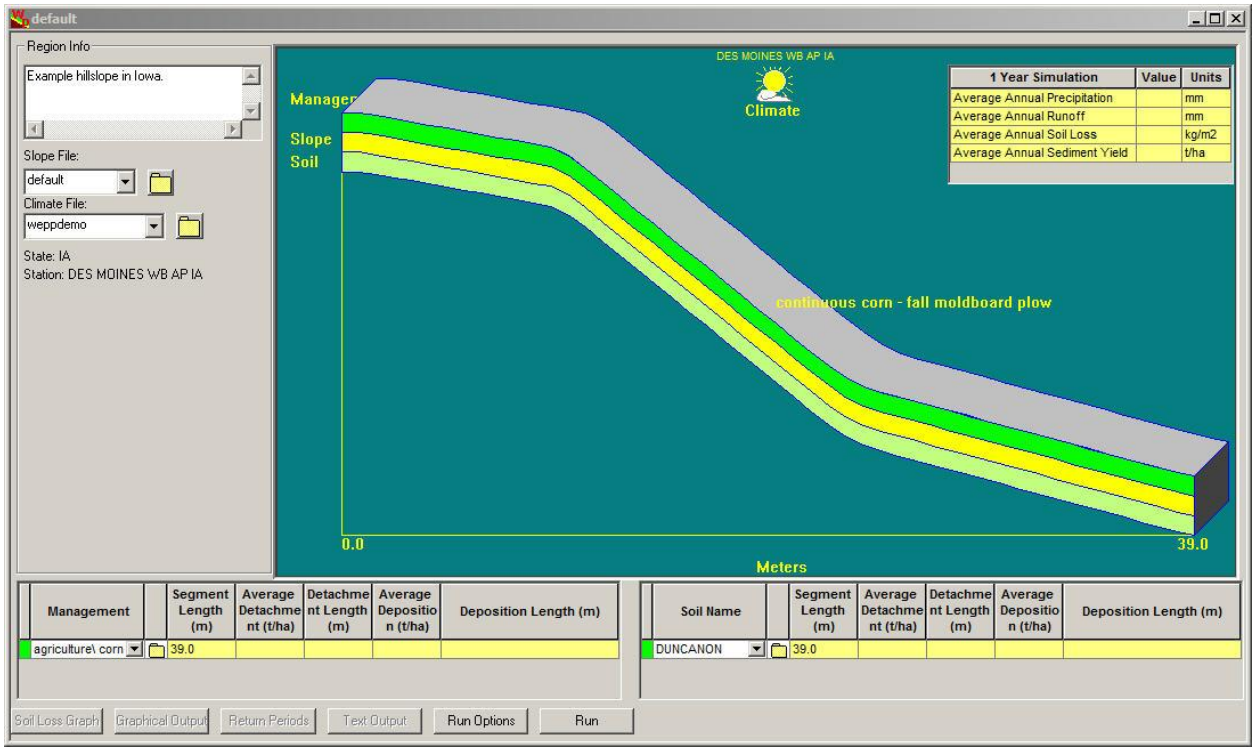
WEPP Management Tutorial –Overview

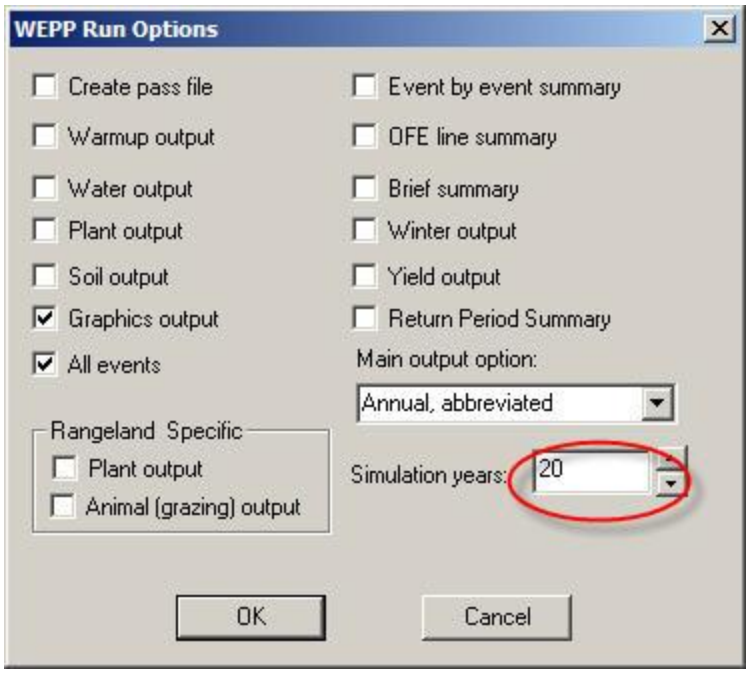
March 4, 2013

This tutorial will show how to work with WEPP managemen inputs and look at the effect on WEPP outputs.

First start the default WEPP project (default).



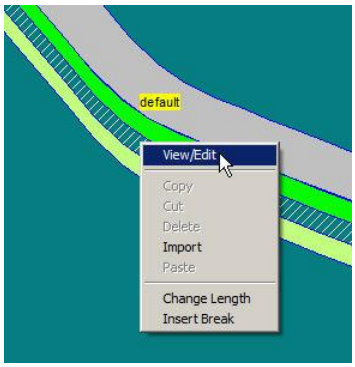
Make an initial baseline run. First change the number of years to run to 20. Click the Run Options button and then fill in the number of years and click OK.



Next , click the Run button:

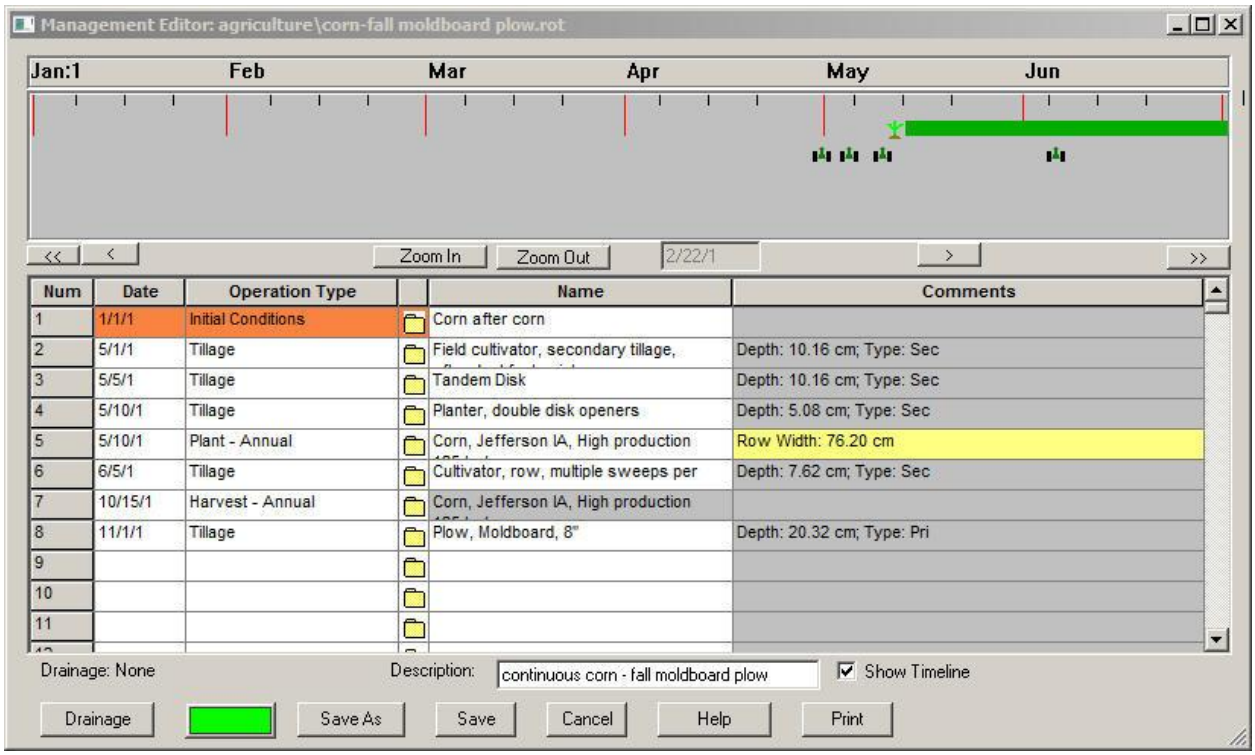
For the baseline condition the runoff was 104.56 mm/yr, soil loss 1.908 kg/m^2 and sediment yield 19.080 t/ha.

