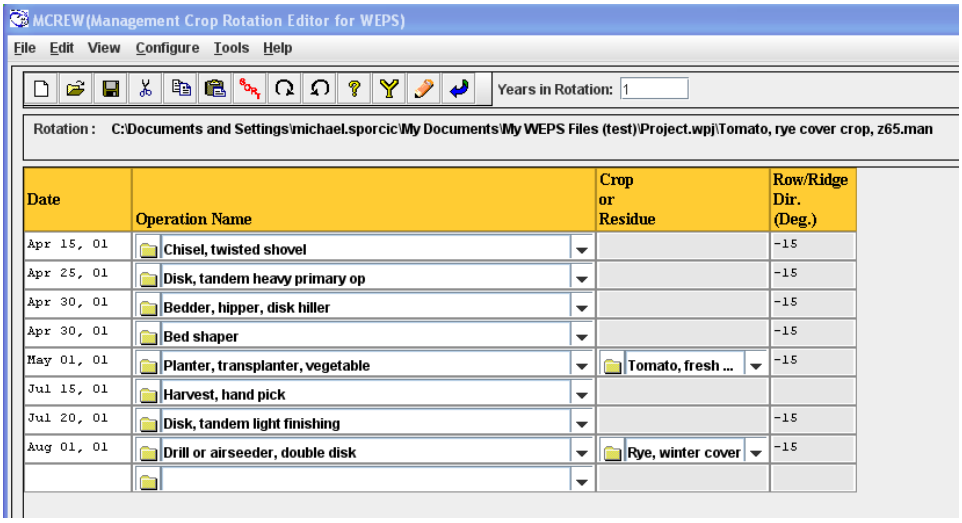



**Figure 4** Shows how the management should look with the Rye cover crop added.

**Step 2:** Make the run and call it, **Tomato, cover, Conv Z65**.

**Erosion**

| Period | Crop/Residue | Gross Loss t/ac | Net Soil Loss From Field ( t/ac ) Total | Creep/Salt | Suspen | PM10 |
|---|---|---|---|---|---|---|
| Rot. year: 1 | Tomato, fresh mkt | 1.8 | 1.8 | 1.0 | 0.9 | 0.03 |
| Ave. Annual | | 1.8 | 1.8 | 1.0 | 0.9 | 0.03 |

**Crop Interval Erosion**

| Date Range | Crop | Gross Loss t/ac | Net Soil Loss From Field ( t/ac ) Total | Creep/Salt | Suspen. | PM10 |
|---|---|---|---|---|---|---|
| Jul 16, 01 - Jul 15, 01 | Tomato, fresh mkt | 1.8 | 1.8 | 1.0 | 0.9 | 0.03 |

**Harvests**

| Date | Crop | Residue lb/ac | Harvest Yield | Yield % Moisture |
|---|---|---|---|---|
| Jul 15, 01 | Tomato, fresh mkt | 2,393 | 298.0 cwt/ac | 94.0 |

**Figure 5** shows the soil loss and the yield from the tomato run with a rye cover crop.

**What is the soil loss now:** 1.8 ton/ac (Figure 5).

**Open the Detailed Report. What period(s) of the year have the erosion problem?**
May 1-31, 01 and Aug. 1-Sept. 14 (Figure 5).

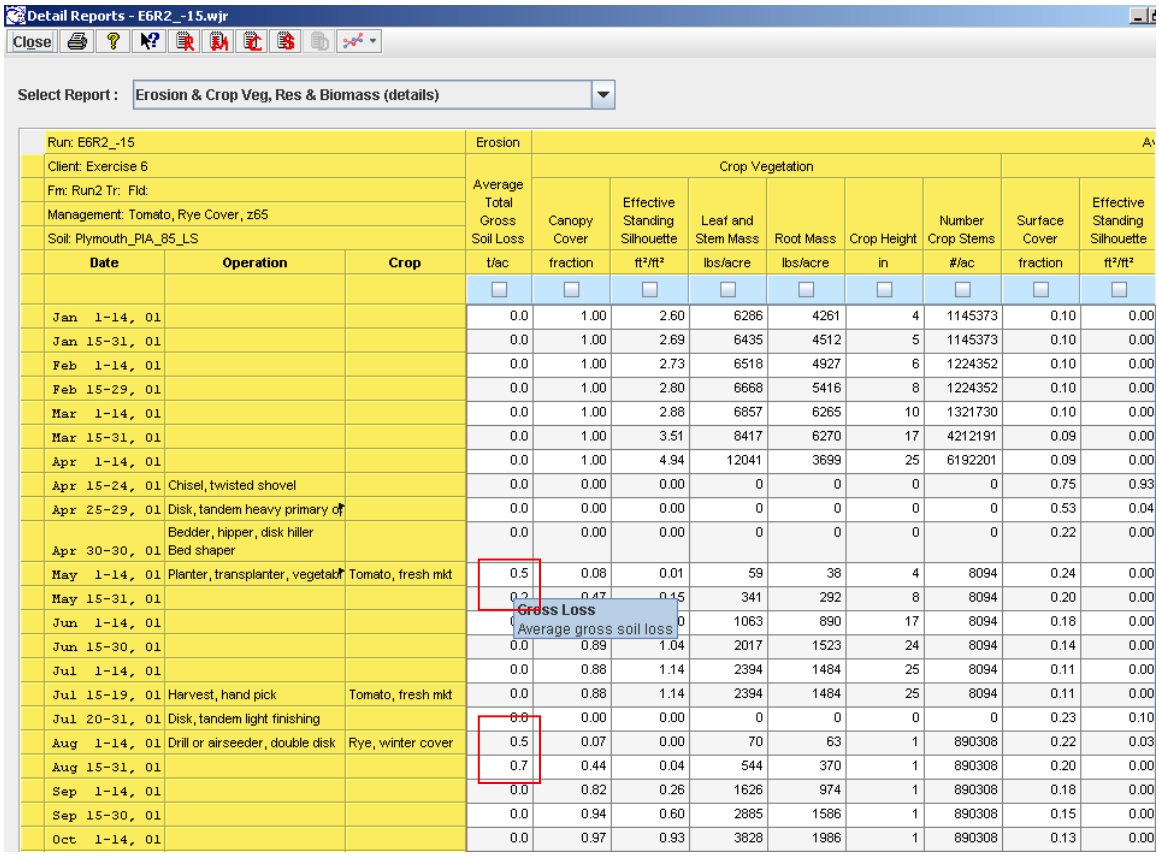



**Figure 6** showing the soil loss after planting the tomatoes and winter rye cover.

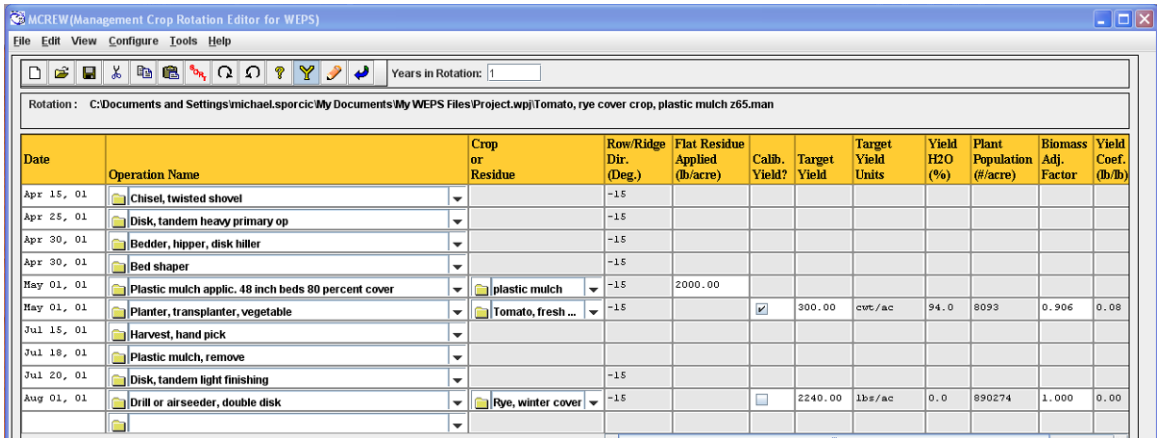
**Add Plastic Mulch**
**Is there a need for plastic mulch indicated by the Run Summary?** Yes.

