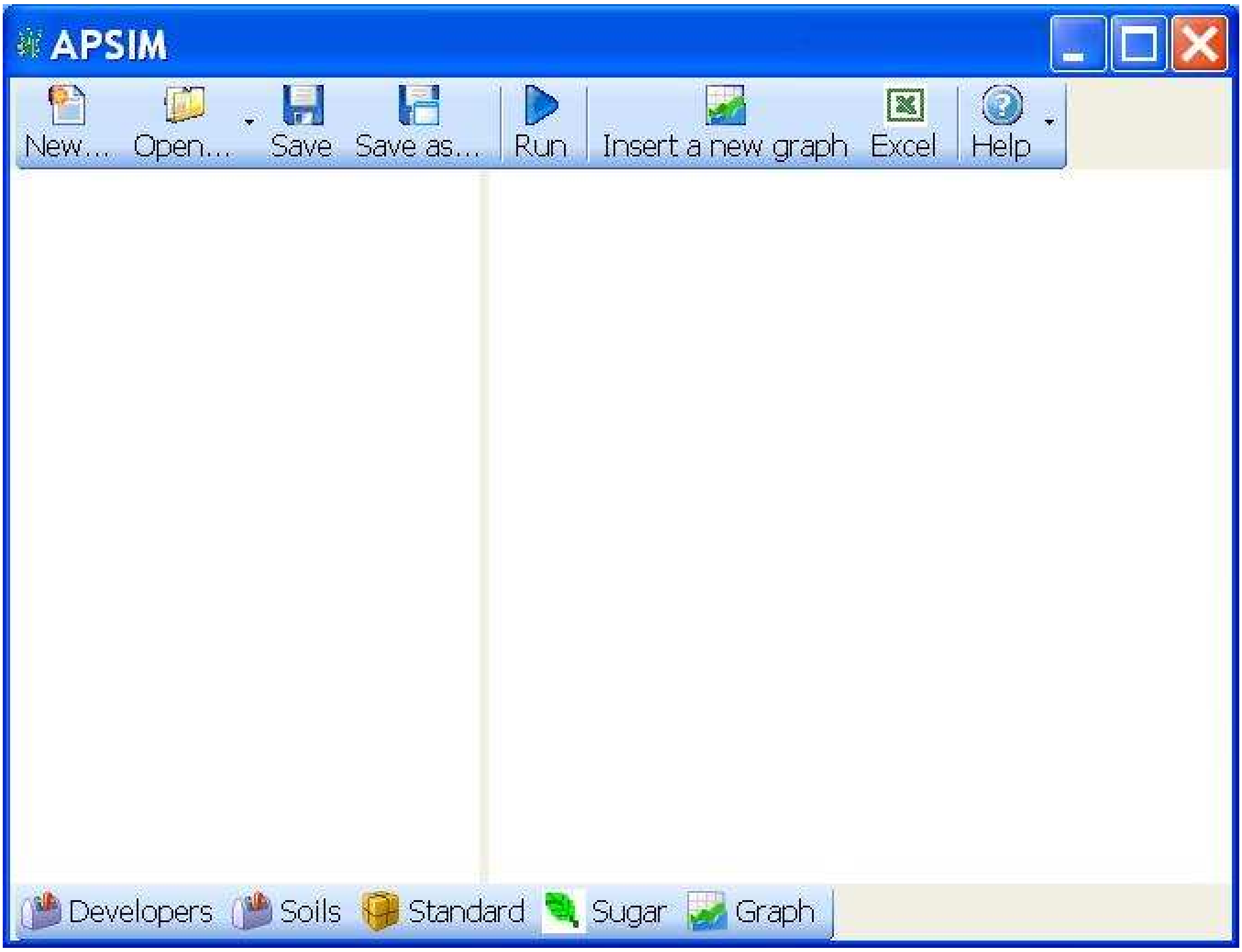
Overview of User Interface

Introduction

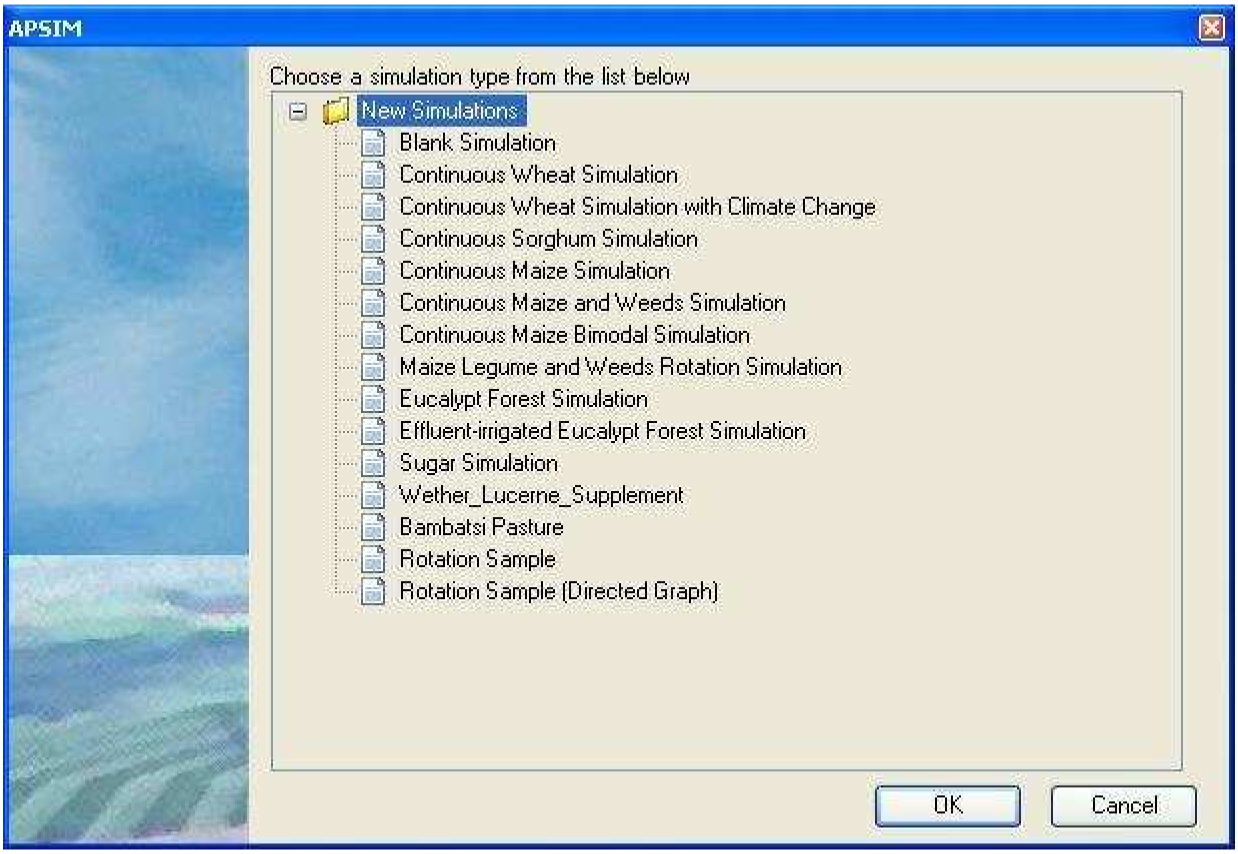
Starting with version 4, APSIM comes with a user interface that lets users configure simulations using a drag and drop paradigm. This interface, unlike APSFront, provides complete access to all APSIM parameters and supports multiple point simulations.

Getting started

When first started (by double clicking the ApsimUI icon from the Apsim icon on your desktop), the interface shows toolbar at the top and a toolbar at the bottom and two empty panes in between.

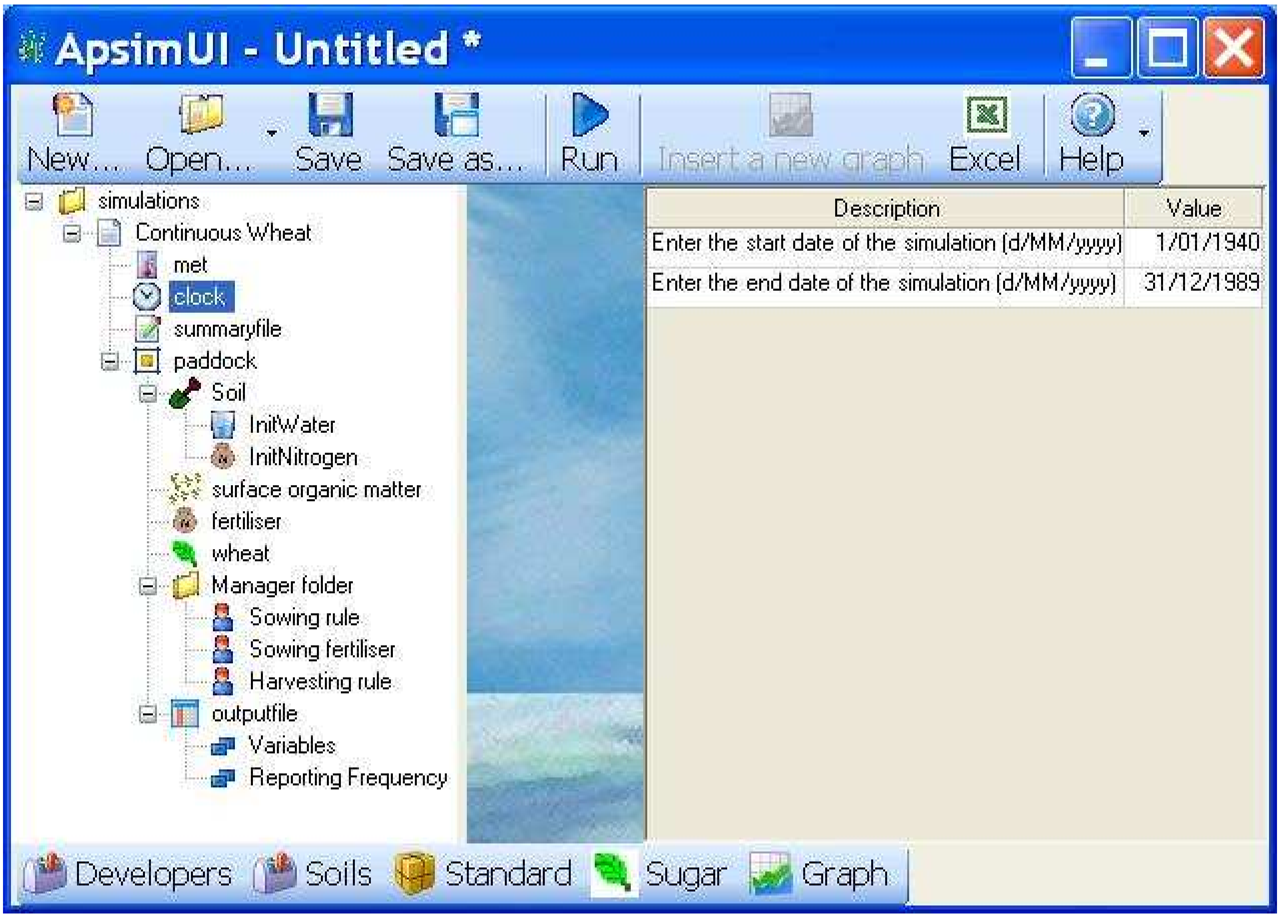


To create a simulation, click *New* and select a simulation that is closest to the type of simulation you want to build.



This list of default simulations will be expanded over time. In fact, you can add your own default simulations to this list allowing you to reuse common simulations.