The management file is changed by using the management editor, this can be started in 3 different ways:



1. Right-click the top layer, which is the management, and then click View/Edit.

2. Double click the management layer
3. Select the management with a left click and then the view toolbar button:



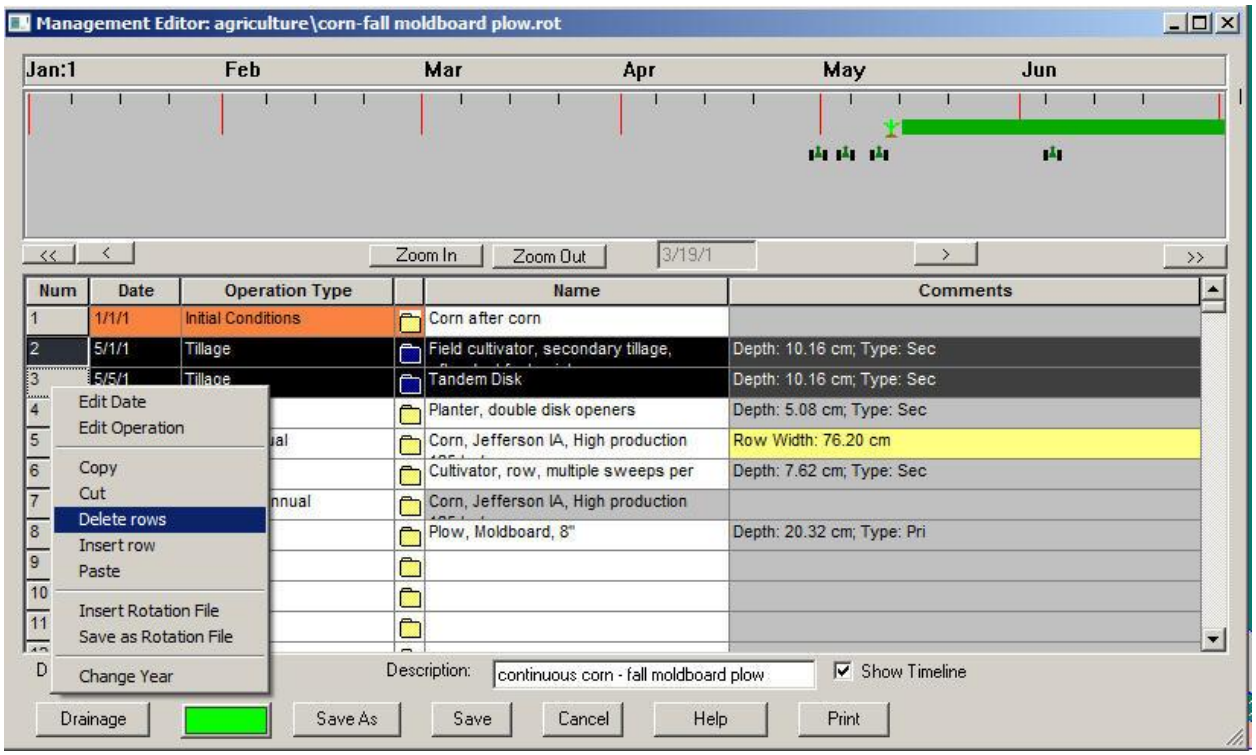
WEPP Management information is composed of the following information:

1. **Initial Conditions** – This represents the lancover on day 1 of the simulation. This is January 1 for continuous (daily) simulation. If the climate file is for a single storm the initial conditions represent the landcover on the day of the storm.

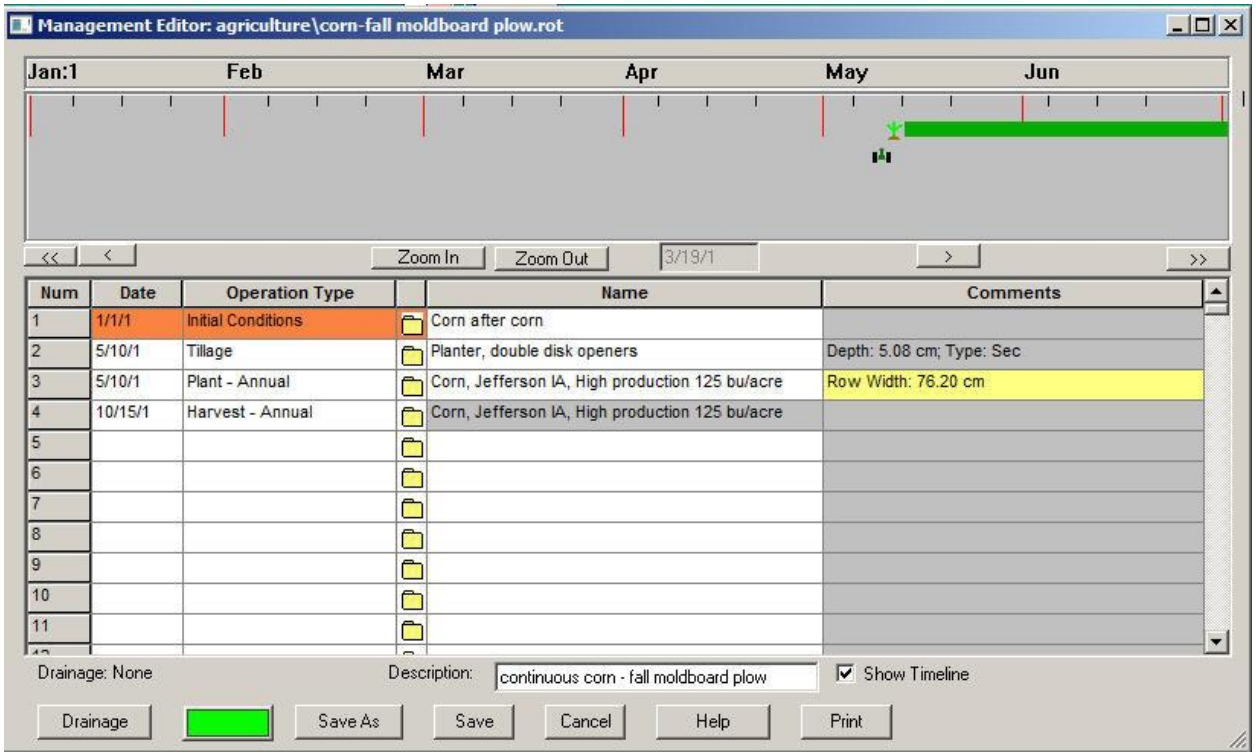
2. **Date** – This is the date that a particular operation occurs. For multiple year simulations where the management file has less years than the simulation length the dates will repeat. For example, a 2 year simulation will repeat the above operations in year 2.
3. **Operation Type** – These are all the management operations for WEPP. Each operation can have a set of detailed parameters. Some operations do not have any parameters. The folder icon  Will display the detail parameters that can be changed.
4. **Operation Name** – These are pre-built scenarios for operation types. New names can be added.