The NRCS National Agronomy Manual, Crop Tolerance to Blowing Soil table lists tomatoes in the 'Very Low Tolerance' category or 0 to 0.5 t/ac loss (See Table 1 in the Exercises Introduction). Also, the producer stated that there is a problem some years with blowing soil damage to the young tomato plants. The 1 ton/ac soil loss value is an average over many years of the simulation. Some years may have higher or lower wind erosion, with the higher erosion years causing more damage to the tomatoes. As resource planners we must also listen to the producer to determine whether a practice is needed or not.

Close any reports open and Click the 'Man' button to open MCREW. Note the **Tomato, cover, Conv z65.man** management file. Save the file as **Tomato, rye cover crop, plastic mulch z65**.

Right Click in the operation column on the 'May 01, 01', **Planter, transplanter, vegetable operation**. Select 'Insert operation'. Select **Plastic mulch applic. 48 inch beds 80 percent cover;** make the date 'May 01, 01'. Mulch application requires a Crop or Residue and 'plastic mulch' is the default residue for the operation.

Set the angle of tillage to -15 degrees. In the date column, Click 'Jul 20, 01' **Disk, tandem light finishing.** In the operation column, right Click and 'Insert an operation' **Plastic mulch, remove,** dated 'Jul 18, 01'. See Figure 7.




| Date | Operation Name | Crop or Residue | Row/Ridge Dir. (Deg.) | Flat Residue Applied (lb/acre) | Calib. Yield? | Target Yield | Target Yield Units | Yield H2O (%) | Plant Population (#/acre) | Biomass Adj. Factor | Yield Coef. (lb/lb) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Apr 15, 01 | Chisel, twisted shovel | | -15 | | | | | | | | |
| Apr 25, 01 | Disk, tandem heavy primary op | | -15 | | | | | | | | |
| Apr 30, 01 | Bedder, hipper, disk hiller | | -15 | | | | | | | | |
| Apr 30, 01 | Bed shaper | | -15 | | | | | | | | |
| May 01, 01 | Plastic mulch applic. 48 inch beds 80 percent cover | plastic mulch | -15 | 2000.00 | | | | | | | |
| May 01, 01 | Planter, transplanter, vegetable | Tomato, fresh ... | -15 | | ☑ | 300.00 | cwt/ac | 94.0 | 8093 | 0.906 | 0.08 |
| Jul 15, 01 | Harvest, hand pick | | | | | | | | | | |
| Jul 18, 01 | Plastic mulch, remove | | | | | | | | | | |
| Jul 20, 01 | Disk, tandem light finishing | | -15 | | | | | | | | |
| Aug 01, 01 | Drill or airseeder, double disk | Rye, winter cover | -15 | | ☐ | 2240.00 | lbs/ac | 0.0 | 890274 | 1.000 | 0.00 |
| | | | | | | | | | | | |

**Figure 7** showing the management file with the plastic mulch applied.

**Note:** In MCREW make sure the default Flat Residue Amount of 2000 lbs/ac was applied to the land the day that the plastic is laid. In WEPS version 1.2.9 we are applying plastic as a high biomass amount of residue for WEPS to simulate no erosion while the plastic is in place. If the inter-furrow area does not have a cover there could be additional erosion occurring that is not included. Some growers plant that area to a cover crop when the tomatoes are planted.

**Step 2:** Click the blue Return button to return to the main interface. Make the run and call it **Tomato, plastic mulch, rye cover crop Z65.**

The Run Summary shows a significant decrease in soil loss (Figure 8). With the plastic mulch in place only 0.9 t/ac wind erosion shows up on the run summary report. The obvious benefit of the mulch is that the tomatoes are not damaged using the plastic, the yield is higher, and the crop does not have to be replanted. Weed control is also another benefit to using the plastic.

## Erosion

| Period | Crop/Residue | Gross Loss t/ac | Net Soil Loss From Field ( t/ac ) Total | Creep/Salt | Suspen | PM10 |
|---|---|---|---|---|---|---|
| Rot. year: 1 | Tomato, fresh mkt | 0.9 | 0.9 | 0.5 | 0.4 | 0.02 |
| Ave. Annual | | 0.9 | 0.9 | 0.5 | 0.4 | 0.02 |

## Crop Interval Erosion

| Date Range | Crop | Gross Loss t/ac | Net Soil Loss From Field ( t/ac ) Total | Creep/Salt | Suspen. | PM10 |
|---|---|---|---|---|---|---|
| Jul 16, 01 - Jul 15, 01 | Tomato, fresh mkt | 0.9 | 0.9 | 0.5 | 0.4 | 0.02 |

## Harvests

| Date | Crop | Residue lb/ac | Harvest Yield | Yield % Moisture |
|---|---|---|---|---|
| Jul 15, 01 | Tomato, fresh mkt | 2,429 | 302.8 cwt/ac | 94.0 |

**Figure 8** showing the soil loss with the plastic mulch in place

The detailed reports indicate that the change of damage to the tomato plants is reduced to a trace.

Detail Reports - E6R3_-15.wjr

Close

Select Report : Erosion & Crop Veg, Res & Biomass (details)

Run: E6R3_-15
Client: Exercise 6
Fm: Run3 Tr: Fld:
Management: Tomato, Rye Cover,Plastic Mulch z65
Soil: Plymouth_PIA_85_LS

| Date | Operation | Crop | Erosion: Average Total Gross Soil Loss t/ac | Crop Vegetation: Canopy Cover fraction | Effective Standing Silhouette ft²/ft² | Leaf and Stem Mass lbs/acre | Root Mass lbs/acre | Crop Height in | Number Crop Stems #/ac | Surface Cover fraction | Effective Standing Silhouette ft²/ft² |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Apr 30-30, 01 | Bedder, hipper, disk hiller Bed shaper | | 0.0 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.22 | 0.00 |
| May 1-14, 01 | Plastic mulch applic. 48 inch bf Planter, transplanter, vegetabl | plastic mulch Tomato, fresh mkt | Trace | 0.08 | 0.01 | 59 | 38 | 4 | 8094 | 0.82 | 0.00 |
| May 15-31, 01 | | | 0.0 | 0.47 | 0.15 | 343 | 294 | 8 | 8094 | 0.81 | 0.00 |
| Jun 1-14, 01 | | | 0.0 | 0.82 | 0.61 | 1077 | 902 | 17 | 8094 | 0.81 | 0.00 |
| Jun 15-30, 01 | | | 0.0 | 0.90 | 1.05 | 2048 | 1546 | 25 | 8094 | 0.80 | 0.00 |
| Jul 1-14, 01 | | | 0.0 | 0.88 | 1.15 | 2430 | 1506 | 26 | 8094 | 0.79 | 0.00 |
| Jul 15-17, 01 | Harvest, hand pick | Tomato, fresh mkt | 0.0 | 0.88 | 1.15 | 2430 | 1506 | 26 | 8094 | 0.79 | 0.00 |
| Jul 18-19, 01 | Plastic mulch, remove | | 0.0 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.13 | 1.13 |
| Jul 20-31, 01 | Disk, tandem light finishing | | 0.0 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.26 | 0.10 |
| Aug 1-14, 01 | Drill or airseeder, double disk | Rye, winter cover | 0.5 | 0.08 | 0.00 | 73 | 66 | 1 | 890308 | 0.26 | 0.03 |
| Aug 15-31, 01 | | | 0.3 | 0.45 | 0.05 | 564 | 384 | 1 | 890308 | 0.24 | 0.00 |
| Sep 1-14, 01 | | | 0.0 | 0.82 | 0.28 | 1666 | 999 | 1 | 890308 | 0.22 | 0.00 |
| Sep 15-30, 01 | | | 0.0 | 0.95 | 0.64 | 2966 | 1630 | 1 | 890308 | 0.20 | 0.00 |
| Oct 1-14, 01 | | | 0.0 | 0.98 | 0.97 | 3921 | 2036 | 1 | 890308 | 0.18 | 0.00 |
| Oct 15-31, 01 | | | 0.0 | 0.99 | 1.36 | 5027 | 2487 | 1 | 890308 | 0.17 | 0.00 |
| Nov 1-14, 01 | | | 0.0 | 1.00 | 1.67 | 5718 | 2809 | 1 | 890308 | 0.17 | 0.00 |
| Nov 15-30, 01 | | | 0.0 | 1.00 | 2.12 | 6151 | 3299 | 1 | 890308 | 0.16 | 0.00 |
| Dec 1-14, 01 | | | 0.0 | 1.00 | 2.38 | 6192 | 3749 | 2 | 890308 | 0.16 | 0.00 |
| Dec 15-31, 01 | | | 0.0 | 1.00 | 2.56 | 6274 | 4145 | 3 | 1176319 | 0.16 | 0.00 |
| Rot. yr: 1 | | | 0.9 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Ave. Annual | | | 0.9 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |

Figure 9 shows that the soil loss at planting time for the tomatoes is down to a trace.