Description of a simulation



Simulation Configuration TreeProperties for selected component (clock)

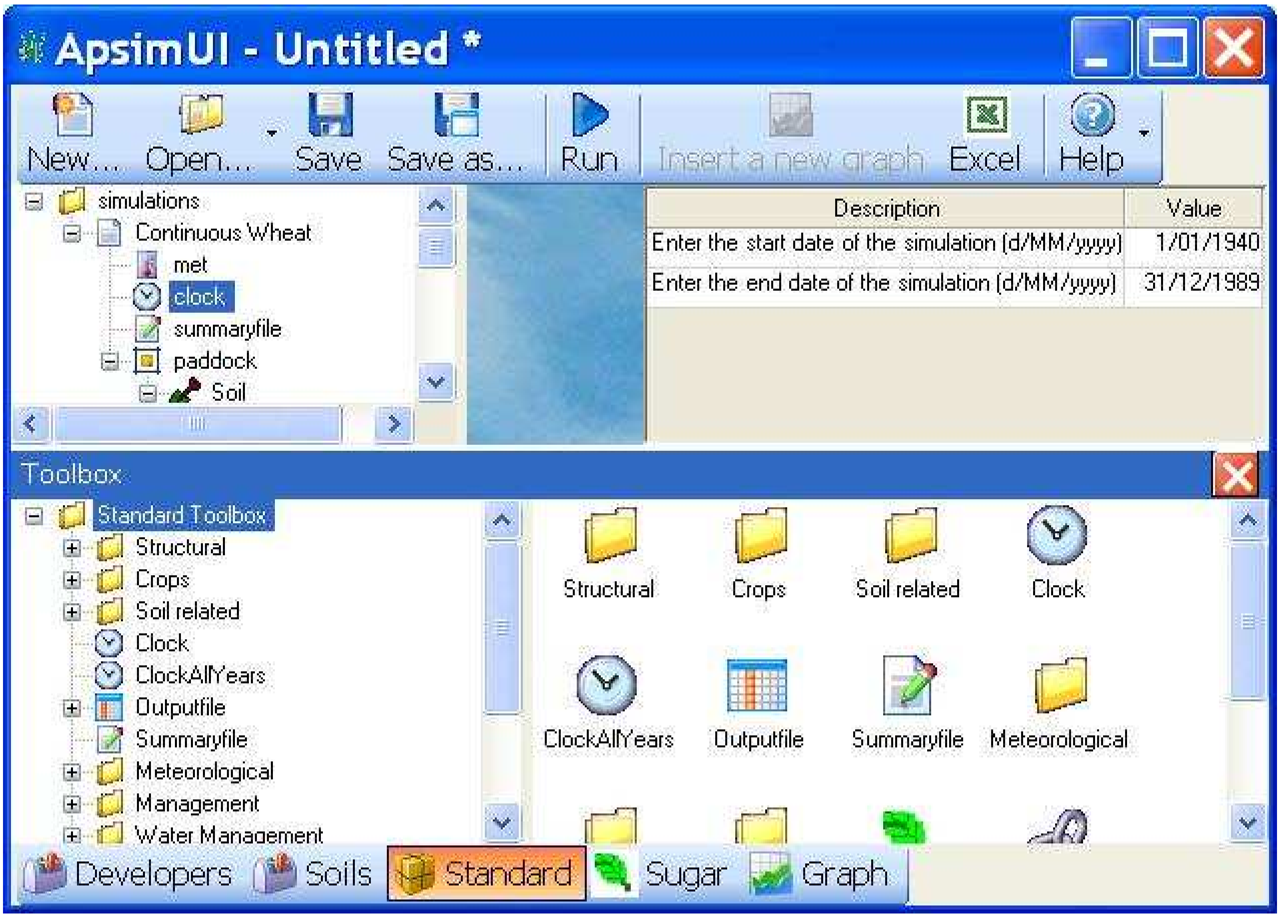
The tree control on the left shows the components that make up the APSIM simulation (Simulation Tree). Clicking on a component will show the properties for that component on the right. The picture above shows the clock component selected with it's properties on the right.

It is recommended that users work their way from top to bottom in the simulation tree, checking each component's properties. Components can be renamed by selecting them, pausing for a second and then clicking again. Components may be deleted from the simulation tree by selecting the component and pressing delete. They can also be renamed or deleted by right mouse clicking on them and selecting "Rename" or "Delete". Remember though that deleting or renaming components usually has implications for other components. For example, deleting a crop usually means the management of that crop (e.g. sow, harvest etc), under the Manager component, needs to be changed as well.

Note that you can change the order of components in the tree. You do this by right mouse clicking on the component and clicking *Move Up* or *Move Down* or you can hold down the Ctrl key and use the up and down arrow. The order of the components is not usually important it is merely cosmetic. The only exception is the order under the *Manager* component.

Adding components to a simulation via Toolboxes

To add components to a simulation tree, click the *Standard* button on the toolbar at the bottom of the window. This will show the standard toolbox containing many components and simulation entities that can be dragged onto the simulation tree.



A toolbox is a collection of reusable simulation components. By default there are many in the standard toolbox that cover a lot of the standard functionality required. The onus, though, is very much on the user to know which combinations of components work together. It is not expected that first time users will know which components work together. The recommendation is to start with a pre-built simulation and modify it, rather than starting from scratch. If in doubt, contact the APSIM Google Group.

How to Build, Run and Graph a Simulation

Building, running and graphing simulations

Click on the *New* button and select a simulation that closest matches the simulation you're trying to create. For this example, choose *Continuous Wheat Simulation*.

Weather

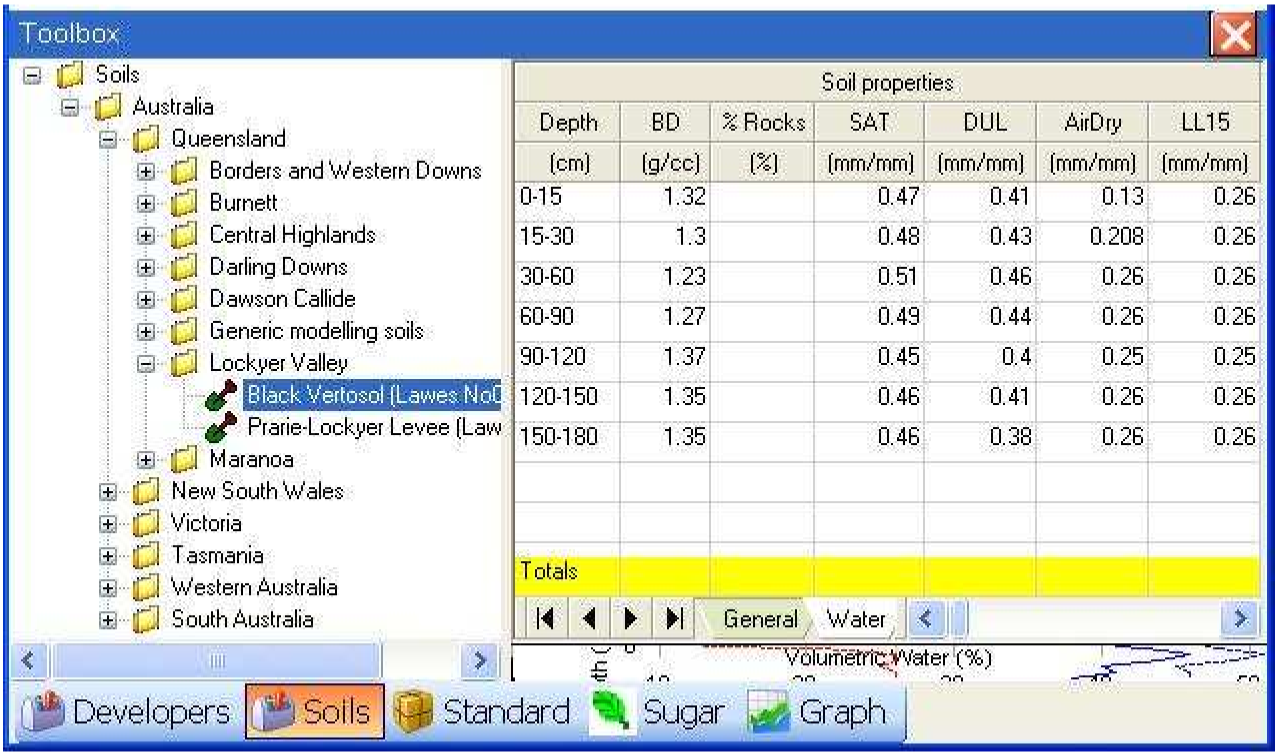
The weather properties are located under the *Met* component in the simulation tree. There you will have the ability to browse to a weather file. Weather files need to be in APSIM format and should have a .met extension. A few sample weather files (e.g. Dalby) can be found in the \Examples\MetFiles directory under your apsim installation

e.g. C:\Program Files\Apsim70\Examples\MetFiles

Closely related to the weather file are the start and end date of simulation. These two properties can be found under the *Clock* component. They need to be within the range of the weather file. At this stage, to set the clock properties to include the entire climate record involves looking at the met file, taking note of the first and last date and entering those dates in the clock properties screen.

Soil

Picking a soil file involves finding a suitable soil from the Soils toolbox. To open the toolbox just click on the *Soils* button on the toolbar at the bottom of the window. The Soils toolbox has many soils to choose from.



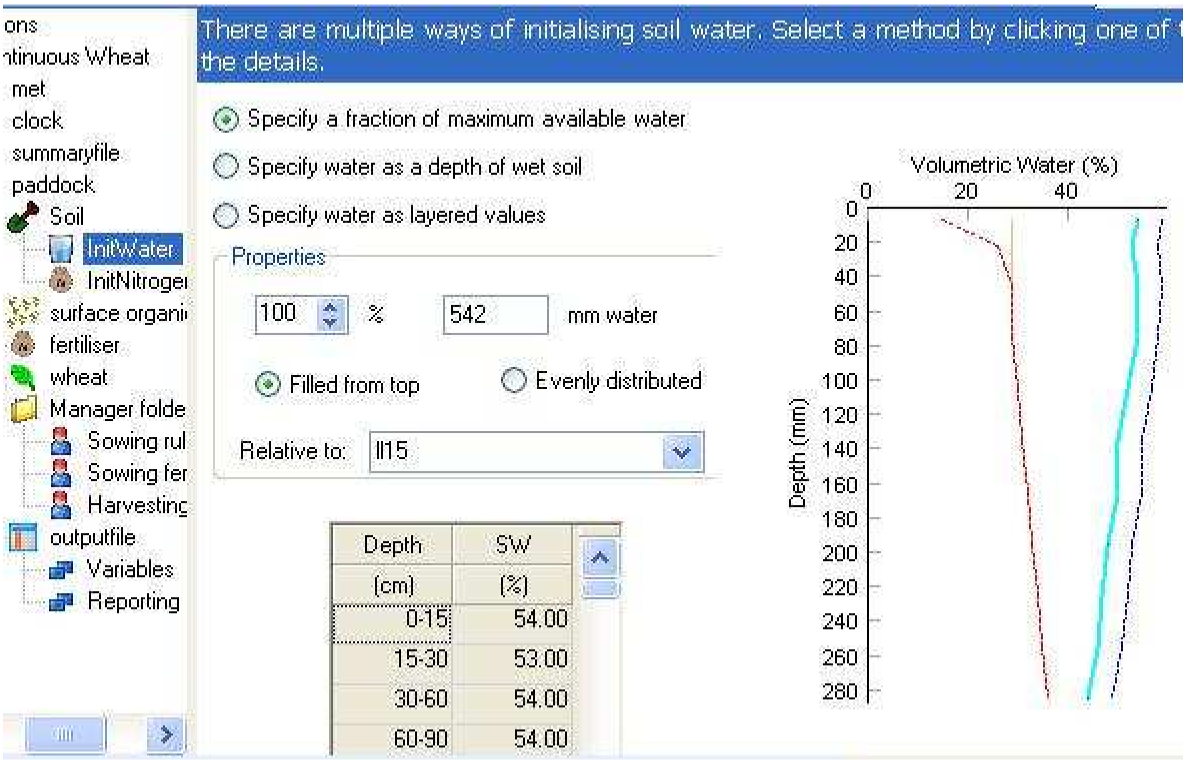
Drag your chosen soil from the toolbox and drop into the paddock on the simulation tree. You can then delete the existing soil in the paddock as it is no longer needed. Once the soil has been dropped it can be modified by clicking on it and then modifying the parameters to the right.

Important:

1. Once you have dragged your soil onto your simulation tree, you should rename it to something with a shorter name. Some soil names in the toolbox are too long and will cause your run to crash if it is not renamed to something shorter.