Lets change the management so that it represents a no-till scenario. This will be done by deleting the lines in the management that disturb the soil.

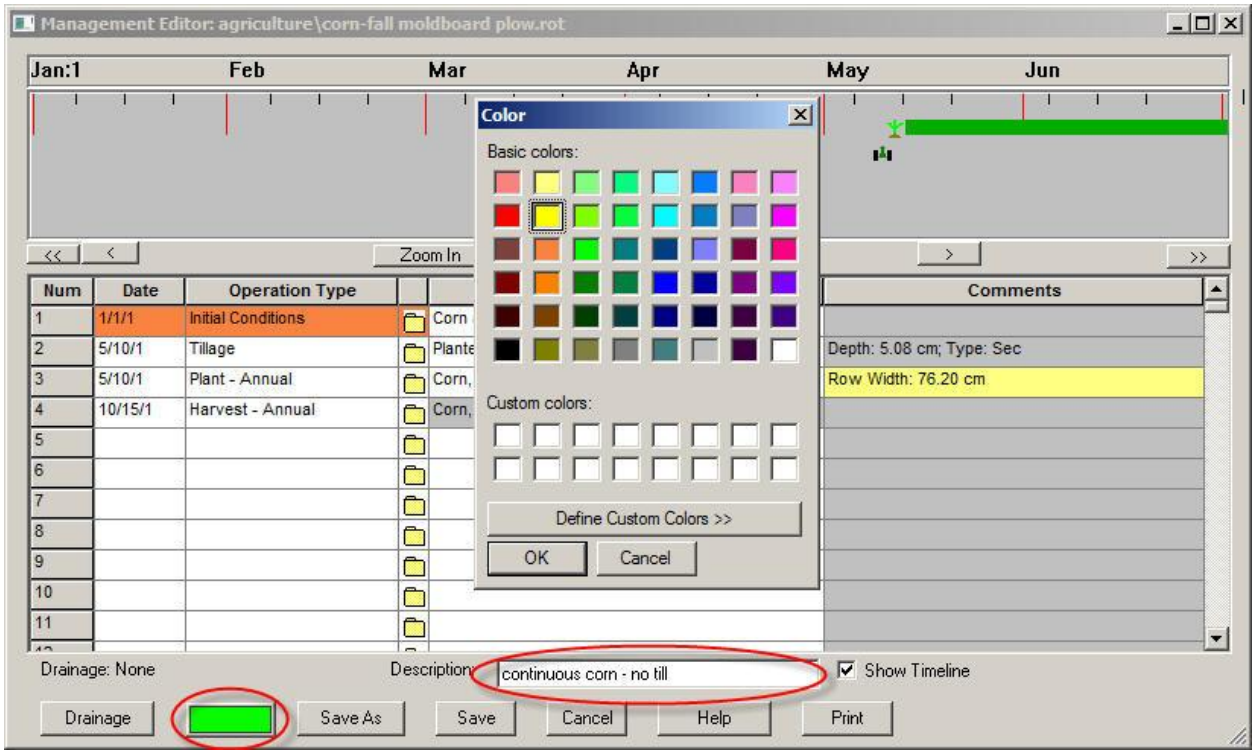
To delete lines click in the area to the left on the lines and then right-click to bring up a menu. From the menu choose the 'Delete Rows' item.



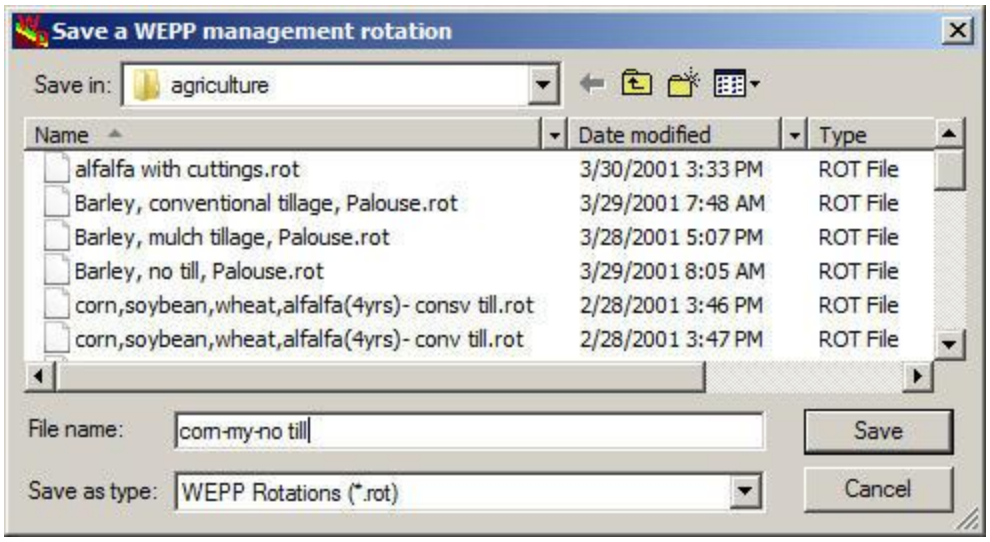
After deleting lines 2,3,6 and 8 the management scenario looks like the following:



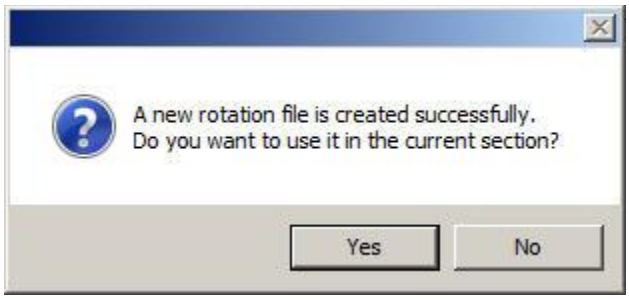
Next, change the description and the color to yellow that will be used on the main screen:



Next, save our new file by clicking the 'SaveAs' button and giving it a new name:



And finally click the 'Save' button. On the next screen, click the 'Yes':



On the main window, make a new run:

20 Year Simulation	Value	Units
Average Annual Precipitation	829.80	mm
Average Annual Runoff	159.53	mm
Average Annual Soil Loss	0.184	kg/m2
Average Annual Sediment Yield	1.845	t/ha

Compared to the original baseline run:

20 Year Simulation	Value	Units
Average Annual Precipitation	829.80	mm
Average Annual Runoff	104.56	mm
Average Annual Soil Loss	1.908	kg/m2
Average Annual Sediment Yield	19.080	t/ha

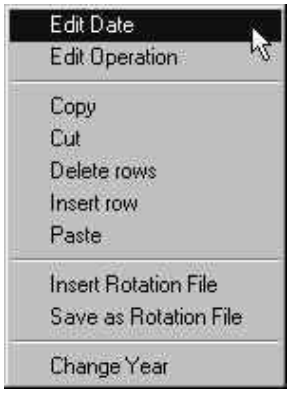
Adding lines to a Management File

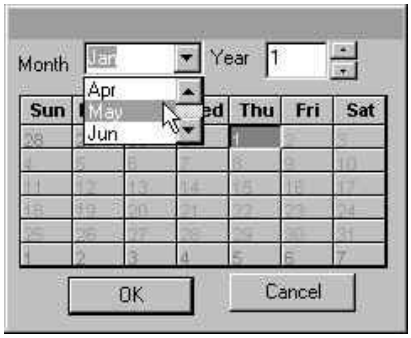
For this scenario we will start with the 'corn-spring chisel plow' management:

Num	Date	Operation Type		Name	Comments
1	1/1/1	Initial Conditions		Corn after corn	
2	4/15/1	Tillage		Chisel Plow	Depth: 20.32 cm; Type: Pri
3	4/25/1	Tillage		Field cultivator, secondary tillage, after	Depth: 10.16 cm; Type: Sec
4	5/1/1	Tillage		Tandem Disk	Depth: 10.16 cm; Type: Sec
5	5/10/1	Tillage		Planter, double disk openers	Depth: 5.08 cm; Type: Sec
6	5/10/1	Plant - Annual		Corn, Jefferson IA, High production 125	Row Width: 76.20 cm
7	6/5/1	Tillage		Cultivator, row, multiple sweeps per row	Depth: 7.62 cm; Type: Sec
8	10/15/1	Harvest - Annual		Corn, Jefferson IA, High production 125	
9					
10					
11					

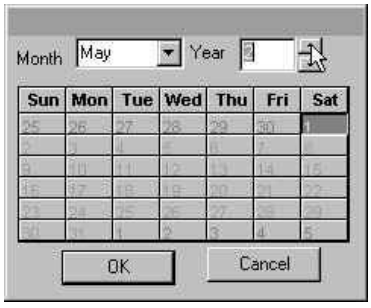
Let's add operations for a soybean crop to be grown in a second year of the rotation. We will initially use a no-till system. Click on the 9th row of the table with the left mouse button to highlight it as shown below, then right click with the mouse to bring up the mouse options screen.

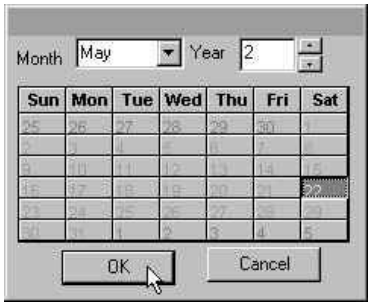
The mouse options allow you to perform many functions in the rotation table. You can edit the date for the current row, edit the operation parameters for the current row, copy, cut, delete, paste, and insert a row, insert an existing rotation from the database at some point in the current rotation, save highlighted rows from the table as a new rotation, and change the year date for a group of highlighted rows. In this example we need to change the date to May 22 of year 2 of the rotation. Select Edit Date from the list, and a calendar screen will appear. On the month field, click on the dropdown arrow and scroll to select May as shown in the figure.



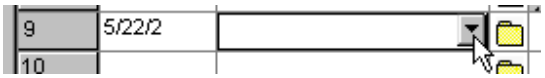


Next, click on the year up arrow button, and increase the value to 2. Then select the 22nd with a left mouse click as shown, then click on the OK button. The calendar screen will disappear and the date 5/22/2 will be entered in row 9.

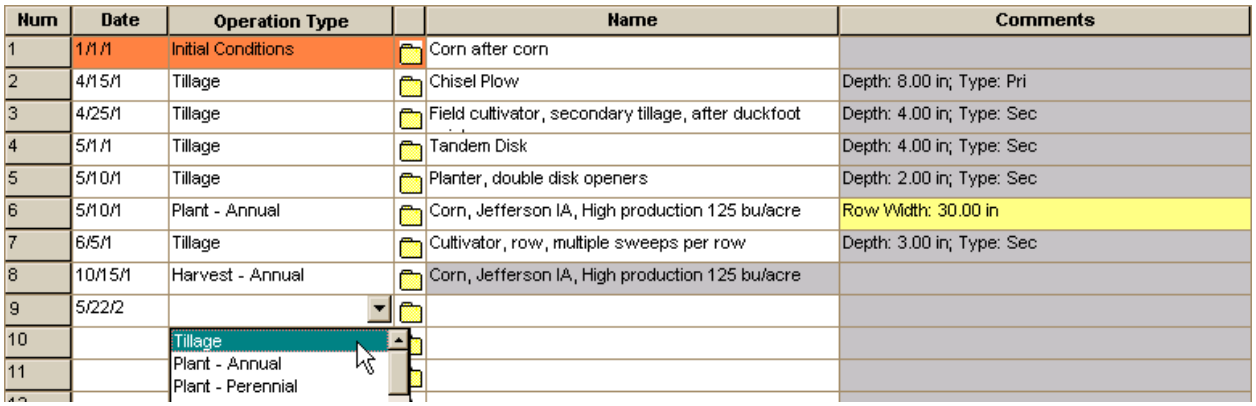




On line 9 in the rotation table go to Operation column and click on the cell.

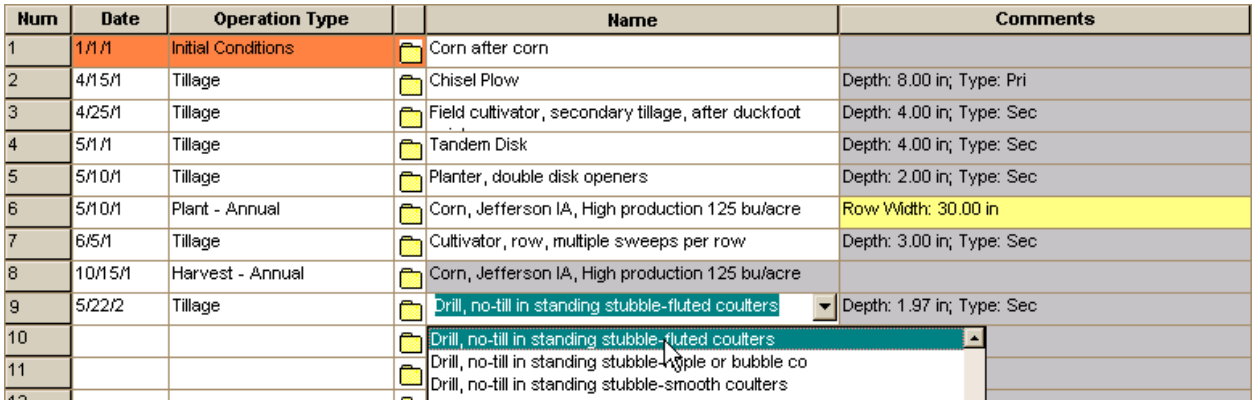


A dropdown list icon will appear at the right of the cell. Click on the dropdown arrow button, and a list of available cropland operations will appear. Select Tillage from the list with a left mouse click.



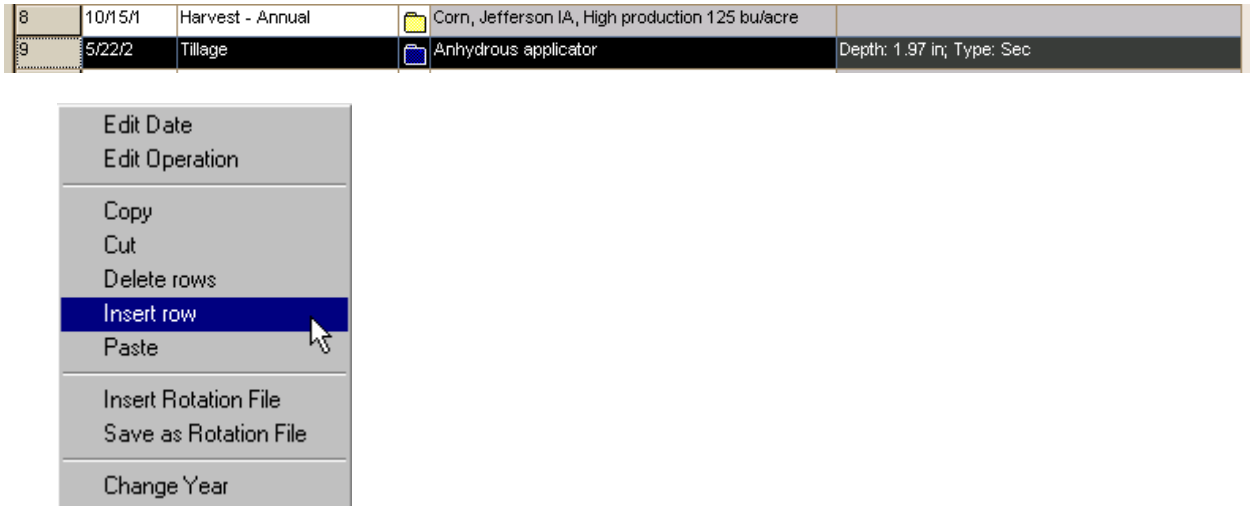
The Name cell will be filled with "Anhydrous applicator" as shown below.