## Exercise 7 - New Mexico: Irrigated Corn Silage, Add Manure and a Winter Forage Crop

**Skill Building:** Start with a blank management and add the operations from the operation database. Corn silage is a low residue crop because most of the biomass is harvested. How to control wind erosion by:

- Adding Dairy manure
- Adding winter wheat, cut for silage in the spring

**Inventory:** Field is an irrigated **half circle** on the west half of a quarter section of land.
Area is **62.7 acres**.
Location: **Curry Co., New Mexico**, just south of Clovis.
CLIGEN station is **CLOVIS 13N**, and WINDGEN station is **interpolated**.
Soil: Amarillo loamy fine sand: **Amarillo_AnB_85_LFS**.
The CNMP calls for **15 ton/ac of very dry manure, 25% moisture by weight** (15 tons/ac x 2000 lbs/ton = 30,000 lbs/ac wet wt. or 30,000 lbs/ac x 0.75 = 22,500 lbs/ac on a dry weight basis).

The option of fall manure application exists since there is no surface or ground water near the dairy and little rainfall runoff over the winter. Spring manure application fits the work schedule. A Low Elevation Spray Application (LESA) nozzle package on the pivot can meet the Consumptive use of corn and winter forage.

Wet yield for the **corn silage is 23 ton/ac** and 65% moisture.
Wet yield for the **winter wheat silage is 7 ton/ac** and 70% moisture.

The 22,500 lbs/ac of manure dry matter (residue) applied is a fairly fine, quickly decomposable organic material. This organic material will have a fairly short term effect on wind erosion, but a long-term impact on soil quality.

**Figure 1** showing the field layout.
**Make a run where no manure is applied.**
Enter all the information listed above on the main interface.
At Region select '**Half Circle VW'.** VW indicates the vertical west half of a circle.
Enter **62.7 acres**.
In the Exercise Soils subfolder select: **Amarillo_AnB_85_LFS.ifc** soil
Open Template Example Management File select:
**Corn Silage, No Manure, No Fall Till, Pivot, CMZ 19**. See Table 1 for operations.

**Table 1** System operations for corn silage alone.

| Date | Operation | Crop | Flat Residue Amt Added (lbs/ac) |
|---|---|---|---|
| Apr 15 | Disk, offset, heavy | | |
| Apr 18 | Cultivator, field 6-12 in sweeps | | |
| Apr 20 | Planter, double disk opener | Corn, silage | |
| Apr 21 | Irrigation, Start Monitor (Pivot, Linear, Wheelline) | | |
| Sep 1 | Irrigation, Stop Monitor | | |
| Sep 20 | Harvest, silage, kill crop | | |
| Sep 25 | Disk, tandem heavy primary op | | |

**Step 2:** Click the Run button  and call the run *Corn, silage, Conv, no manure, pivot***,** do not calibrate.

**Erosion**

| Period | Crop/Residue | Gross Loss t/ac | Net Soil Loss From Field ( t/ac ) Total | Creep/Salt | Suspen | PM10 |
|---|---|---|---|---|---|---|
| Rot. year: 1 | Corn, silage | 124.6 ⚠ | 124.6 ⚠ | 58.2 | 66.3 | 1.89 |
| Ave. Annual | | 124.6 ⚠ | 124.6 ⚠ | 58.2 | 66.3 | 1.89 |

⚠ WARNING: Erosion values exceeded the science model accuracy thresholds.

**Crop Interval Erosion**

| Date Range | Crop | Gross Loss t/ac | Net Soil Loss From Field ( t/ac ) Total | Creep/Salt | Suspen. | PM10 |
|---|---|---|---|---|---|---|
| Sep 21, 01 - Sep 20, 01 | Corn, silage | 124.6 | 124.6 | 58.2 | 66.3 | 1.89 |

**Harvests**

| Date | Crop | Residue lb/ac | Harvest Yield | Yield % Moisture |
|---|---|---|---|---|
| Sep 20, 01 | Corn, silage | 283 | 19.5 ton/ac | 65.0 |

**Figure 2** showing the 124 t/ac loss without manure applied.

**What is the corn silage yield?** 19.5 ton/ac (Figure 2). This is close enough to the 23 ton/ac mentioned in the inventory for now because there is still too much erosion.

**What was the predicted soil loss?** >124 ton/ac (**Figure 2).**

**Add Manure in the spring**

1. Open the management editor and right Click the operation cell on the first line, Click 'Insert Operation' and select **Manure spreader**.

2. Set the date to 'Apr 15, 01'.

3. Under the Crop or Residue column, select **manure, solid, signif. Bedding** (at the bottom of the drop down menu).

4. In the Total Manure Applied column type in the **22,500** lbs/ac manure applied in the spring (Figure 4). **Note:** All Residue material (manure included) is added as a dry weight material.

5. Click 'File', 'Save As...', and save the file as *Corn, silage, Conv, spring manure, pivot CMZ19.man*.

6. Click the 'Return' button  to return to the main interface.

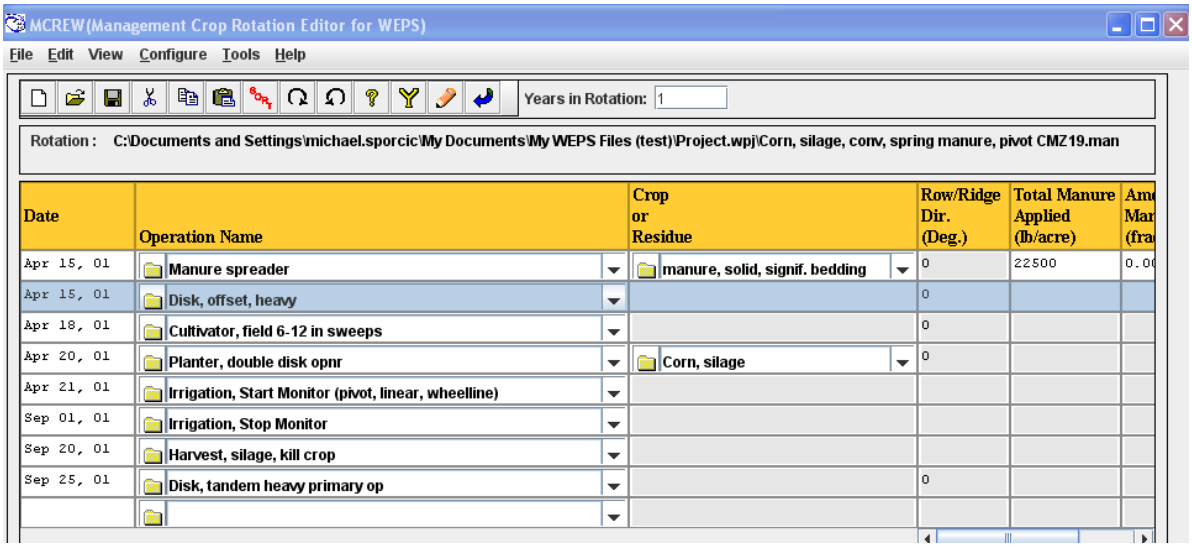



**Figure 3** Showing a row added and the manure applied on April 15.

**Step 2:** Click the Run button  on the main toolbar to make the run. Call it: *Corn, silage, Conv, spring manure, pivot CMZ19.*

**What is the soil loss with the manure applied in the spring and tilled in?** 20 t/ac (Figure 4). Good reduction but still not enough.

| Period | Crop/Residue | Gross Loss t/ac | Net Soil Loss From Field ( t/ac ) Total | Creep/Salt | Suspen | PM10 |
|---|---|---|---|---|---|---|
| Rot. year: 1 | Corn, silage | 20.6 | 20.6 | 10.1 | 10.4 | 0.31 |
| Ave. Annual | | 20.6 | 20.6 | 10.1 | 10.4 | 0.31 |

**Crop Interval Erosion**

| Date Range | Crop | Gross Loss t/ac | Net Soil Loss From Field ( t/ac ) Total | Creep/Salt | Suspen. | PM10 |
|---|---|---|---|---|---|---|
| Sep 21, 01 - Sep 20, 01 | Corn, silage | 20.6 | 20.6 | 10.1 | 10.4 | 0.31 |

**Harvests**

| Date | Crop | Residue lb/ac | Harvest Yield | Yield % Moisture |
|---|---|---|---|---|
| Sep 20, 01 | Corn, silage | 290 | 21.2 ton/ac | 65.0 |

**Figure 4** Show the run with the spring manure added

**Open the Detailed Report:**

**When and where are the high wind erosion rates?** Just before the manure is applied January 15 through April 15 are the big months with 16 ton/ac occurring (figure 5).