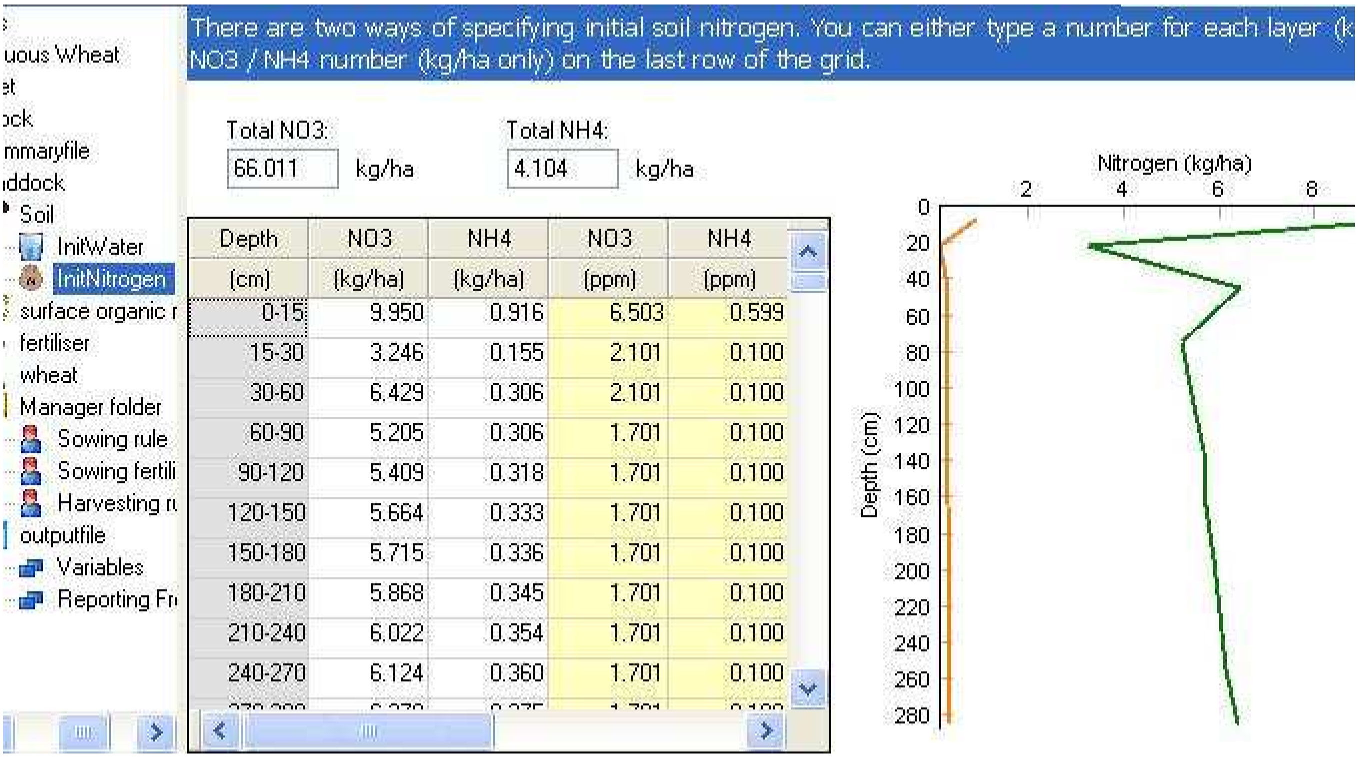
2. It is important to remember that the soil must be parameterised for the crops that you're going to sow. If your simulation is going to sow wheat, then the soil must have LL, KL and XF values for wheat. These soil/crop values can be added to the soil but it is probably better to choose a soil that is already parameterised for the crops that you want.

The starting water that a simulation initialises with can be found by expanding the soil component in the simulation tree and then clicking *InitWater*.



The initial water can be specified in multiple ways by selecting one of the radio buttons and then entering a percent water or mm water. All changes made are automatically reflected in the graph on the right. By selecting *Specify water as layered values*, you are able to directly enter the values in the soil water grid.

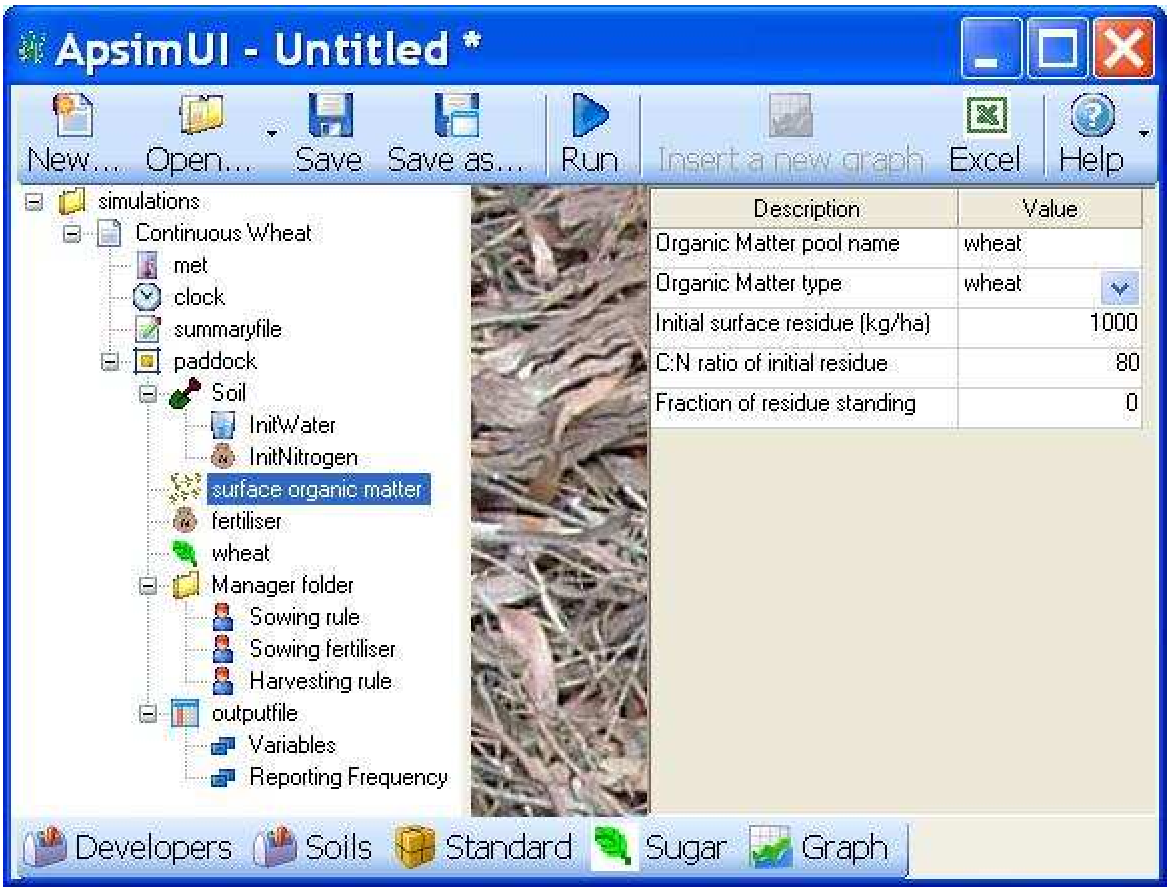
The starting nitrogen that a simulation initialises with can be found under the *InitNitrogen* node under the soil in the Simulation tree.



A single value for amount of nitrate or ammonia can be entered for the whole profile (in kg/ha) or amounts for individual layers can be entered in the grid.

Surface Residues / Organic Matter

The parameters for the initial surface residues can be found under the *surface organic matter* component in the simulation tree.



The "Organic Matter pool name" is simply an alphabetic description of the residue pool. The more important parameters are the "Organic matter type" and "Initial surface residue", "C:N ratio of initial residue" and the "Fraction of residue standing".

Fertiliser

This component does not have any editable parameters. This component only needs to be present if you are going to be doing fertiliser applications in your simulation.

Crops

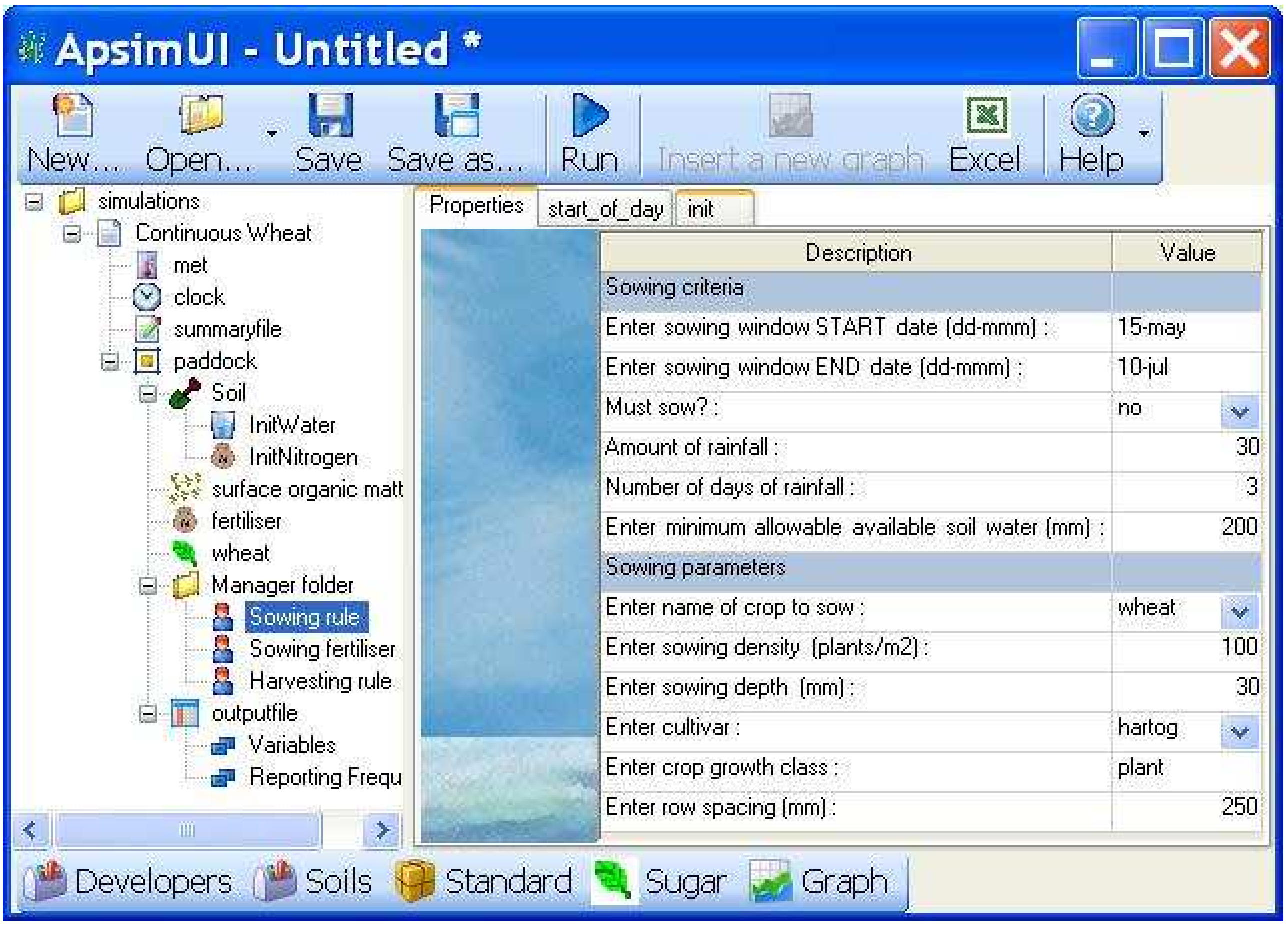
Crops can be dragged from the Standard Toolbox and dropped onto a paddock. A crop can be deleted by selecting it and pressing Delete. Crops typically don't have any editable parameters. It is important to remember that the crop parameters LL, KL and XF come under the soil.

Simulation management

The *Manager* component contains all the management options for the simulation e.g.

- sowing
- fertilising
- irrigation
- tillage
- resetting of water and nitrogen
- rotations

These options can be dragged from the *Standard toolbox* (under *Manager*) and dropped under a *Manager* component within a paddock.

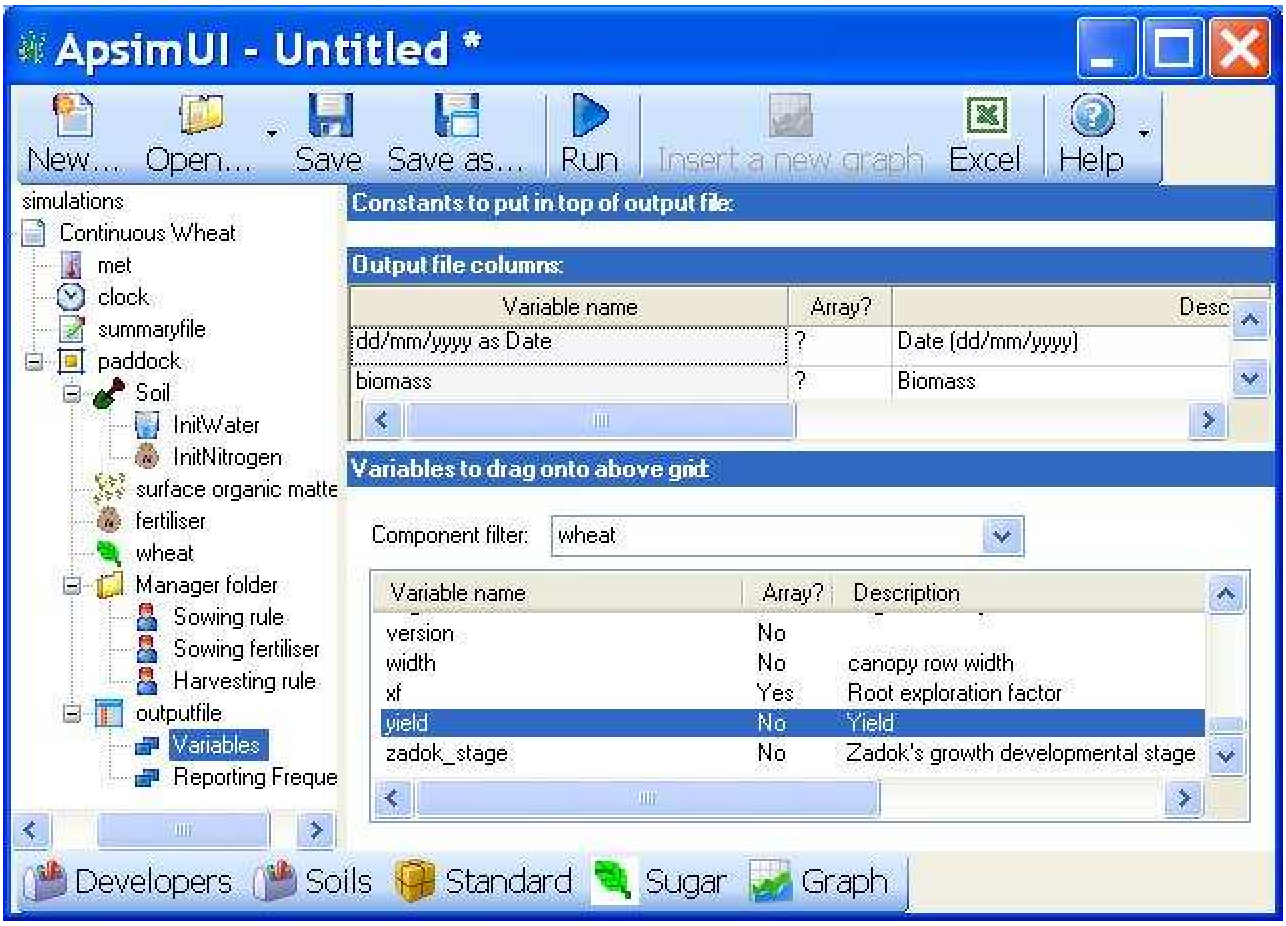


The properties of the management option can then be edited on the right. The management options in the toolbox cover the same sort of functionality as the older APSFront software.