Click on the name cell to make another dropdown arrow button appear, then click on the dropdown list button.

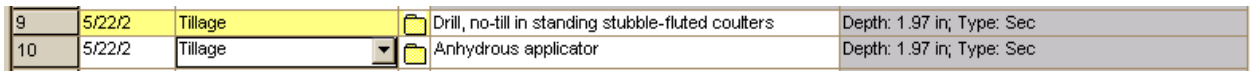


In the list of tillage operations, scroll down to the Drill section, then select "Drill, no-till in standing stubble – fluted coulter" with a left-mouse click. The new information for the no-till drill should now be displayed in row 9 of the table. (Table column and row widths can be resized if long text wrapping makes some entries hard to read.)

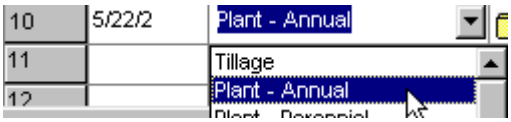
Next, let's insert a new row with the same information as is now in row 9. Click on row 9 column 1 with a left mouse click, then right click to bring up the option menu.



A new row 10 will appear, with the same date and operation type as in row 9 information.



The tillage operations address soil disturbance activities. To actually plant and start the growth of our new soybean crop, we need to go to the Operations column in line 10, click on the dropdown list, and select Plant-Annual, since we will be growing soybeans as an annual crop.

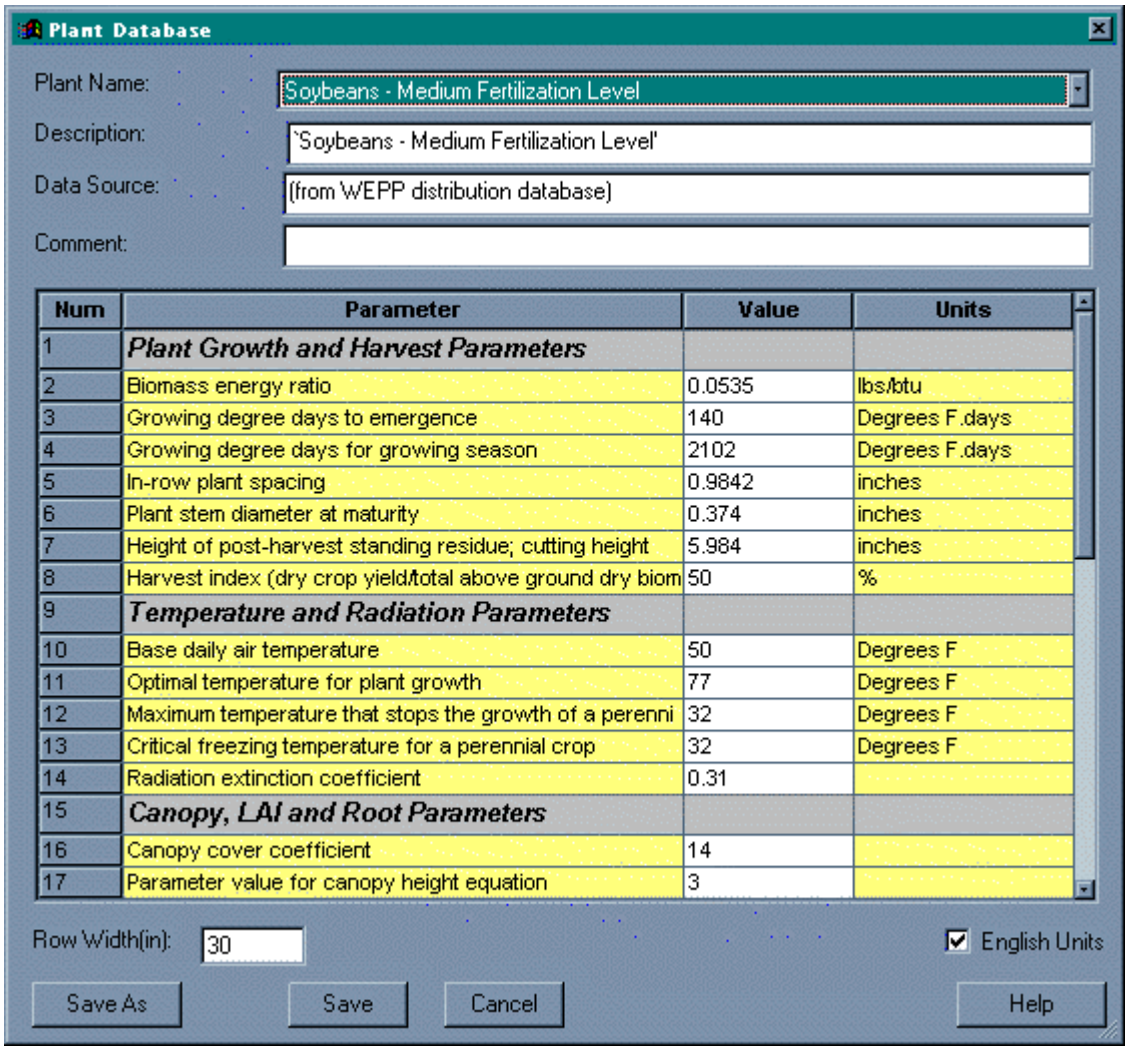


The remainder of the row will then be filled in, with Alfalfa listed in the Name cell. Go to the Name cell and click on the dropdown list to select a soybean crop. We want to choose medium fertility level soybeans.

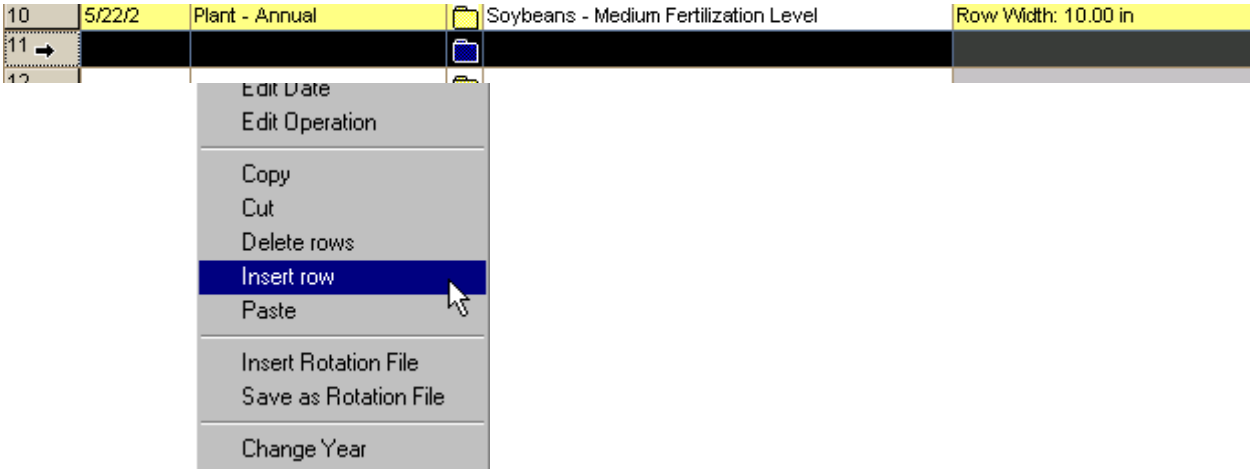
Select "Soybeans – Medium Fertilization Level" from the list as shown with a left mouse click.