Detail Reports - E7R2.wjr

Close

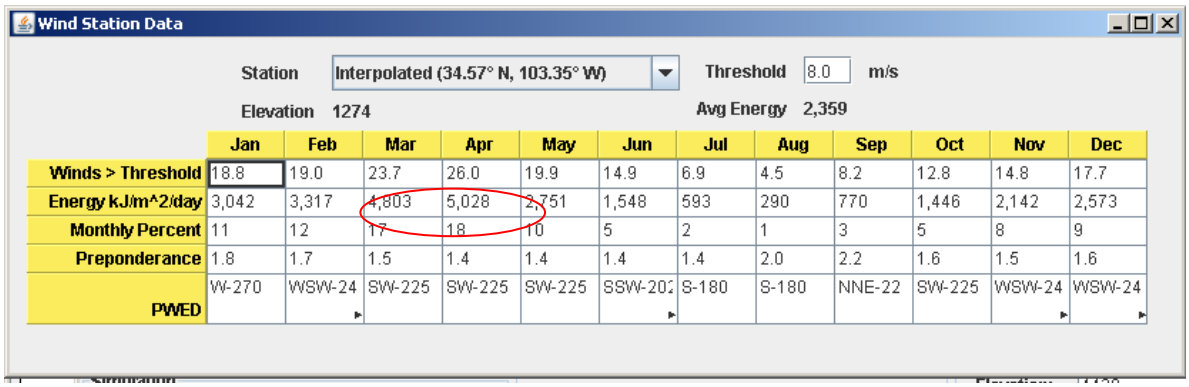
Select Report : Erosion & Crop Veg, Res & Biomass (details)

Run: E7R2
Client: Exercise 7
Fm: Run 2 Tr: Fld:
Management: Corn, silage, manure, no fall till, pivot CMZ19
Soil: Amarillo_AnB_85_LFS

| Date | Operation | Crop | Erosion: Average Total Gross Soil Loss t/ac | Crop Vegetation: Canopy Cover fraction | Effective Standing Silhouette ft²/ft² | Leaf and Stem Mass lbs/acre | Root Mass lbs/acre | Crop Height in | Number Crop Stems #/ac | Surface Cover fraction | Effective Standing Silhouette ft²/ft² |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Jan 1-14, 01 | | | 0.3 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.13 | 0.00 |
| Jan 15-31, 01 | | | 1.5 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.13 | 0.00 |
| Feb 1-14, 01 | | | 0.6 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.12 | 0.00 |
| Feb 15-29, 01 | | | 0.5 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.12 | 0.00 |
| Mar 1-14, 01 | | | 2.5 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.11 | 0.00 |
| Mar 15-31, 01 | | | 8.0 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.11 | 0.00 |
| Apr 1-14, 01 | | | 2.9 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.10 | 0.00 |
| Apr 15-17, 01 | Manure spreader Disk, offset, heavy | manure, solid, signif | 0.0 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.75 | 0.00 |
| Apr 18-19, 01 | Cultivator, field 6-12 in sweep | | 0.0 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0.73 | 0.00 |
| Apr 20-20, 01 | Planter, double disk opnr | Corn, silage | Trace | 0.00 | 0.00 | 0 | 18 | 0 | 24281 | 0.73 | 0.00 |
| Apr 21-30, 01 | Irrigation, Start Monitor (pivot, | | 0.0 | 0.01 | 0.00 | 12 | 11 | 1 | 24281 | 0.71 | 0.00 |

**Figure 5** showing the high erosion periods.

On the main interface screen left **Click Tools, Display Wind Station.** Notice that March and April both have very large values for the Wind Energy at 4900 KJ/m$^2$/day (Figure 6).




| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Winds > Threshold | 18.8 | 19.0 | 23.7 | 26.0 | 19.9 | 14.9 | 6.9 | 4.5 | 8.2 | 12.8 | 14.8 | 17.7 |
| Energy kJ/m^2/day | 3,042 | 3,317 | 4,803 | 5,028 | 2,751 | 1,548 | 593 | 290 | 770 | 1,446 | 2,142 | 2,573 |
| Monthly Percent | 11 | 12 | 17 | 18 | 10 | 5 | 2 | 1 | 3 | 5 | 8 | 9 |
| Preponderance | 1.8 | 1.7 | 1.5 | 1.4 | 1.4 | 1.4 | 1.4 | 2.0 | 2.2 | 1.6 | 1.5 | 1.6 |
| PWED | W-270 | WSW-24 | SW-225 | SW-225 | SW-225 | SSW-202 | S-180 | S-180 | NNE-22 | SW-225 | WSW-24 | WSW-24 |

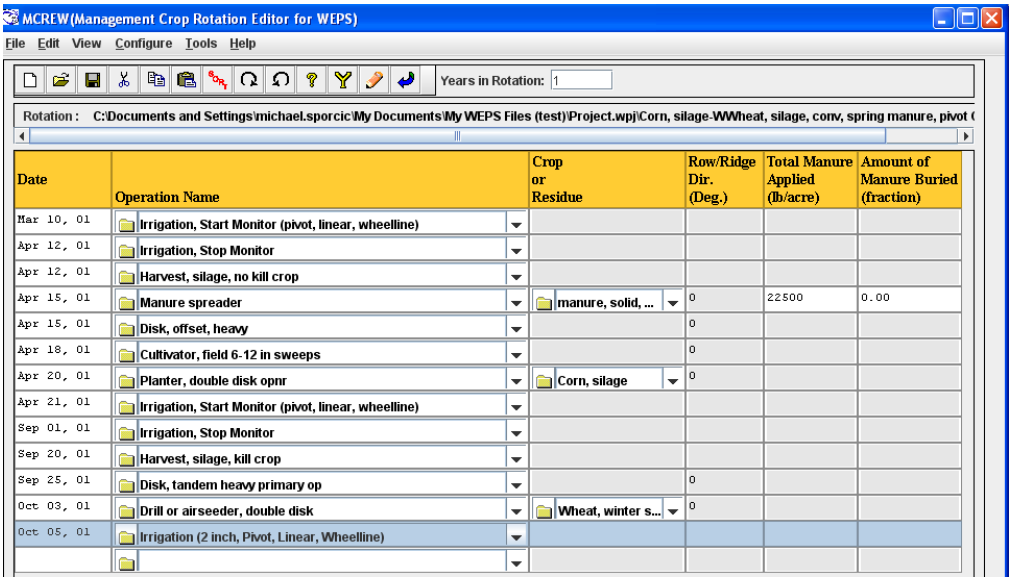
**Figure 6** Showing the Wind Station Data.

Clearly more needs to be done for this system to meet T.

### Add the Winter Wheat Forage Crop

Close all reports and reopen the MCREW.