It is also possible to drag a *Logic* component from the *Standard toolbox* and drop it on a paddock. This component lets you exactly specify your own manager logic for a sowing, harvesting etc. This will be familar to you if you have used control / parameter files in the past.

Reporting

APSIM is capable of producing an ASCII space separated output file containing whatever APSIM variables you want. In fact you need to exactly specify which variables you want output to the file. This is all configured from the *Outputfile* component. Expand the outputfile component and click *Variables*



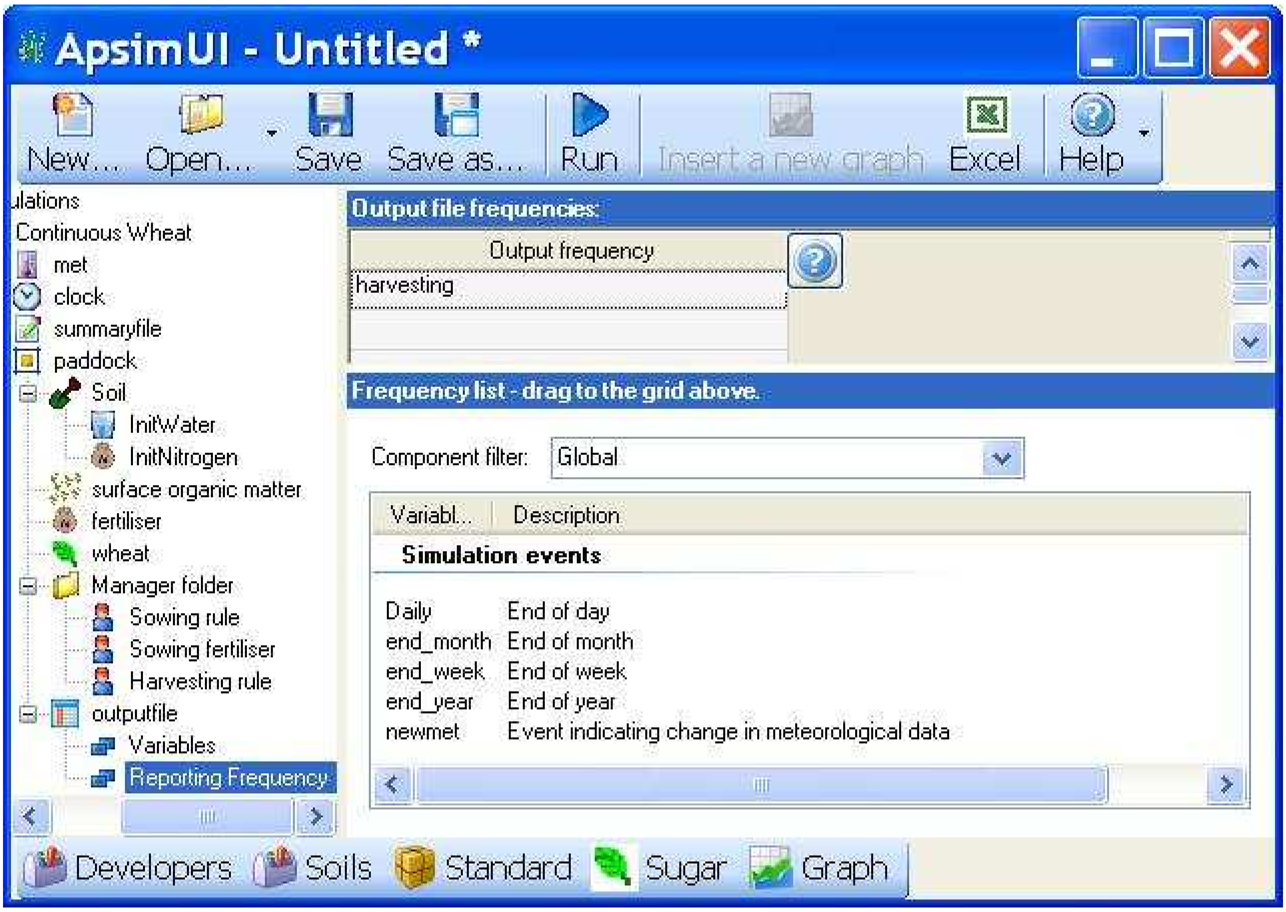
The top pane allows you to enter some text to put at the top of the output file. This is usually used to put some constant values that you have used in your simulation.

The middle pane lists which variables are to go into the output file (date, biomass yield etc) as columns. These variables can be deleted and reordered up and down in the same way as the components in the simulation.

The bottom pane gives you the variables that can be dragged onto the variable list in the middle pane (adding them to the list)(**nb.** you can also just double click on the variable name to add it to the list). The variables are grouped according to the components currently plugged into the simulation. To see the variables belonging to each component, simply choose the component from the "Component filter" drop down list.

Some variables are layer variables or profile variables e.g. extractable soil water. Look for "Yes" or "No" in the *Array?* to see if a variable is or not. These variables that are, when dropped onto the variable list will produce a number for each layer in the output file. If you want the sum of all layers, put a () in alongside the variable name in the *Variable name* column of the middle pane. Other options include a (1-3) for the first 3 layers, or a (5) for the fifth layer. (click the ? button in the middle pane for more information)

The frequency of output is controlled by the "Reporting Frequency" sub component. The top pane contains a list of events and whenever one of these events occur in the simulation a line with the current values of the variables will be written to the output file.



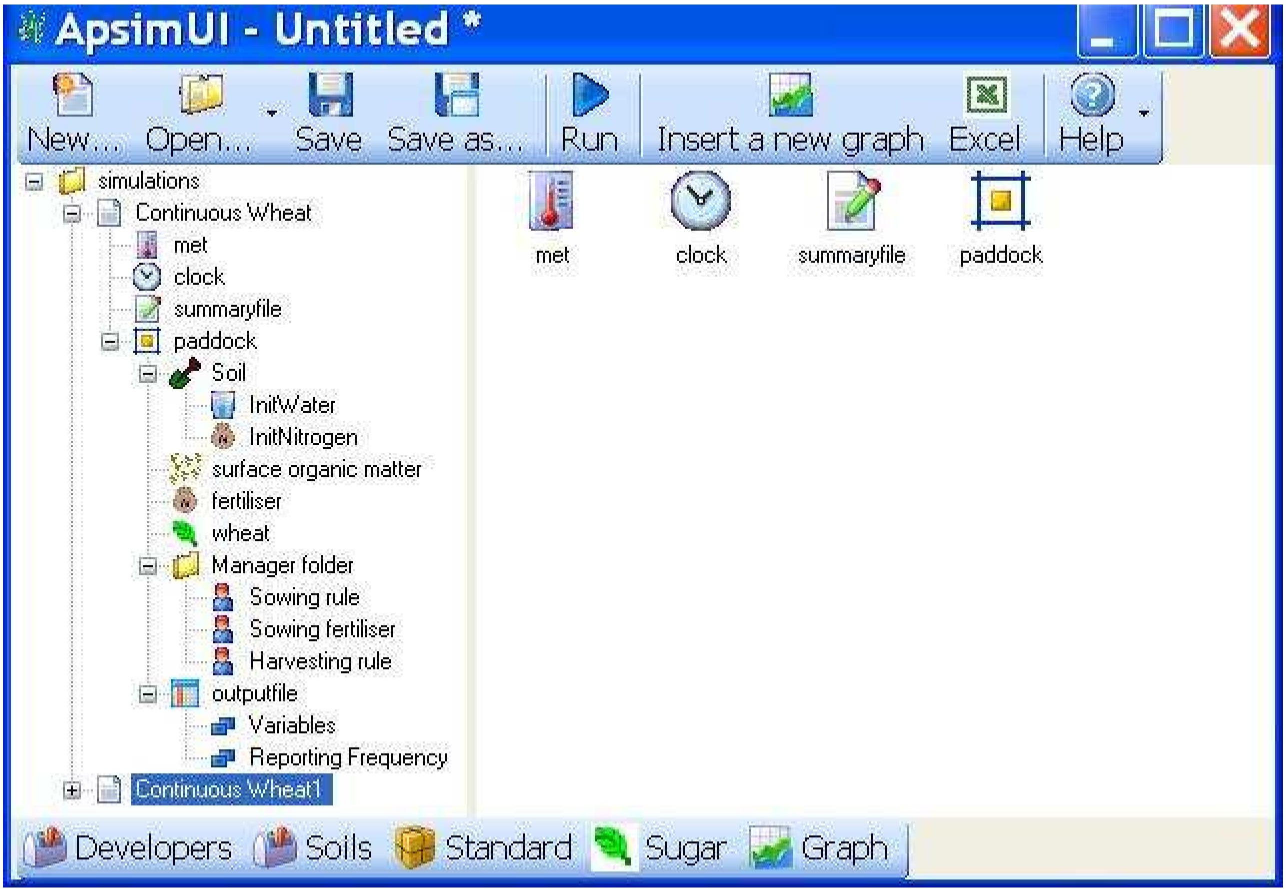
In this example, a line of output will be produced every time APSIM harvests a crop. Daily output can be achieved by dragging *Daily* from the *Global* component list of events in the bottom pane. Just like with variables, use the "Component filter" drop down list to see the events for each component that can be dragged to the top pane.

APSIM is also capable of producing multiple output files. The user simply needs to drag and drop multiple *outputfile* components onto the simulation tree. Each can then be configuring independently.

Precisely specifying outputs can quickly become tedious. If you frequently use common outputs, why not create a toolbox and drag your configured *outputfile* component and drop it onto your toolbox. You can then easily reuse this configured outputfile in your next simulation. To see how to do this, read the overview on toolboxes.

Multiple simulations; creating / saving and running them

Simulations can be saved to any folder by clicking the *Save* button. Likewise, running a simulation is as simple as clicking *Run* on the button bar. The user interface is capable of hosting multiple simulations within the single simulation tree. The example we've been working through here has a single simulation called *Continuous Wheat*. You can add another simulation by simply dragging this simulation and dropping it back on the top level node *Simulations*, a copy will be made and there will be two simulations in the simulation tree.



Notice the second simulation called *Continuous Wheat1* at the bottom. This simulation will be identical to the first simulation. Usually you would change a parameter in the second simulation to see what effect this parameter has on the result compared with the first simulation. Before you run the simulations the second simulation should be renamed to a more suitable name. Clicking *Run* in this situation will cause both simulations to be run.

Often APSIM will produce a fatal error as a result of an invalid configuration or parameterisation. In this instance, it is important to consult the summary file that APSIM produces. Clicking on the *summaryfile* component will give quick access to the contents of this file. When looking for errors, always scroll down to the first error and fix that first.

NOTE: The user interface keeps track of output and summary file names automatically. It uses the simulation name in the tree (eg. *Continuous Wheat*) for the output / summary file name. This ensures names of output and summary files are always kept in sync with the name of the simulation. The suffixes .out and .sum are used for the output and summary files respectively. After a run you will find them in the same folder that you have saved the simulation to.

Graphing the output and Exporting to Excel

To graph the output file, you can drag a graph component in to your simulation tree from the *Graph* toolbox. There are different types of graph components availible allowing you to choose the type of graph you wish to use.

By default the graph component is able to find any output file on the same level or lower in the simulation tree as itself. So dropping a graph control on the top *Simulations* node will allow it to find all the output files in all the simulations. Dropping on a specific simulation will allow it to find all the output files in the simulation and dropping it on a paddock will allow it to find all of them in that paddock. If you just drop it on a specific output file it will only be able to find that outputfile.