Row 10 will now be filled in as shown below. However the row width for the soybeans is not typical of a drill, so we will need to edit the soybean parameters. To do this, click on the small folder icon to the left of the Name column.

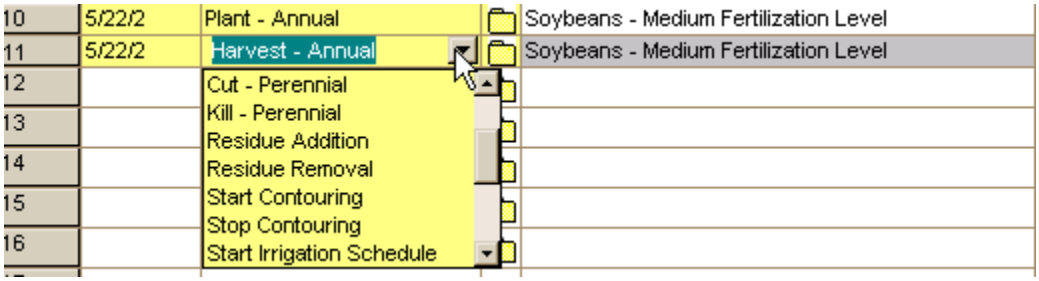
The plant database window will appear. This screen contains 32 parameters associated with a plant type. We will only change the Row width in the entry field at the bottom left of the screen, from 30 inches (76cm) to 10 inches (25.4cm)



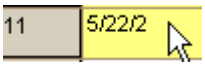
Enter a value of 10 inches (25.4 cm) here, and click on the Save button. Returning to the table, line 10 now appears with the correct row spacing. Next, click on line 11 column 1 with the left mouse button, then right click to bring up the mouse options. Select insert row again, and the information on line 10 will be copied to line 11.

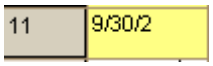


On line 11, go to the Operation column, and select Harvest Annual from the drop-down pick-list.



Next, click with the left mouse button into the date column, and directly enter the harvest date of September 30, year 2.



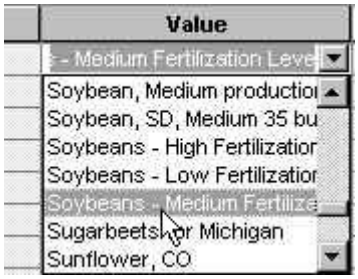


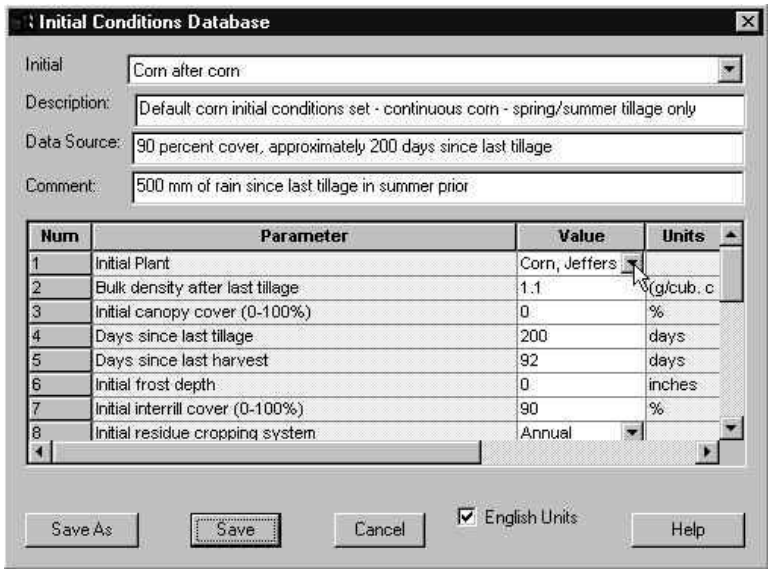
The rotation table now contains all of the operations necessary for a two year corn-soybean rotation, as shown in the next figure.

Num	Date	Operation Type		Name	Comments
1	1/1/1	Initial Conditions		Corn after corn	
2	4/15/1	Tillage		Chisel Plow	Depth: 8.00 in; Type: Pri
3	4/25/1	Tillage		Field cultivator, secondary tillage, after duckfoot	Depth: 4.00 in; Type: Sec
4	5/1/1	Tillage		Tandem Disk	Depth: 4.00 in; Type: Sec
5	5/10/1	Tillage		Planter, double disk openers	Depth: 2.00 in; Type: Sec
6	5/10/1	Plant - Annual		Corn, Jefferson IA, High production 125 bu/acre	Row Width: 30.00 in
7	6/5/1	Tillage		Cultivator, row, multiple sweeps per row	Depth: 3.00 in; Type: Sec
8	10/15/1	Harvest - Annual		Corn, Jefferson IA, High production 125 bu/acre	
9	5/22/2	Tillage		Drill, no-till in standing stubble-fluted coulters	Depth: 1.97 in; Type: Sec
10	5/22/2	Plant - Annual		Soybeans - Medium Fertilization Level	Row Width: 10.00 in
11	9/30/2	Harvest - Annual		Soybeans - Medium Fertilization Level	
12					

However, the Initial Conditions were from the original continuous corn spring chisel system, and likely do not contain correct information. Click on the file icon in the Initial Conditions on line 1 of the rotation table.

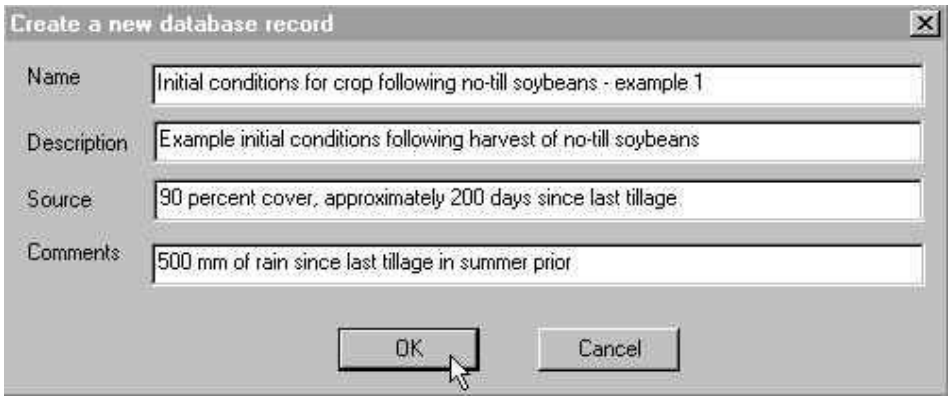
The Initial Conditions Database screen will appear. It contains 21 parameter values related to initial conditions for a rotation. Here we need to change the Initial Plant/Residue type in row 1 of the table. Click on the Value cell for row 1, then scroll down the drop-down list and select Soybeans-Medium Fertilization with a left mouse click.