1. Add to the existing system, the additional operations for the winter wheat silage listed in Figure 7. Hint: These can be added to the end of the run and sorted or just insert them at the correct places. Be sure to change the date of the manure application from Apr 1 to Apr 15. When you have them entered and sorted, then Click 'File', 'Save as...', and enter the management name as: *Corn, silage-WWheat, silage, Conv, spring manure, pivot CMZ19.man*.
2. Close the editor and return to the main interface.




| Date | Operation Name | Crop or Residue | Row/Ridge Dir. (Deg.) | Total Manure Applied (lb/acre) | Amount of Manure Buried (fraction) |
|---|---|---|---|---|---|
| Mar 10, 01 | Irrigation, Start Monitor (pivot, linear, wheelline) | | | | |
| Apr 12, 01 | Irrigation, Stop Monitor | | | | |
| Apr 12, 01 | Harvest, silage, no kill crop | | | | |
| Apr 15, 01 | Manure spreader | manure, solid, ... | 0 | 22500 | 0.00 |
| Apr 15, 01 | Disk, offset, heavy | | 0 | | |
| Apr 18, 01 | Cultivator, field 6-12 in sweeps | | 0 | | |
| Apr 20, 01 | Planter, double disk opnr | Corn, silage | 0 | | |
| Apr 21, 01 | Irrigation, Start Monitor (pivot, linear, wheelline) | | | | |
| Sep 01, 01 | Irrigation, Stop Monitor | | | | |
| Sep 20, 01 | Harvest, silage, kill crop | | | | |
| Sep 25, 01 | Disk, tandem heavy primary op | | 0 | | |
| Oct 03, 01 | Drill or airseeder, double disk | Wheat, winter s... | 0 | | |
| Oct 05, 01 | Irrigation (2 inch, Pivot, Linear, Wheelline) | | | | |

**Figure 7** showing the management file with the winter wheat silage added in.

**Step 2:** Make the run and call it, *Corn, silage-WWheat, silage, Conv, spring manure, pivot CMZ19.*

**Erosion**

| Period | Crop/Residue | Gross Loss t/ac | Net Soil Loss From Field ( t/ac ) Total | Creep/Salt | Suspen | PM10 |
|---|---|---|---|---|---|---|
| Rot. year: 1 | Wheat, winter silage<br>Corn, silage | 2.3 | 2.3 | 1.2 | 1.2 | 0.03 |
| Ave. Annual | | 2.3 | 2.3 | 1.2 | 1.2 | 0.03 |

**Crop Interval Erosion**

| Date Range | Crop | Gross Loss t/ac | Net Soil Loss From Field ( t/ac ) Total | Creep/Salt | Suspen. | PM10 |
|---|---|---|---|---|---|---|
| Sep 21, 01 - Apr 12, 01 | Wheat, winter silage | 2.1 | 2.1 | 1.0 | 1.1 | 0.03 |
| Apr 13, 01 - Sep 20, 01 | Corn, silage | 0.2 | 0.2 | 0.1 | 0.1 | 0.00 |

**Harvests**

| Date | Crop | Residue lb/ac | Harvest Yield | Yield % Moisture |
|---|---|---|---|---|
| Apr 12, 01 | Wheat, winter silage | 693 | 8.5 ton/ac | 65.0 |
| Sep 20, 01 | Corn, silage | 277 | 18.2 ton/ac | 65.0 |

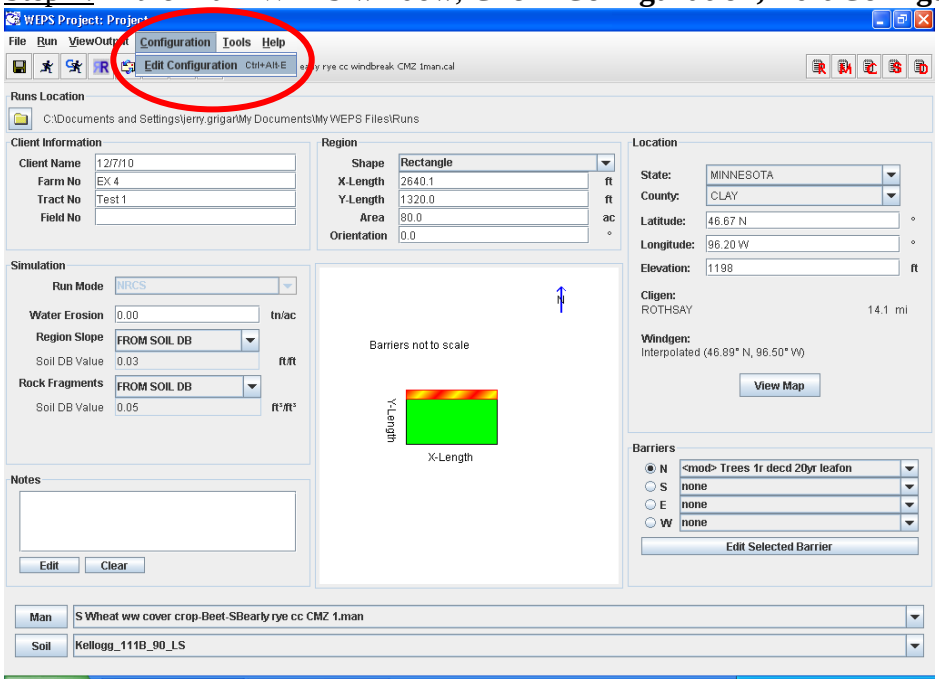
**Figure 8** Showing the effect of adding a winter cover crop of winter wheat silage.

**What is the predicted soil loss?** About 2 ton/ac. Corn silage yield is 18 t/ac. and winter wheat silage yield is 8.5 t/ac.

Both are reasonable yields for Curry Co. The run could be calibrated if needed since there is only one harvest for each of the crops. In this case it would only lower the soil loss slightly if we calibrated the corn up to the 23 t/ac mentioned in the inventory.

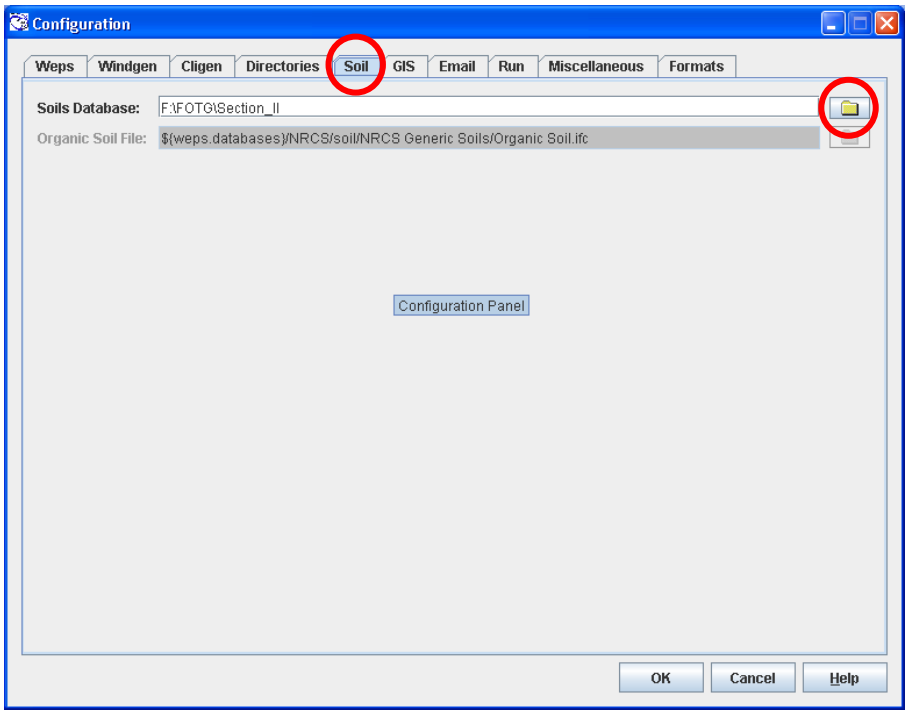
**HOW TO ACCESS LOCAL SOILS DATA FOR USE IN WEPS** 1/2011