Once you have added the graph component to your simulation tree, you can expand the nodes of this component to see the child components. To configure the graph component the general rule is to start at the bottom most child component and work your way back up towards the graph component. Each different type of graph component is slightly different in what child components it has, however generally at the bottom you will select which .out files you want to graph, and then as you go up you will choose what columns and data from the .out files you want to plot.

To find out how to modify a graph see How To: Modify a Graph component

You can also create a graph by using the *Insert a new graph* button on the main application toolbar. This will allow you to create a graph using the Graph Wizard.

There is also a button on the main toolbar to send an .out file to Microsoft Excel. To send an output file or multiple output files to Excel, just select them in the simulation tree and click the *Excel* button

The help system

The *Help* button on the main toolbar provides access to help information and tools.

A lot of documentation, including the science documentation and how some of the modules perform at different locations (i.e. sensibility tests), can be found under *Documentation*.

There is a link to the Apsim Google Search Engine which allows for the searching of our apsim.info website using a customised google search engine.

There is a link to the Apsim Google Group for asking questions of the Software Engineering Group, Apsim Module Developers or just other Apsim users.

Fallow Water Balance

In this exercise you will explore the major elements of interest in soil water balance during a fallow - soil water storage, drainage, runoff, and evaporation. Changes will be examined over a one year period in the Dalby area.

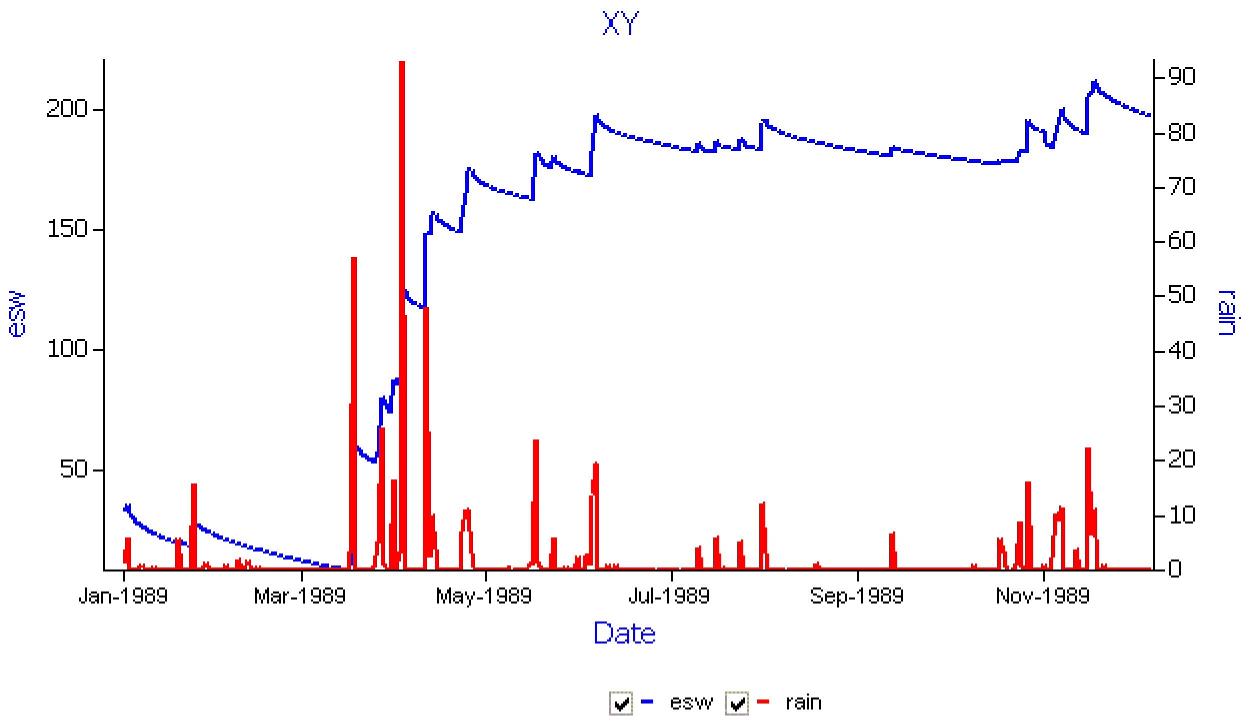
The examples assume you have read and walked through the previous document: How to Build, Run and Graph a Simulation

1. Create a new simulation using *Continuous Wheat Simulation* as a starting point.
2. Choose Goondiwindi weather (C:\Program Files\Apsim70\Examples\MetFiles)
3. Starting date: 1/1/1989 Ending date: 31/12/1989
4. Drag a "Grey Vertosol-Cecilvale (Brookstead No004)" soil onto the simulation, removing the old soil (You can find it under Soils->Australia->Queensland->Darling Downs). Rename the soil to something short like "Soil". If you like you can also reorder the soil component so it comes straight under the paddock.
5. Set the starting water to 10% full - filled from the top.
6. Set the starting NO_3 to 50.34 (kg/ha) and starting NH_4 to 3.23 (kg/ha).
7. Check that the default initial residue type is wheat and the mass is 1000 kg/ha.
8. Delete the *Fertiliser*, *Wheat* and *Manager* components out of the simulation. They are not needed for a fallow run.
9. Choose these variables to report (removing old ones):

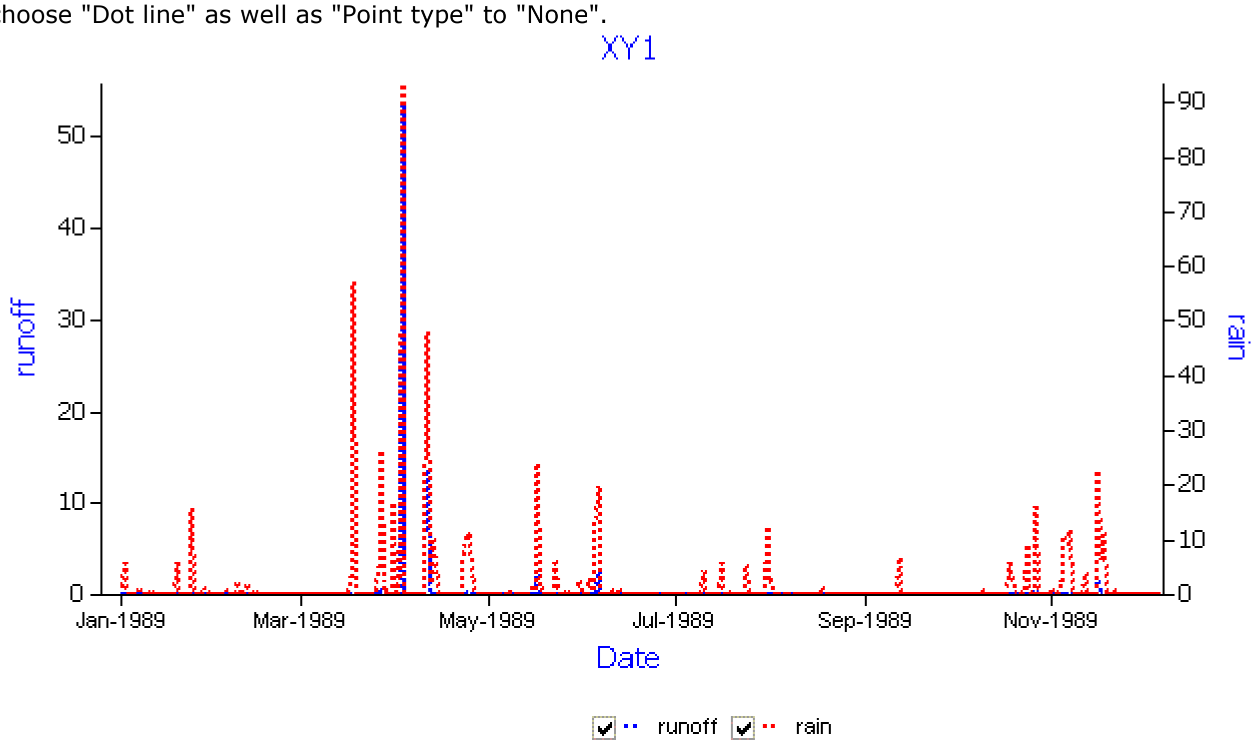
Component	Variable name
Global	Date (dd/mm/yyyy)
	Day
	Year
	Rain
Soil	ESW - Extractable soil water (mm)
	ES - Evaporation
	Runoff
	DRAIN - Drainage
	NO3 - **summed over profile** (Do this by putting () next to the name in the "Variable name" column) eg. no3() (click "?" button next to variable list for more info)
	DLT_N_MIN - N mineralised - summed over profile
Surface organic matter	SURFACEOM_WT - Weight of all surface organic materials.
	SURFACEOM_COVER - Fraction of ground covered by all surface organic materials.

10. Choose a daily reporting frequency for the output file. This can be found under *Global* in the variables and events tree.
11. Rename the simulation to something more meaningful: *Brookstead Fallow.*
12. Save the simulation file as *Fallow.apsim*
13. Run the simulation.
14. Create a graph of Date vs ESW and Rain(Right Hand Axis). To do this Click on the *Graph* toolbox to open it. Then drag in an XY component onto the output file in your simulation. Click on the "+" symbol next to XY component to expand the node. Click on the *Plot* component. Now in the Plot window click on the *X variables* square to make sure the background of the square is pink. Now click on the "Date" column heading. It should appear in the list in the square. Now click on the *Y variables* square to make its background pink. Then click on the esw column heading, then the rain column heading. They should be added to the list in the square. Now to make the "rain" appear on the right hand axis, click rain in the square to highlight it, and then "right" mouse click on it again. In the popup menu click on "Right Hand Axis". Now we want a nice clean line to be plotted with no points so now under "Point type" choose "None". Now just click on the XY component to view the graph.

    The graph should show the ESW (in mm) increasing with day of year. The sudden increases are due to rainfall events and the declines to evaporation and drainage loss. Daily rainfall will show this more clearly.



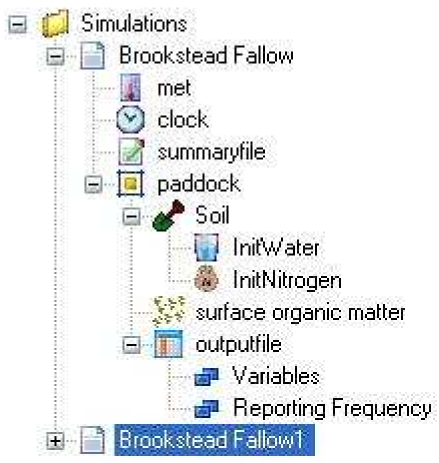
15. Create a graph of Date vs Runoff and Rain(right hand axis). This time in the Plot window under "Type" choose "Dot line" as well as "Point type" to "None".



The effect of runoff on the water balance.

Runoff is affected by weather and soil water storage capacity. This run will take an additional soil into account, and compare runoff from both soil types. The user interface still contains all the specifications provided for the previous simulation.

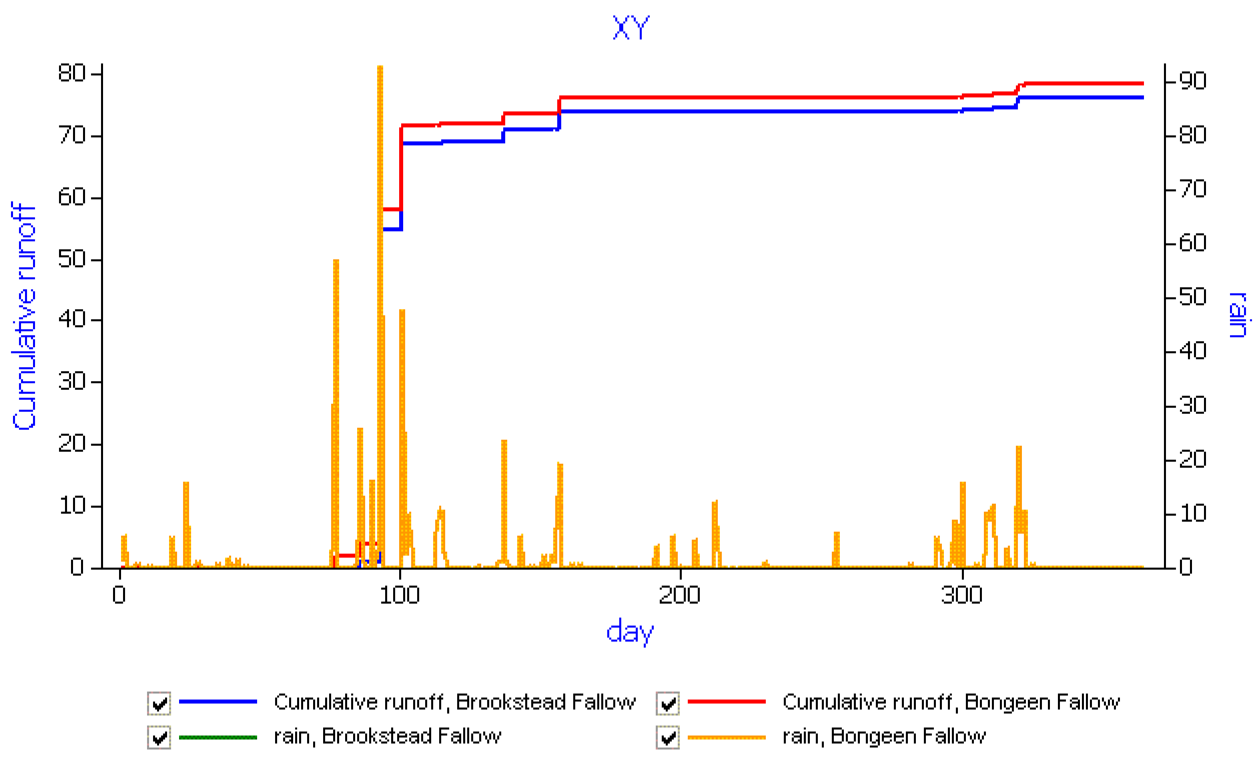
If you drag the *Brookstead Fallow* node in the Simulation Tree to the top node *Simulations*), a copy of it will be made and your file will then have 2 simulations in it. e.g.