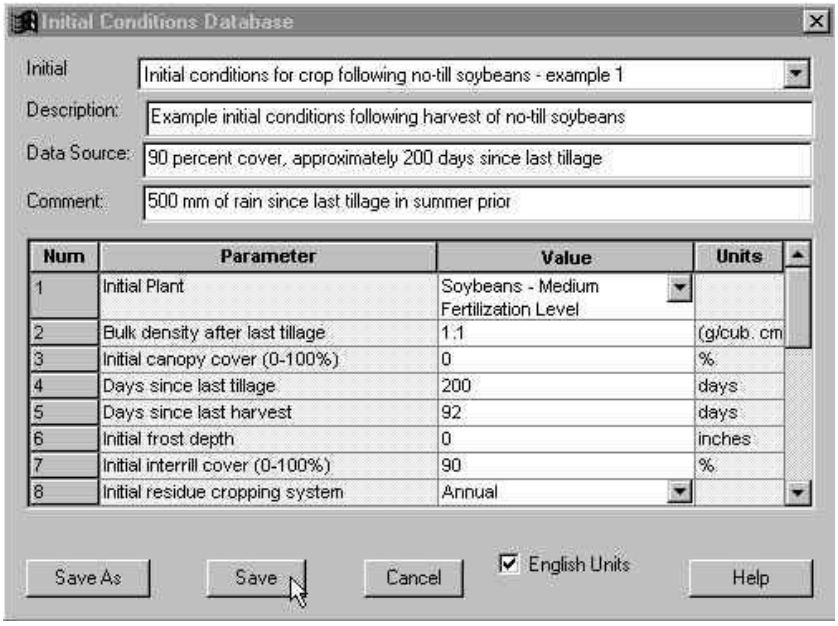


The initial residue cover values (interrill cover and rill cover) are at 90%, which is reasonable following harvest of soybeans and no tillage. If there are no other changes, click on the SaveAs button at the lower left of the screen.

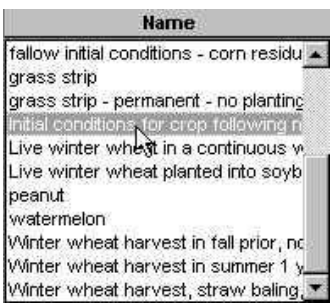
In the **Create a new database record** window, change the name to "Initial conditions for crop following no-till soybeans – example 1", and also change the description line as shown in the figure below. Then click on the OK button.



Returning to the Initial Conditions Database screen, the values have now changed to the new ones we entered. Click on the Save or Cancel button to exit the screen.



Once back in the main rotation screen, the initial conditions set selected is still "Corn after corn" (this is an interface bug that needs to be corrected). Click on the dropdown list, and choose the new initial conditions set just created.



At the bottom of the management editor screen, type in a new description for the new rotation as shown here.

Now our final rotation table looks like this:

Num	Date	Operation Type		Name	Comments
1	1/1/1	Initial Conditions		Initial conditions for crop following no-till soybeans - example-1	
2	4/15/1	Tillage		Chisel Plow	Depth: 8.00 in; Type: Pri
3	4/25/1	Tillage		Field cultivator, secondary tillage, after duckfoot points	Depth: 4.00 in; Type: Sec
4	5/1/1	Tillage		Tandem Disk	Depth: 4.00 in; Type: Sec
5	5/10/1	Tillage		Planter, double disk openers	Depth: 2.00 in; Type: Sec
6	5/10/1	Plant - Annual		Corn, Jefferson IA, High production 125 bu/acre	Row Width: 30.00 in
7	6/5/1	Tillage		Cultivator, row, multiple sweeps per row	Depth: 3.00 in; Type: Sec
8	10/15/1	Harvest - Annual		Corn, Jefferson IA, High production 125 bu/acre	
9	5/22/2	Tillage		Drill, no-till in standing stubble-fluted coulters	Depth: 1.97 in; Type: Sec
10	5/22/2	Plant - Annual		Soybeans - Medium Fertilization Level	Row Width: 10.00 in
11	9/30/2	Harvest - Annual		Soybeans - Medium Fertilization Level	
12					
13					
14					

WEPP Operation Types

Tillage	Soil disturbances
Plant Annual	Starts growth of an annual plant.
Harvest	Harvest of annual plant. Must be matched with a Plant Annual operation. This operation has no additional parameters.
Plant Perennial	Starts growth of a perennial plant.
Cut Perennial	Removes portion of perennial down to cutting height parameter.
Kill Perennial	Stops growth of a perennial plant.
Residue Addition	Adds residue to field, give type and amount.
Residue Removal	Removes percentage of residue from field.
Start Contouring	Specifies that contour ridges are in place
Stop Contouring	Specifies contour ridge are removed
Start Irrigation Schedule	Establish irrigation schedule
Start Grazing Schedule	Establish grazing schedule
Stop Grazing	
Herbicide Application	Kills any annual plant
Silage	
Burning	Removes fraction of residue by burning.
Shredding/Cutting	
Irrigate	

Initial Conditions

Corn After Corn

Num	Parameter - *Read Only*	Value	Units
1	Initial Plant	Corn, Jeffers	
2	Bulk density after last tillage	1.1	(g/cub. cm)
3	Initial canopy cover (0-100%)	0	%
4	Days since last tillage	200	days
5	Days since last harvest	92	days
6	Initial frost depth	0	cm
7	Initial interrill cover (0-100%)	90	%
8	Initial residue cropping system	Annual	
9	Cumulative rainfall since last tillage	500.1	mm
10	Initial ridge height after last tillage	2	cm
11	Initial rill cover (0-100%)	90	%
12	Initial roughness after last tillage	2	cm
13	Rill spacing	0	cm
14	Rill width type	Temporary	
15	Initial snow depth	0	cm
16	Initial depth of thaw	0	cm
17	Depth of secondary tillage layer	10	cm
18	Depth of primary tillage layer	20	cm
19	Initial rill width	2.54	cm
20	Initial total dead root mass	0.5	kg/sq.m
21	Initial total submerged residue mass	0.2	kg/sq.m

Tree

Num	Parameter - *Read Only*	Value	Units
1	Initial Plant	Tree-20 yr forest-disturbed WEPP	
2	Bulk density after last tillage	1.1	(g/cub. cm)
3	Initial canopy cover (0-100%)	90	%
4	Days since last tillage	1000	days
5	Days since last harvest	100	days
6	Initial frost depth	0	cm
7	Initial interrill cover (0-100%)	100	%
8	Initial residue cropping system	Perennial	
9	Cumulative rainfall since last tillage	1000	mm
10	Initial ridge height after last tillage	10	cm
11	Initial rill cover (0-100%)	100	%
12	Initial roughness after last tillage	10	cm
13	Rill spacing	0	cm
14	Rill width type	Temporary	
15	Initial snow depth	0	cm
16	Initial depth of thaw	0	cm
17	Depth of secondary tillage layer	10	cm
18	Depth of primary tillage layer	20	cm
19	Initial rill width	0	cm
20	Initial total dead root mass	0.5	kg/sq.m
21	Initial total submerged residue mass	0.5	kg/sq.m

Row Width (in): 0 Day of senescence(0-365): 0 English Units

Plant Parameters

Corn Parameters: (annual crop)