Step 1: In the Main WEPS window, Click "**Configuration, Edit Configuration"**

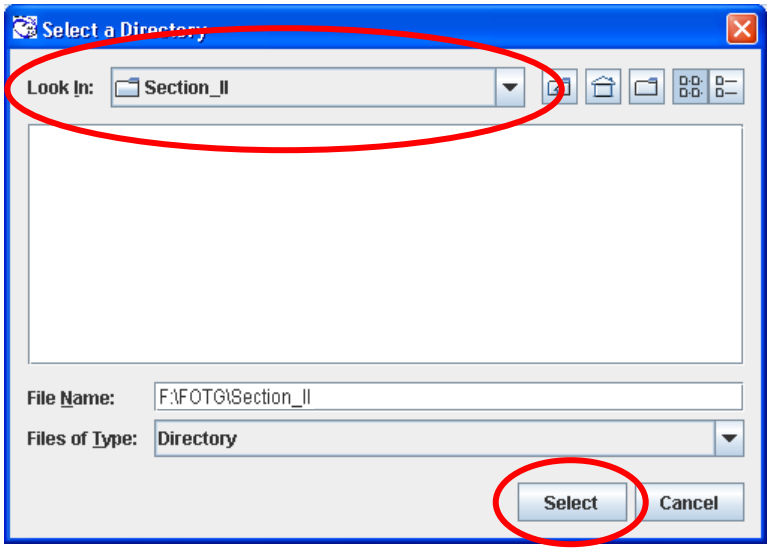



Step 2: Select the **Soil** tab

Step 3: Click the yellow folder button



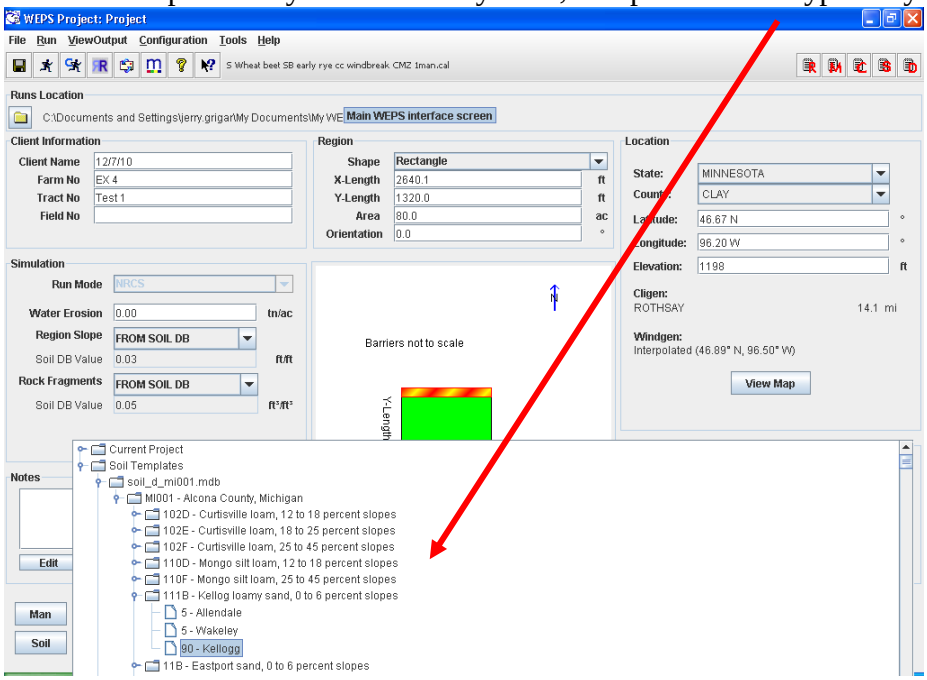
Step 4: Drill down on the **Look In:** box and navigate to **F: \FOTG\Section II**
See (My computer/data on MI …"your FO name" F**: \FOTG\Section II)**

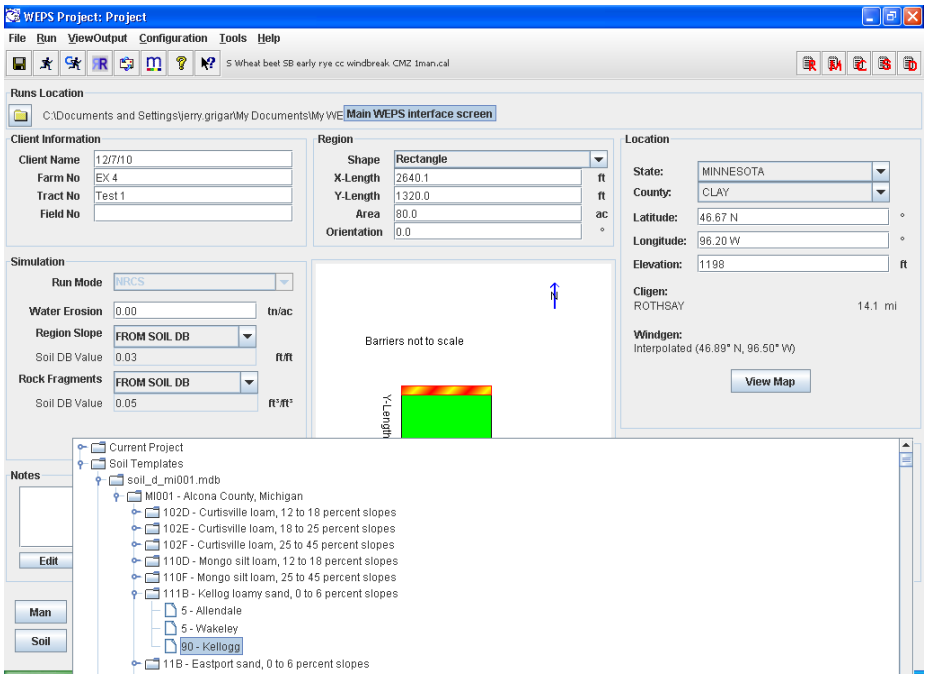



Step 5: Left Click on **Select Button** and set the path to the soil directory on F.

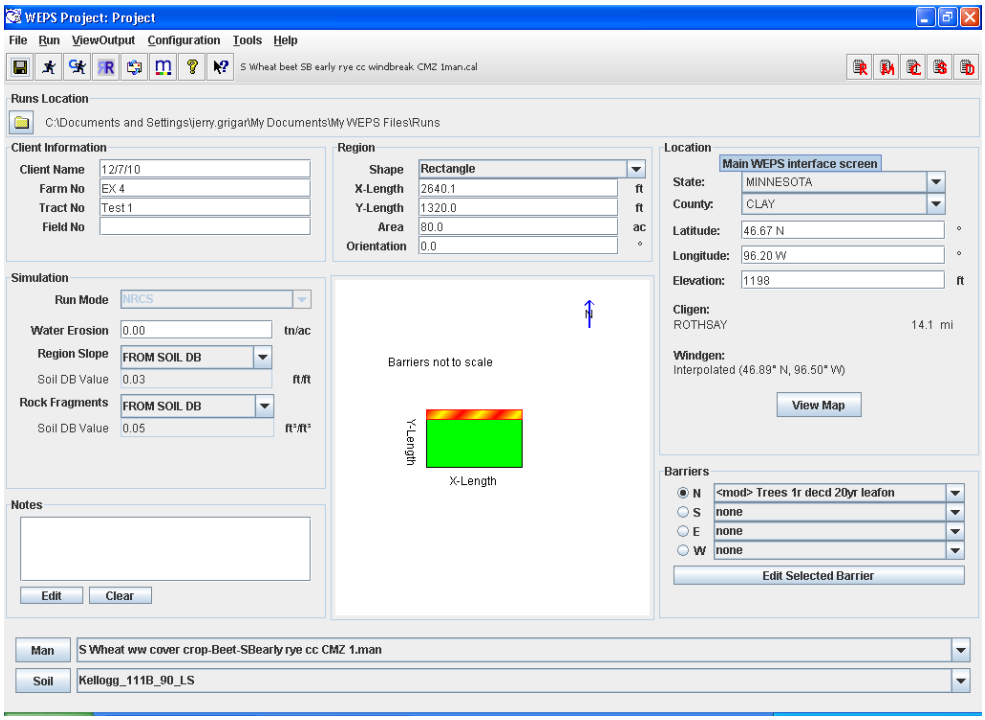
Step 6: Click **OK** until you return to the WEPS Project Window

Step 7: In the main WEPS window, drill down on the **Soil** list, choose the soil database which corresponds to your soil survey code, and pick the soil type for your WEPS run.