This second simulation can then be modified to add the characteristics of a Macalister, Bongeen soil.

1. Drag the "Black Vertosol-Bongeen (Macalister No026)" soil onto the paddock in the simulation tree (located under Soils->Australia->Queensland->Darling Downs) and then remove the old soil . It is important you drag in a new soil **BEFORE** you delete the old one, otherwise the simulation will lose all your soil reporting variables. Also remember to rename your soil to something shorter.
2. Since now we have a new soil we will need to go and set the initial soil water (InitWater) to 10% filled from top and initial soil nitrogen (InitNitrogen) to NO3 to 50.340 kg/ha and NH4 to 3.230 kg/ha. When you delete soils you also delete the initial soil water conditions and initial soil nitrogen conditions so these will need to be set to the same conditions as the "Grey Vertosol-Cecilvale (Brookstead No004)" soil.
3. Rename the simulation to *Bongeen Fallow*.
4. Save the simulations
5. Run APSIM.
6. Graph both the output files by dragging an XY graph onto the top node *Simulations* in the simulation tree.

   Create a graph of day vs runoff(cumulative) and rain(right hand axis). To make the runoff be cumulative it is the same procedure as to make the rain appear on the right hand axis. Only select "Cumulative" from the popup menu instead of "Right Hand Axis". Set "Point Type" to "None".



The effect of residue cover on soil water storage during fallow

Tracking the decline of cover as residues decompose

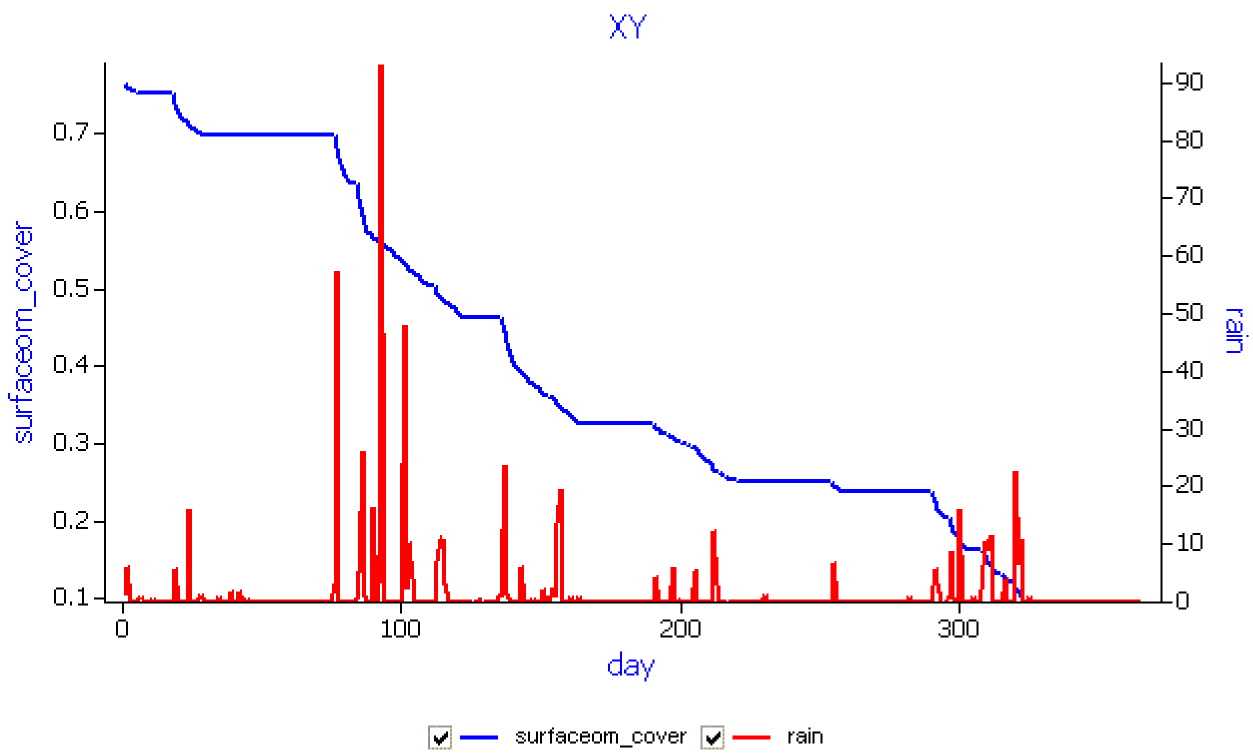
APSIM simulates the influence of crop residues on the efficiency with which water is captured and retained during fallows. But residue cover declines as residues decompose. Residue decomposition is simulated in APSIM in response to weather, as well as the chemical composition of the residues. By doing this simulation you will reinforce skills learned in previous exercises and learn to do some basic editing of default values to 'customise' your simulations.

The examples assume you have read and walked through the previous document: How to Build, Run and Graph a Simulation

This simulation will demonstrate how surface residue decomposes over time. You should use the previous simulation as a starting point for this simulation. You need to add an initial amount of surface residues.

1. Reopen the previous file (*Fallow.apsim)*
2. Save the file as *Residue.apsim* (**reminder** don't forget to use the *Save as* button NOT the *Save*, or you will save these changes to Fallow.aspim)
3. Remove the *Brookstead Fallow* simulation. We're going to use *Bongeen Fallow* as our starting point for this exercise. Also remove the graph component.
4. Make a copy of the *Bongeen Fallow* simulation by dragging to the top node in tree (*Simulations*).
5. Set the initial surface residue to 3000 kg/ha in the second simulation.
6. Rename second simulation to *Bongeen Residue*
7. Run the simulation
8. Create a graph of day vs surfaceom_cover and rain(right hand axis) for just the *Bongeen Residue* simulation. Just drag an XY graph from the Graph toolbox onto the output file. Remember to set "Point type" to "None".

   To find out how to modify a graph see How To: Modify a Graph component

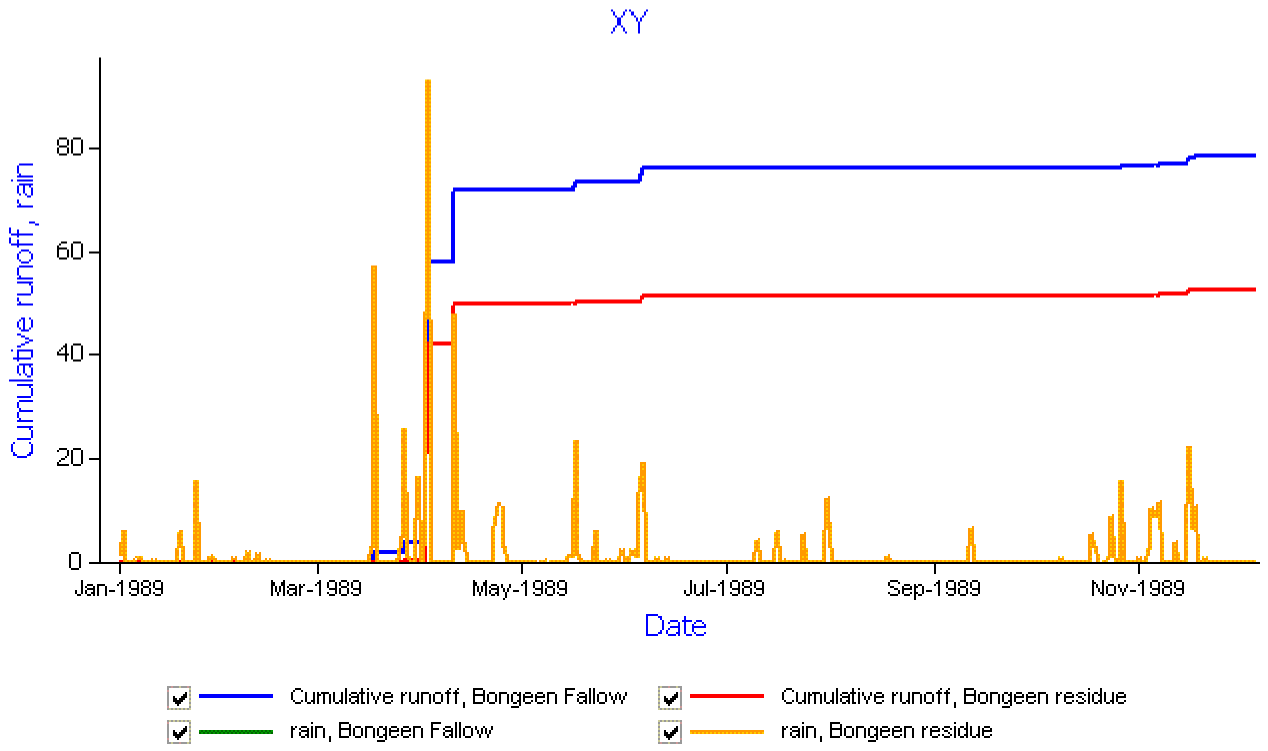


It can be seen that periods of high decomposition rate match with higher rainfall and low decomposition with dry periods.

The effect of cover decline on runoff and evaporation

In this activity, a comparison will be made of two simulations: 'Bongeen Fallow' and 'Bongeen Residue'.

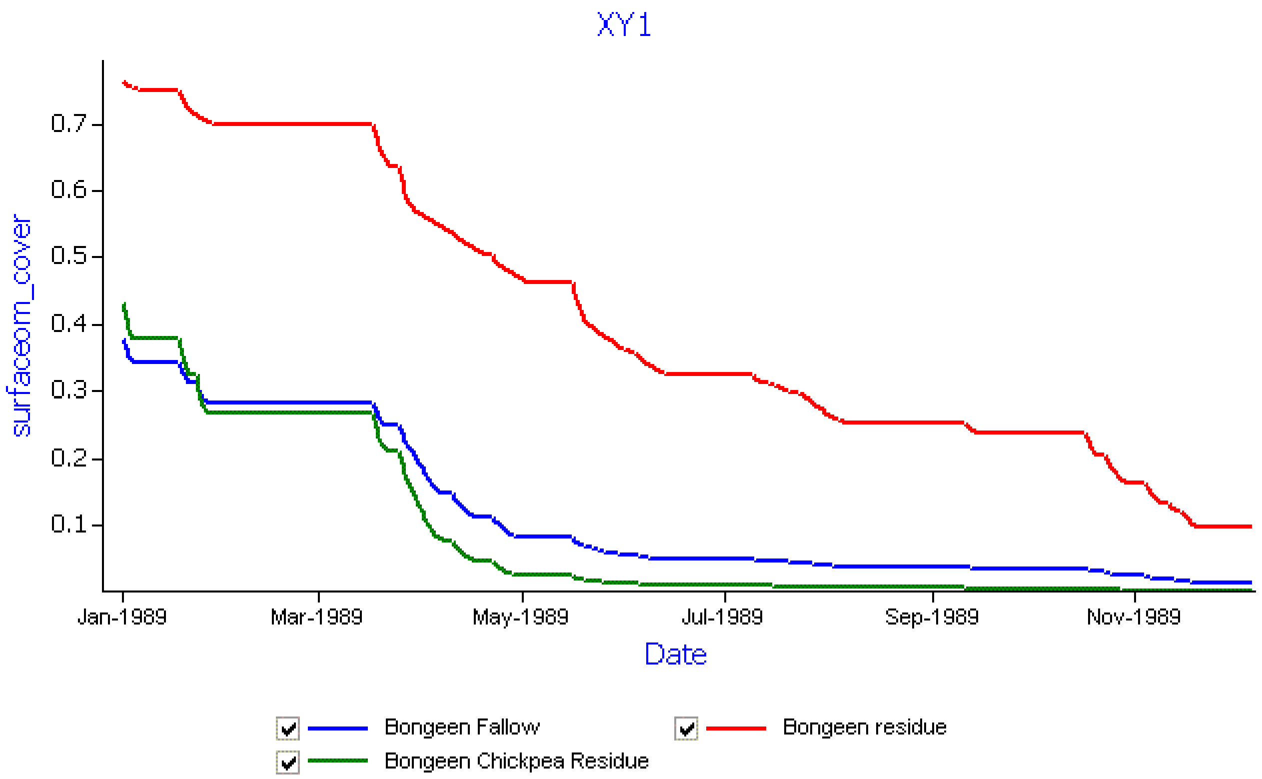
1. Graph both output files with Date vs runoff(cumulative) and rain(this time on the same axis as the runooff. NOT right hand axis)



The effect of residue type on speed of decomposition

The APSIM residue model will decompose residues at differing rates according to the C:N ratio of the material. To demonstrate this we will reproduce the previous simulation but apply legume residues in the place of the wheat residues.