Num	Parameter - *Read Only*	Value	Units
1	***Plant Growth and Harvest Parameters***		
2	Biomass energy ratio	35	kg/MJ
3	Growing degree days to emergence	55	Degrees C.days
4	Growing degree days for growing season	1700	Degrees C.days
5	In-row plant spacing	21.9	cm
6	Plant stem diameter at maturity	5.1	cm
7	Height of post-harvest standing residue; cutting height	30.4	cm
8	Harvest index (dry crop yield/total above ground dry biom	50	%
9	***Temperature and Radiation Parameters***		
10	Base daily air temperature	10	Degrees C
11	Optimal temperature for plant growth	25	Degrees C
12	Maximum temperature that stops the growth of a perenni	0	Degrees C
13	Critical freezing temperature for a perennial crop	0	Degrees C
14	Radiation extinction coefficient	0.65	
15	***Canopy, LAI and Root Parameters***		
16	Canopy cover coefficient	3.6	
17	Parameter value for canopy height equation	3	
18	Maximum canopy height	260.1	cm
19	Maximum leaf area index	3.5	
20	Maximum root depth	152	cm
21	Root to shoot ratio (% root growth/% above ground grow	25	%
22	Maximum root mass for a perennial crop	0	kg/sq.m
23	***Senescence Parameters***		
24	Percent of growing season when leaf area index starts t	85	%
25	Period over which senescence occurs	30	days
26	Percent canopy remaining after senescence (0-100%)	65	%
27	Percent of biomass remaining after senescence (0-100%	98	%
28	***Residue Parameters***		
29	Parameter for flat residue cover equation	2.3	sq.m/kg
30	Standing to flat residue adjustment factor (wind, snow, e	99	%
31	Decomposition constant to calculate mass change of abo	0.0065	
32	Decomposition constant to calculate mass change of root	0.0065	
33	Use fragile or non-fragile mfo values	Non-Fragile	
34	***Other Parameters***		
35	Plant specific drought tolerance (% of soil porosity)	25	%
36	Critical live biomass value below which grazing is not allo	0	kg/sq.m
37	Maximum Darcy Weisbach friction factor for living plant	0	
38	Harvest Units	WeppWillSet	
39	Optimum yield under no stress conditions	0	kg/sq.m

Row Width(cm): 76.2 English Un

Tree: (perennial)

Num	Parameter - *Read Only*	Value	Units
1	***Plant Growth and Harvest Parameters***		
2	Biomass energy ratio	150	kg/MJ
3	Growing degree days to emergence	5	Degrees C.days
4	Growing degree days for growing season	0	Degrees C.days
5	In-row plant spacing	200	cm
6	Plant stem diameter at maturity	25	cm
7	Height of post-harvest standing residue; cutting height	2000	cm
8	Harvest index (dry crop yield/total above ground dry biom	42	%
9	***Temperature and Radiation Parameters***		
10	Base daily air temperature	2	Degrees C
11	Optimal temperature for plant growth	20	Degrees C
12	Maximum temperature that stops the growth of a perenni	40	Degrees C
13	Critical freezing temperature for a perennial crop	-40	Degrees C
14	Radiation extinction coefficient	0.9	
15	***Canopy, LAI and Root Parameters***		
16	Canopy cover coefficient	14	
17	Parameter value for canopy height equation	3	
18	Maximum canopy height	500	cm
19	Maximum leaf area index	6	
20	Maximum root depth	200	cm
21	Root to shoot ratio (% root growth/% above ground grow	33	%
22	Maximum root mass for a perennial crop	0.5	kg/sq.m
23	***Senescence Parameters***		
24	Percent of growing season when leaf area index starts t	25	%
25	Period over which senescence occurs	300	days
26	Percent canopy remaining after senescence (0-100%)	50	%
27	Percent of biomass remaining after senescence (0-100%	70	%
28	***Residue Parameters***		
29	Parameter for flat residue cover equation	5	sq.m/kg
30	Standing to flat residue adjustment factor (wind, snow, e	99	%
31	Decomposition constant to calculate mass change of abo	0.006	
32	Decomposition constant to calculate mass change of root	0.006	
33	Use fragile or non-fragile mfo values	Non-Fragile	
34	***Other Parameters***		
35	Plant specific drought tolerance (% of soil porosity)	10	%
36	Critical live biomass value below which grazing is not allo	0	kg/sq.m
37	Maximum Darcy Weisbach friction factor for living plant	17	
38	Harvest Units	WeppWillSet	
39	Optimum yield under no stress conditions	0	kg/sq.m

Tillage Parameters

Num	Parameter - *Read Only*	Value	Units
1	Percent residue buried on interrill areas for fragile crops	50	%
2	Percent residue buried on interrill areas for non-fragile cr	30	%
3	Number of rows of tillage implement	0	
4	Implement Code	Other	
5	Cultivator Position	Rear mounted	
6	Ridge height value after tillage	5	cm
7	Ridge interval	30	cm
8	Percent residue buried on rill areas for fragile crops	50	%
9	Percent residue buried on rill areas for non-fragile crops	30	%
10	Random roughness value after tillage	2.3	cm
11	Surface area disturbed (0-100%)	100	%
12	Mean tillage depth	15	cm

Tillage Depth(cm): 20.32 Tillage Type: Primary English Units

Residue Addition

Amount of Residue Added: 0.5 kg/m*m Eng Units Operation Disturbs Soil

Plant Drybean, MI Details

Disturbance Implement aaaField cultivator, secondary tillage, after duckfoot points Details

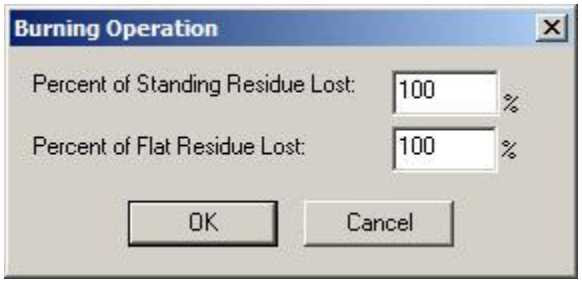
Residue Removal

Amount of Res Removed: 99 % Operation Disturbs Soil

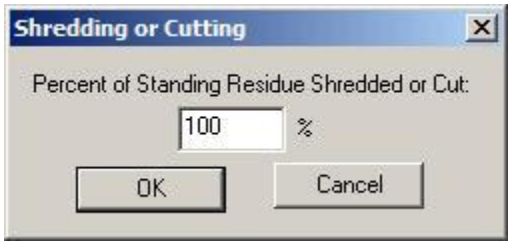
Plant Details

Disturbance Implement aaaField cultivator, secondary tillage, after duckfoot points Details

Burning



Shredding/Cutting

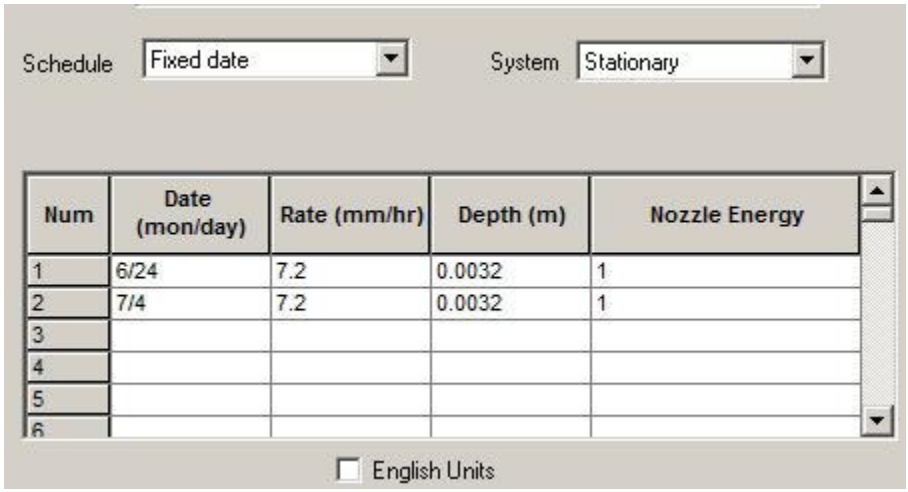


Irrigation

4 Types:

1. Depletion Furrow
2. Depletion Stationary
3. Fixed Date Furrow
4. Fixed Date Stationary

Example



Grazing

Num	Begin Date	End Date	Number of Animals	Field Size (m^2)	Body Weight (kg)	Digestibility
1	5/1	10/1	3	110000	500	0.6
2						
3						
4						
5						