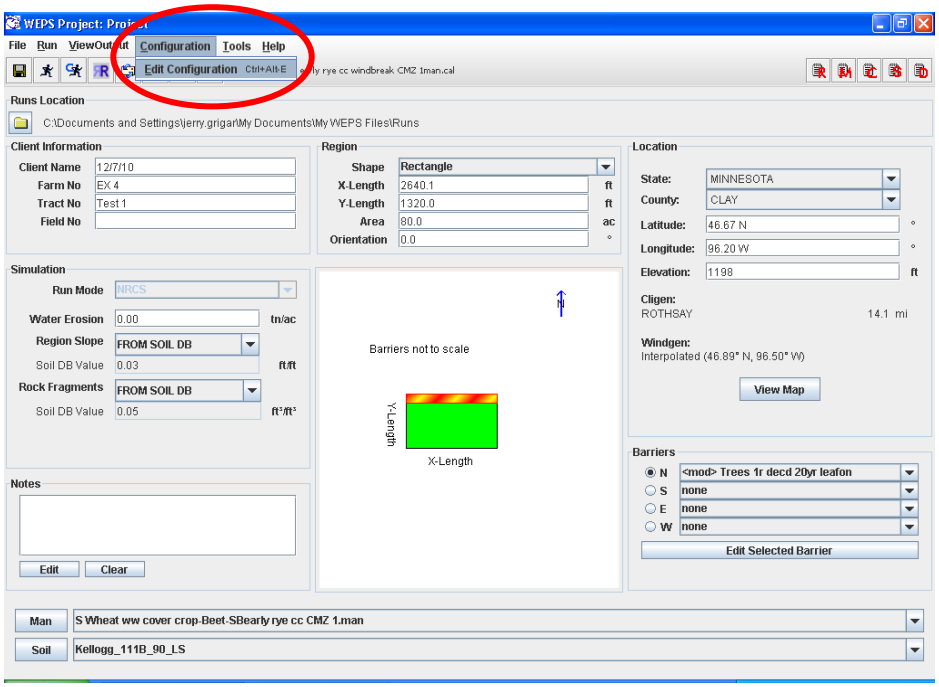



Congratulations! The WEPS model is now configured to locate the county soils database for the current project. Soil databases for surrounding counties can be accessed in the same way.

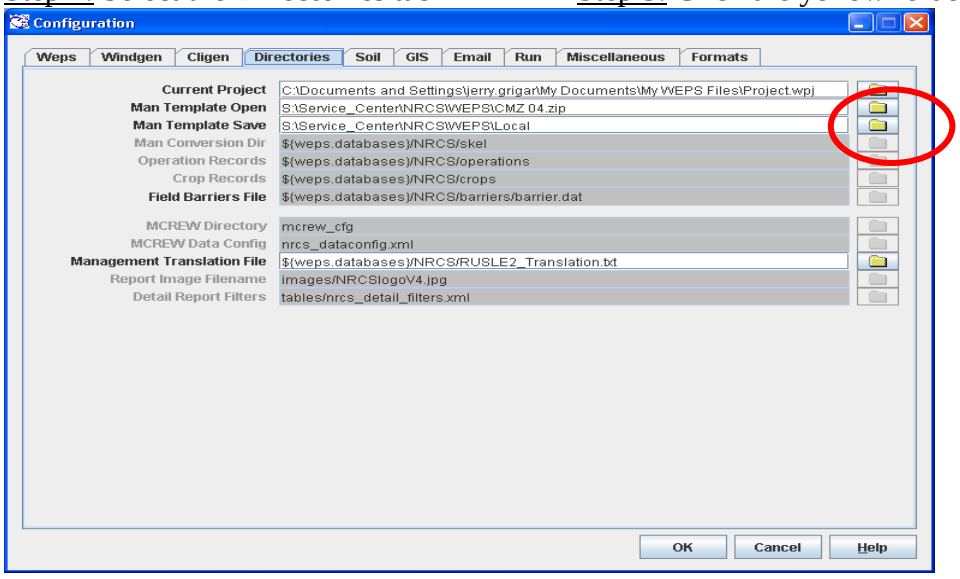


HOW TO ACCESS LOCAL CROP MAN DATA FOR USE IN WEPS 1/2011

Step 1: In the Main WEPS window, Click "**Configuration, Edit Configuration"**




Step 2: Select the **Directories** tab Step 3: Click the yellow folder button




Step 4: In the Man Template Open directory yellow folder drill down to the S drive to the WEPS\CMZ04.zip file Select either CMZ01.zip or CMZ04.zip file. Leave Zipped! Select.

Step 5: Do the same In the Man Template Save folder. Select. Your WEPS model is now ready to use.

## Wind Erosion and Wind Erosion Prediction System (WEPS) glossary 1/20/2011

**Barriers:** on the WEPS interface provides a place to describe the properties (height, age, width, row number, type, etc.) and placement of barriers on the field borders.
**Button Bar: (symbols)** of the Main WEPS interface provides a shortcut way of executing the Menu functions.
**Critical wind erosion period** is that part of the year when agricultural fields are particularly vulnerable to wind erosion due to higher wind speeds than normal and low vegetative cover on fields.
**Crop tolerance** is the maximum wind erosion that a growing crop can tolerate, from crop emergence to field stabilization, without and economic loss of stand, yield, or quality.
**Detachment** occurs when the wind force against soil particles increases enough to overcome the force of gravity. Once detached, moving particles may collide and detach other particles.
**Deposition** typically occurs when the wind velocity decreases and soil particles are deposited in furrows or grassy areas. Deposition also occurs along the edge of fields in ditches, fence rows, or barriers such as windbreaks. However, suspension particles can travel much farther than the edge of the field by air.
**Field View panel** on the WEPS main interface displays the physical dimensions and orientations of the field and barriers. This panel is for information only and not editable.
**Location** on the WEPS main interface is used to specify the location of the simulation field. This information is used to assist in determining the climate and wind stations selected for the simulation.
**MCREW** (Management Crop Rotation Editor Worksheet) accessed by selecting the **MAN button** on the WEPS main interface allows for the selection, creation and editing of management practices.
**Menu Toolbar:** The Menu Bar of the main WEPS Project interface has access to the operational functions of WEPS: File, Run, View Output, Configuration, Tools and Help. Under

1. **Project menu** is a drop down list of various computer operations in WEPS projects. The project **File menu** contains the following options:

- **Save**- saves the currently displayed project to its current name
- **Set Run Location** allows the user to set the default Run Directory
- **Reset**- resets current run setting to defaults. Management and soil files will be deleted
- **Export Run** used to send Run directory to another location.
- **Delete Run** opens the Run directory window to delete a WEPS run
- **Delete Management Rotation File**- opens a file window to delete a WEPS management file
- **Delete IFC Soil** file opens a window to delete a WEPS soil file
- **Browse Databases Folder** opens window to C drive and the NRCS databases folders with Soil, Management, Cligen, etc.

2. **Project Run** this menu allows the user to run WEPS using the current inputs specified on the WEPS main screen or to restore from previous WEPS Runs. **The Run menu** on the WEPS main screen displays the following options:
    - **Make a WEPS Run** begins a WEPS simulation using the current selected inputs
    - **Make a Yield Calibration RUN-** begins a simulation running WEPS in "yield calibration mode"
    - **Restore a WEPS Run** opens a list of previous WEPS runs to select and load the inputs used in a previous WEPS run.

3. **Project View Output** this menu allows the user to view output for the most recent (i.e., most current) WEPS run and previous WEPS runs.
    - **Most Recent Run-** this menu opens six output options for the most **recent** WEPS run::
        1. **Run Summary** displays a brief output summary
        2. **Crop Summary** displays a summary of yield parameters
        3. **Management Summary** displays a summary of management operations
        4. **Detailed Reports** displays a detailed report
        5. **Stir Energy Report** displays the soil tillage intensity rating (STIR) and the energy used in the crop rotation
        6. **Debugging Reports** displays a screen to view additional output files.

    - **Previous Run** this menu open six output option to view for a **previous** WEPS run
        7. **Run Summary** displays a brief output summary
        8. **Crop Summary** displays a summary of yield parameters
        9. **Management Summary** displays a summary of management operations
        10. **Detailed Reports** displays a detailed report
        11. **Stir Energy Report** displays the soil tillage intensity rating (STIR) and the energy used in the crop rotation
        12. **Debugging Reports** displays a screen to view additional output file

    - **Multiple Run Manager** opens a window displaying output information from multiple runs for side by side comparisons. The RUN menu at the top of the screen contains items that allow the user to add a directory or runs, or a single run. The user can also restore a selected run in WEPS so

that the results can be viewed in more detail or modified for another run. The Help menu allows the user to display version information about the multiple run managers and the active WEPS model.