1. Create another copy of the *Bongeen Residue* simulation and call it *Bongeen Chickpea Residue*.
2. Change the residue parameters to 3000 kg/ha of Chickpea (*type)* residue. Set the C:N ratio to 25. (Remember you may want to change the *Organic Matter pool name* to something like chickpea as well)
3. Run this new simulation. (If you just select this simulation in the tree and click the run button it will only run this simulation instead of all of them)
4. Graph all three residue simulations with residue cover as a function of time (eg date).


XY1
surfaceom_cover
0.7
0.6
0.5
0.4
0.3
0.2
0.1
Jan-1989
Mar-1989
May-1989
Jul-1989
Sep-1989
Nov-1989
Date
Bongeen Fallow
Bongeen residue
Bongeen Chickpea Residue

Nitrogen cycling

In this exercise you will observe the fate of fertiliser nitrogen in a fallow situation: Urea to ammonium to nitrate and the loss of soil nitrate via denitrification.

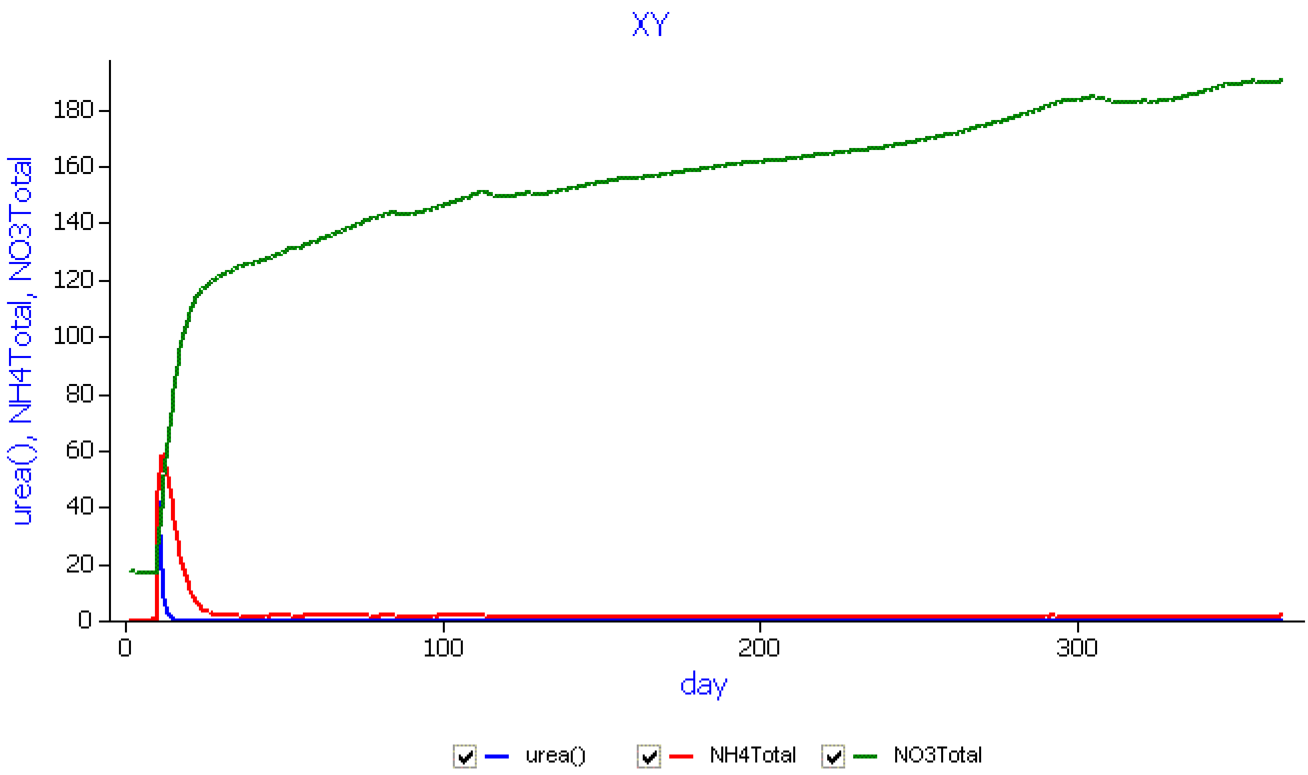
This simulation will introduce us to editing a simple Manager rule and to more advanced features of graphing simulation results. Firstly we need to set up our weather and soil data. The simulation is on Brookstead,Anchorfield soil in the Dalby area.

The examples assume you have read and walked through the previous document: How to Build, Run and Graph a Simulation

1. Start with a new simulation based on *Continuous Wheat Simulation*
2. Choose Dalby weather. (C:\Program Files\Apsim61\apsim\met\sample)
3. Starting date 1/1/1989 Ending date: 31/12/1989
4. Choose "Black Vertosol-Bongeen (Tipton No116)" soil. (Soils->Australia->Queensland->Darling Downs) (remember to rename it)
5. Set the Starting water to 50% full. Leave it as evenly distributed.
6. Set the Starting nitrogen to 19 kg/ha NO_3 and 0 kg/ha NH_4
7. Set the initial surface organic matter to 1000 kg/ha wheat.
8. Remove all manager rules from your simulation.
9. Drag a *Fertilise on fixed date* to your *Manager* component. (Standard toolbox->Management->Manager with examples)
10. Change the fertiliser management parameters to apply 100 kg/ha of urea_N on 10-Jan. (leave the "Don't add fertiliser if N in top 2 layers exceeds (kg/ha)" property, and set the "Module used to apply the fertiliser" to "fertiliser")
11. Make sure your simulation contains a *Fertiliser* component in your paddock. Even though it doesn't have any changeable properties it is still necessary when fertiliser is to be applied.
12. Choose these variables to report:

Component	Variable name
Global	Date (dd/mm/yyyy)
	Day
	Year
	Rainfall(mm)
Soil (whatever you renamed it to)	Depth - **layered** (mm) (to do this just drop the array variable as is onto the variable list. This will create a separate column in the output file for each layer in the soil) (click "?" button next to variable list for more info) (the array variable for depth of each layer is *dlayer*)
	Drainage (mm)
	Extractable Soil Water (mm)
	NO3 **sum over profile and change alias to NO3Total.** (to alias use the "as" keyword) eg. no3() as NO3Total
	NH4 **sum over profile and change alias to NH4Total**
	NO3 **layered**
	NH4 **layered**
	DNIT **sum over profile**
	UREA **sum over profile**

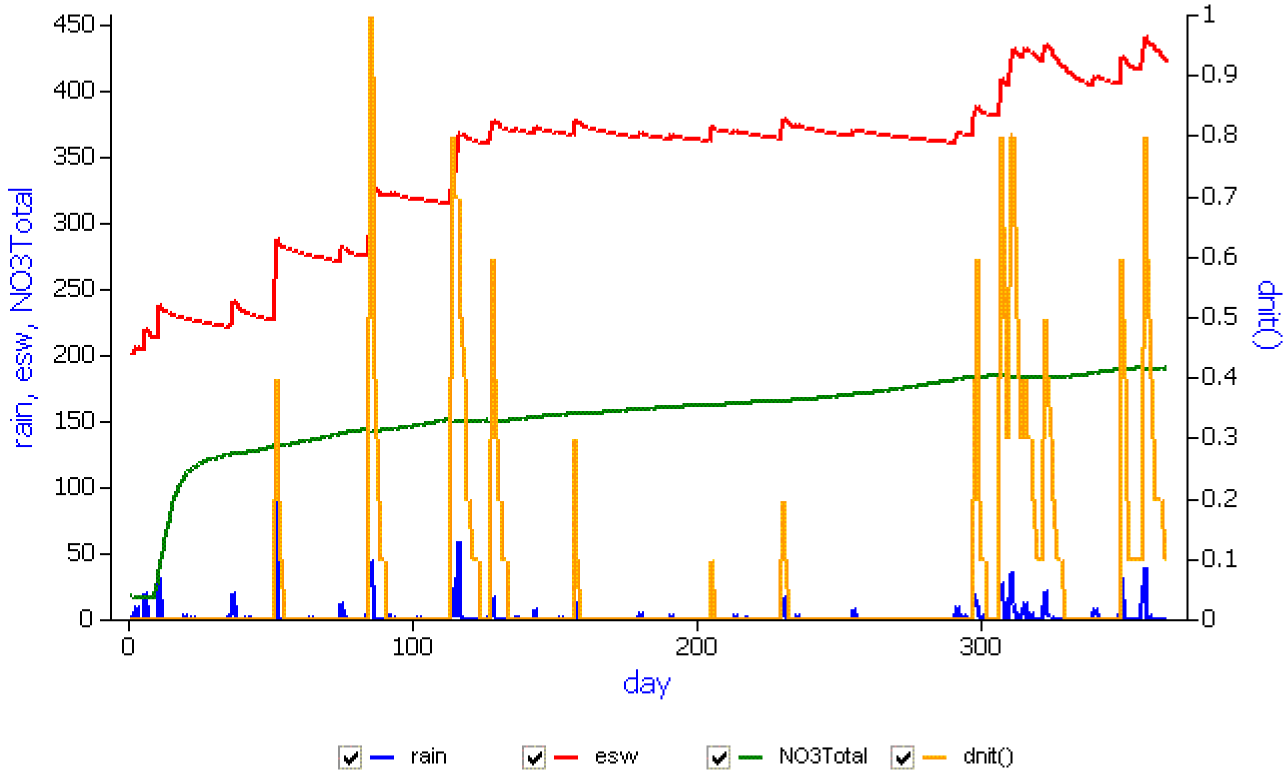
13. Change reporting frequency to daily.
14. Change simulation name to *Tipton N Fallow* and save the file to the same name.
15. Run simulation
16. Create a graph of day vs urea, total ammonium and total nitrate. Drag an XY graph component onto the simulation. On the *Plot* node set "Point type" to "None" and leave "Type" as "Solid line".



Question: Why does the above graph look the way it does?

Illustrating the extent and conditions required for denitrification losses

Create a new chart of Day vs Rain, DNIT (on Right Hand Axis), ESW and NO3Total.



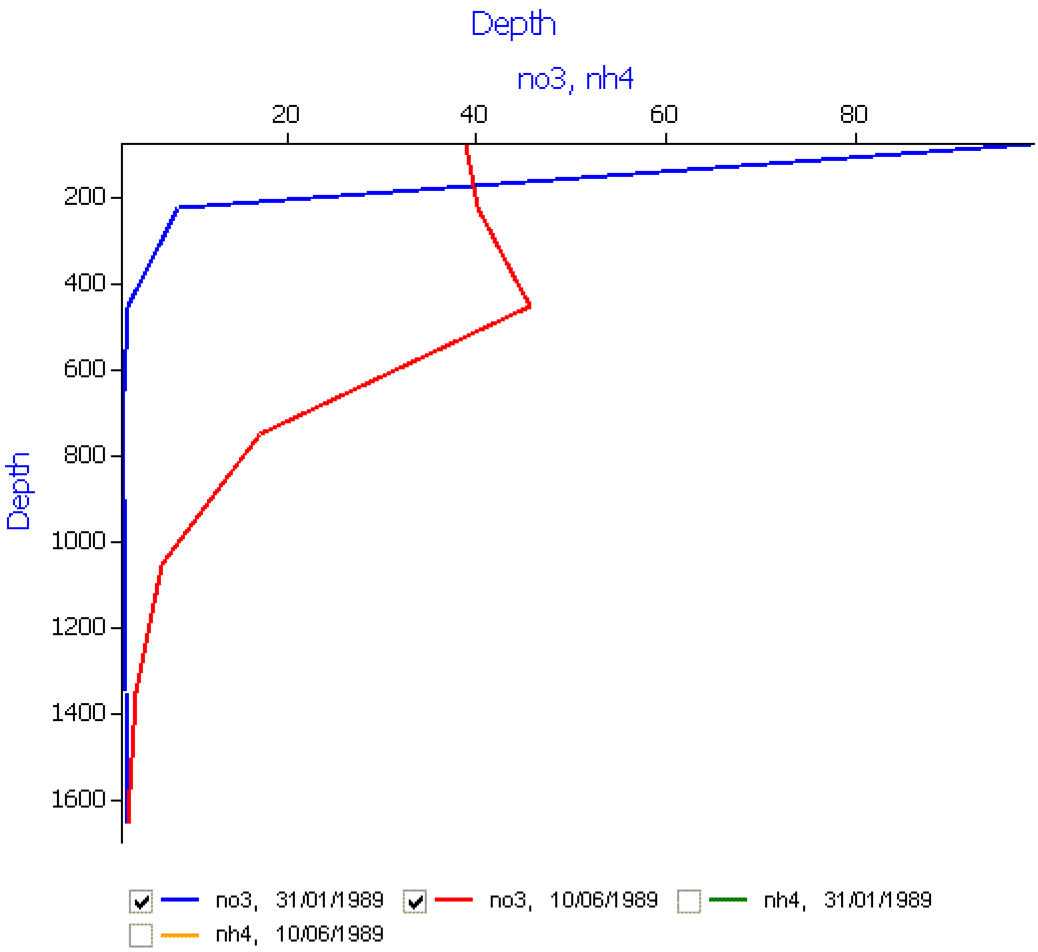
From this chart you can see that significant nitrogen is lost via denitrification when large amounts of nitrate is available in saturated soil conditions.