**Prevailing wind erosion direction** is that direction in which the greatest amount of soil is moved. The effectiveness of wind barriers, strip cropping, ridges, etc. in reducing wind erosion is determined by their orientation relative to the prevailing wind erosion direction for the particular month(s) that control is desired.

**PM10** These suspension soil particles are particulate matter less than 10 microns in size or smaller. A small fraction of PM 10 suspension particles may cause health problems when inhaled.

**Region** on the WEPS main interface provides the physical dimensions and the orientation of the simulated field relative to the longest unsheltered distance N-S (Y length) and E-W (X length).

**Run Summary** displays user information, input parameter files and basic soil loss information by rotation year and the average annual for the total simulation: Erosion losses are displayed as follows:

1. **Gross Loss** is the average wind erosion in the field
2. **Total** is the average total net loss from the field
3. **Creep/salt** is the average creep plus saltation net loss from the field
4. **Suspension** is the average suspension net loss from the field
5. **PM 10** is the average net loss of particulate matter less than 10 microns in size from the field

**Saltation** is the transport of soil particles by wind forces that generally involves smaller particles than surface creep, approximately 1/10 to 1/2 millimeter still, in size, that bounce or hop along the surface.

**Simulation Region Orientation and Angles:** Field orientation and tillage direction in WEPS are independent and measured relative to true North (0 degrees). Because of the daily variance of the direction of the wind angles, tillage ridge spacing and height impact the wind simulation runs daily calculations. Field Orientation should be rotated to field angle or ridge orientation in a range of plus or minus 45 degrees.

**Soil Panel** in WEPS is used to select and view the soil information for the simulation. Only one soil is allowed for the WEPS simulation region.

**Surface creep** is the transport of soil particles by wind that generally involves particles approximately 1/2 to 1 millimeter in size, small enough to be moved by the wind but too massive to be lifted off the surface.

**Suspension** is the transport of soil particles less than 1/10 of a millimeter - smaller than the diameter of a human hair - that are lifted far above the surface and carried great distances

**Tillage Direction**: The direction of tillage in relation to true North (0 degrees) in the MCREW Editor.

**Threshold velocity** is dependent on the state of the soil surface and the wind speed at which particle movement is initiated. Soil erosion by wind is initiated when the wind speed exceeds the saltation threshold speed for a given soil and biomass condition.

**Transport** occurs when the detached soil particles are blown by the wind, either through the air or along the surface. The distance, height, and duration of transport are dependent largely on the wind speed.

**WEPS Project** is a directory… where WEPS simulation runs are created. WEPS projects store soils (.ifc) files and management (.man) files. WEPS projects are located at:
*C:\Documents and Settings\your. name\My Documents\My WEPS files\Project.wpj*.

**WEPS Run** is a single simulation of a field with all input and output files. WEPS runs store all data that can be recalled at a later date without a rerun to see the results with the same parameters. *Send the run directory file to another location from the main interface by using the* ***File\Export Run*** *command.*

Each run is located in the WEPS Run directory at:
*C:\Documents and Settings\your. name\My Documents\ My WEPS files\Runs*

**WEPS Template** is a pre-built management rotation file or crop file. These can be the calibrated crops or managements that are saved by the users with a local Biomass Adjustment Factor. *To move the local files to a shared server location use the* ***Configuratation\ Edit Configuration*** *Drop down.*

1. **Management template folders are at:**

   *C:\Documents and Settings\All Users\Application Data\USDA\WEPS\Databases\nrcs\man*
2. **Local Management Template folders made locally by the Users are field at:**

   *C:\Documents and Settings\All Users\Application Data\USDA\WEPS\Databases\nrcs\man\local*
3. **Crop Template Folders made locally by the Users are filed at:**

   *C:\Documents and Settings\All Users\Application Data\USDA\WEPS\Databases\nrcs\crop\local*
4. **Soils files are at:**

   *C:\Documents and Settings\All Users\Application Data\USDA\WEPS\Databases\nrcs\soil*

**NOTE: WEPS soils and Crop Management files are configured to the F drive and the S drive. Therefore, the crop cmz.zip file and soils databases will have to be saved to the C drive and the WEPS configuration edited to the C location to use WEPS as a laptop program.**

## Conservation Practices and Management that Impact Wind Erosion

**Addition of Crop Residues** to the surface reduces wind velocity and traps moving soil particles. Almost any kind of residue, such as hay, straw or corn stalks can be used. Approximately 2000 to 4000 pounds of residue per acre is required to control erosion in areas where erosion has already begun. See NRCS Standard Residue Management, Seasonal (344)

**Annual Crops** can be used as herbaceous wind barriers, so one crop provides protection for another crop. See the NRCS Standard Herbaceous Wind Barriers (603)

**Artificial Barriers** such as snow fences, board walls, bamboo and willow fences, earthen banks, hand-inserted straw rows, and rock walls have been used for wind erosion control. Artificial Barriers are often useful for dune stabilization until permanent vegetation can be established.

**Conservation Cover** involves establishing and maintaining permanent vegetative cover on land retired from agriculture production, such as land considered highly erodible in Conservation Reserve Program. See the NRCS Standard Conservation Cover (327).

**Critical Area Planting** involves planting vegetation, such as trees, shrubs, vines, grasses, or legumes on highly erodible areas. This practice is used on areas that cannot be stabilized by ordinary planting techniques and may suffer severe erosion if left untreated. Critical areas include dams, levees, surface-mined land, and areas of agriculture land with severe erosion. See the NRCS Standard Critical Area Planting (342).

**Cross Wind Ridges** are formed by tilling or planting across the prevailing wind erosion direction. If erosive winds show no seasonal or annual prevailing direction, this practice has limited protective value. See the NRCS Standard Cross Wind Ridges (589A)

**Cross Wind Strip Cropping** is the practice of growing crops in strips, arranged perpendicular to the prevailing wind erosion direction. See the NRCS Standard Stripcropping (585)

**Cross Wind Trap Strips** consist of herbaceous vegetation resistant to wind erosion, established in one or more strips, perpendicular to the prevailing wind direction. Since saltating particles can travel up to 15 feet, the cross wind trap strips should be at least 15 feet in width and up to 25 feet for shorter strip vegetation. See the NRCS Standard Cross Wind Traps Strips (589C)

**Emergency Tillage** is tillage performed on an actively blowing field to provide a rough, ridged, cloddy surface that reduces wind velocity and helps trap windblown soil particles.

**Herbaceous Wind Barriers** are tall, non-woody vegetative barriers, established in 1-2 row narrow strips across the prevailing wind direction. These are primarily used on soils where stubble mulching and strip cropping do not adequately control wind. See the NRCS Standard Herbaceous Wind Barriers (603)

**Livestock Manure** is like crop residue or large clods and can reduce wind erosion by slowing the wind velocity at the soil surface and by trapping soil particles. Usually 6 to 8 tons of manure per acre effectively controls wind erosion on wind prone areas. See NRCS Standard Residue Management, Seasonal (344)

**Mulch Tillage** maintains crop residues on the entire soil surface year-round. Mulch tillage uses non-inversion tillage where residue is only partially incorporated using chisels, sweeps, field cultivators, or similar implements. See NRCS Standard Residue and Tillage Management Mulch till (345)

**No-till or Strip Till** is a residue management tillage system that involves managing the amount, orientation and distribution of plant residues on the soil surface year-round, while growing crops in narrow slots or tilled strips in the field. This practice is also referred to as no-till, zero-till, slot plant, row-till, or more generally, conservation tillage. See NRCS Standard Residue and Tillage Management No Till/Strip Till/Direct Seed (329)

**Pasture and Hay land Planting** establishes native or introduced forage species for livestock grazing or feed. See the NRCS Standard Pasture and Hayland Planting (512)

**Perennial Grass** barriers work well for wind erosion control, as well as trapping snow and reducing evaporation on dry-land cropping areas. See the NRCS Standard Herbaceous Wind Barriers (603)

**Permanent Vegetative Cover** is one of the most effective ways to control wind erosion. It protects the soil from wind and water erosion forces throughout the year**.** See the NRCS Standard Conservation Cover (327) or Critical Area Planting (342)

**Ridge Till** is a residue management tillage system that maintains crop residues on the soil surface year-round by growing crops on pre-formed ridges alternating with furrows which are protected by crop residue. See NRCS Standard Residue and Tillage Management Ridge Till (346)