Exploring vertical movement of nitrate, after fertilisation, through the soil profile

Let's look at the distribution of nitrate through the soil profile at 21 days after fertilisation, and again at 5 months.

1. Create a depth graph of dlayer vs no3 for 31/01/1989 and 10/06/1989. Depth plots can only be done when the simulation has dlayer in the output file along with at least one other layered variable. This is why we included no3 and nh4 as layered variables in the output file and not just include NO3Total and NO4Total.

   Drag a *Depth* component onto the simulation. Expand the Plot node to get the *Depth* node. Tick the dates mentioned above. In the *Plot* node, add "no3" and "nh4" as the X variable and leave the Y variable as "Depth" Now below the graph untick the checkboxes for the "nh4" lines.



   From this chart you can see the distribution of nitrate in the soil profile just 21 days after the addition of fertiliser and at 5 months.

A sorghum crop simulation

Response of crop to N fertiliser

In this exercise you will observe the growth a crop over a single season.

You will learn a bit more about specifying a Manager template, execute more than one run in batch mode and use the simulator to do a "what-if" experiment with fertiliser rates. These skills can also be used to "experiment" with time of planting, rate of sowing, crop comparisons and different starting soil moisture conditions.

The examples assume you have read and walked through the previous document: How to Build, Run and Graph a Simulation

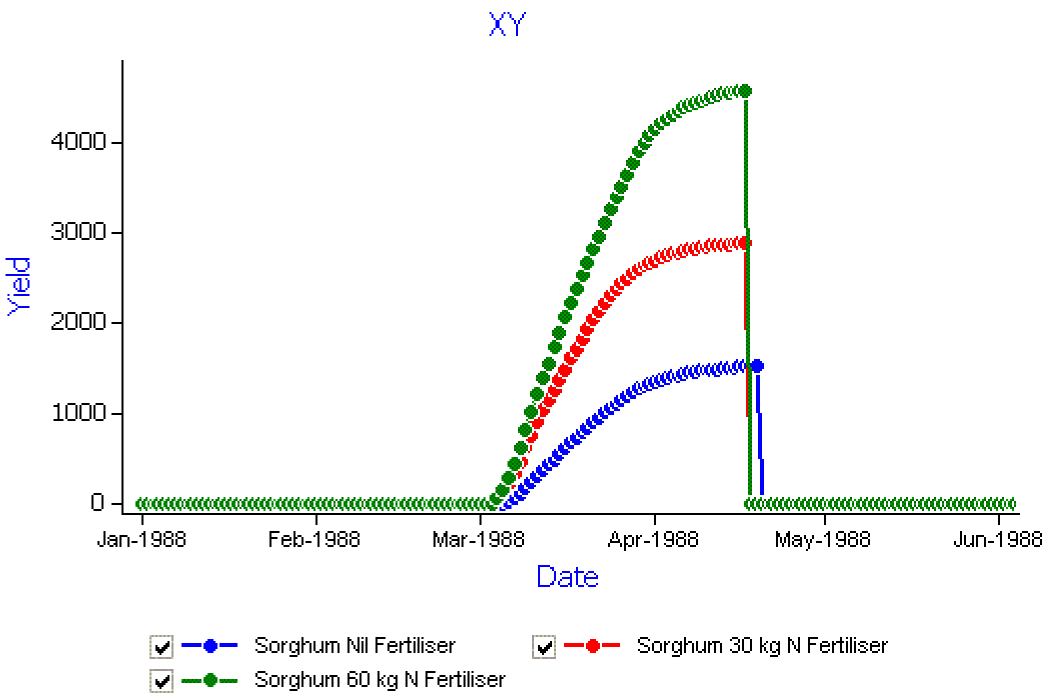
1. Start a fresh simulation using *Continuous Sorghum Simulation* as a template
2. Choose the Dalby weather 1/1/1988 - 30/6/1988
3. Select the Black Vertosol-Mywybilla (Bongeen No001) Soil. (Soils->Australia->Queensland->Darling Downs)(remember to rename it)
4. Set the Starting water to 25% full - filled from top.
5. Set the Starting nitrogen to 12 kg/ha of NO_3 and 3 kg/ha of NH_4
6. Change the sowing rule to:

   set sowing date to 1-Jan by setting both the 'window start' and 'window end' to 1-Jan and 'Must Sow' to 'yes'.
   set sowing density to 8
   set sowing depth (mm) to 30
   set cultivar to early
   set row spacing to 1000mm
   skip row to solid
   leave all the other parameters as they are.

7. Check that the harvest rule indicates that *Sorghum* should be harvested.
8. Remove the *Sowing fertiliser* rule from the *Manager* component.
9. Choose these variables to report:

Component	Variable name
Global	dd/mm/yyyy as Date
	Day
	Year
Soil (whatever you renamed it to)	Depth - layered (mm)
	Soil water - layered (mm/mm)
Sorghum	DaysAfterSowing
	LAI
	Biomass
	Yield

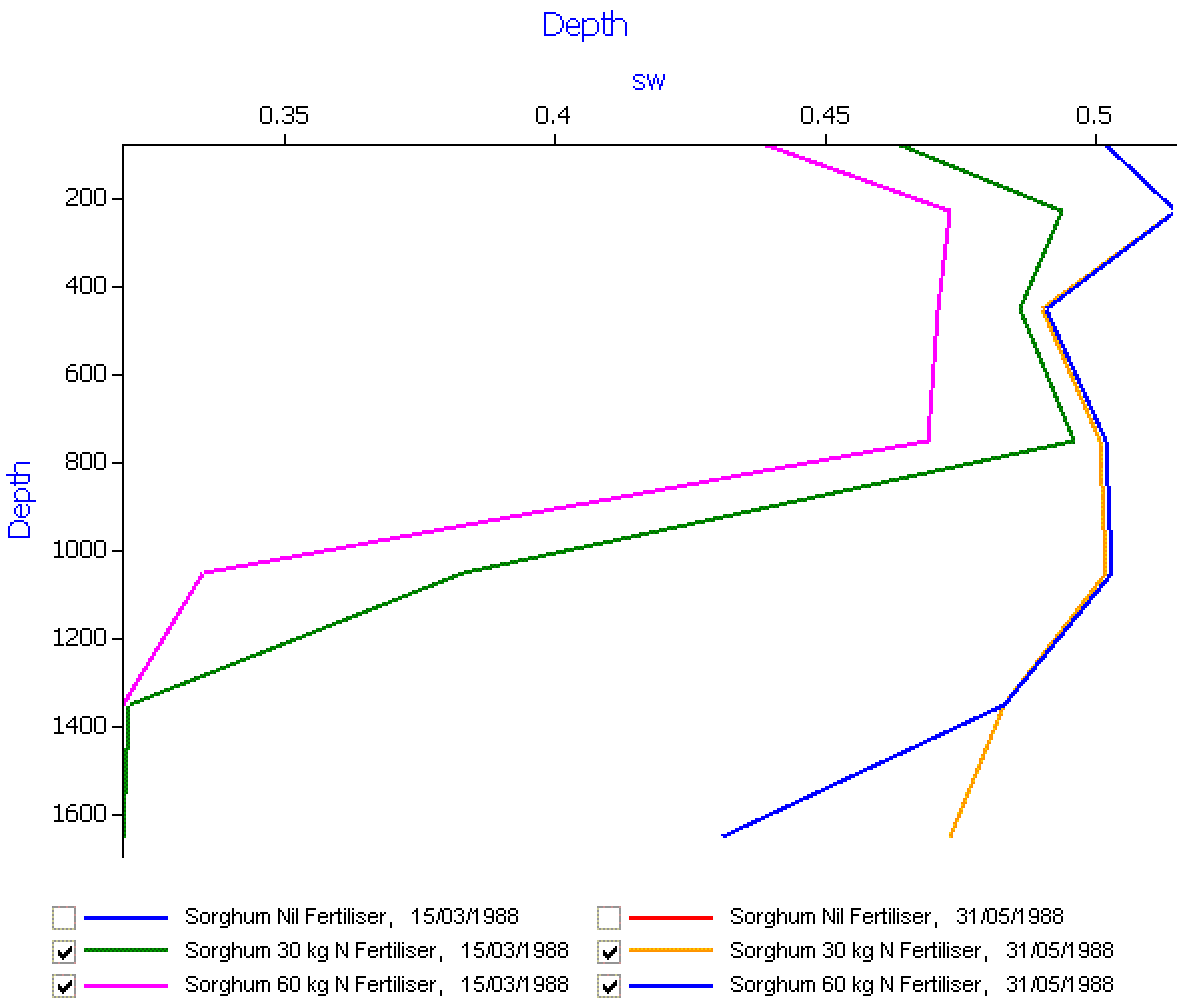
10. Choose a daily reporting frequency.
11. Rename the simulation as *Sorghum Nil Fertiliser.* Save the filename as *Sorghum Fertiliser.apsim*
12. Make a copy of the simulation by dragging *Sorghum Nil Fertiliser* node to the *Simulations* node at the top of the simulation tree.
13. Rename this copy to *Sorghum 30 kg N Fertiliser*.
14. Add a *Fertilise at sowing* rule to the *Manager* component. Apply 30 kg urea_n fertiliser, making sure to change the "On which module should the event come from" name from wheat to sorghum.
15. Make another copy of the simulation, this time adding 60 kg/ha of fertiliser.
16. Run all 3 simulations.
17. Graph all 3 output files creating a Date vs Yield chart using a graph component. Click on the *Graph* toolbox. Drag an *XY Chart* onto the top node *Simulations*.



Rate of water extraction from soil profile

Create a new depth chart of dlayer vs sw with 2 dates 15 Mar (crop is growing) and 31st May (after the harvest).

Drag a *Depth* component onto the top *Simulations* node. Expand the Plot node to get the *Depth* node. Tick the dates mentioned above. In the *Plot* node, add "sw" as the X variable and leave the Y variable as "Depth"


Depth
sw
0.35
0.4
0.45
0.5
Depth
200
400
600
800
1000
1200
1400
1600
Sorghum Nil Fertiliser, 15/03/1988
Sorghum 30 kg N Fertiliser, 15/03/1988
Sorghum 60 kg N Fertiliser, 15/03/1988
Sorghum Nil Fertiliser, 31/05/1988
Sorghum 30 kg N Fertiliser, 31/05/1988
Sorghum 60 kg N Fertiliser, 31/05/1988

Chickpea sowing rates - 10 year runs

In this exercise you will use sowing rules to plant Chickpea crops and observe yield probabilities for a 10 year period given a half soil moisture profile at sowing. You can compare two sowing rate strategies for these conditions.

By doing this simulation you will learn about rule based sowing, long term simulations, resetting soil moisture and nitrogen at sowing and graphing probability data.

The examples assume you have read and walked through the previous document: How to Build, Run and Graph a Simulation

1. Start a fresh simulation using *Continuous Wheat Simulation* as a template
2. Choose the Goondiwindi weather 1/01/1979 - 30/04/1989
3. Select the "Black Vertosol (Garah No10011)" soil (Soils->Australia->New South Wales->North West Slopes and Plains) **and rename it to Vertosol**
4. Set the Starting water to 50% full - filled from top.
5. Set the Starting nitrogen to 20 kg/ha NO_3 and 0 kg/ha NH_4
6. Change the surface residue type to sorghum (don't forget to rename the pool name to "sorghum" as well), initial surface residue: 550 kg/ha, C:N ration of 76, leave the Fraction of residue standing as is.
7. Replace the wheat crop with chickpea.
8. Replace the *Sowing rule* with the *Sow using a variable rule* from the toolbox.
9. Set the properties of the sowing rule to:

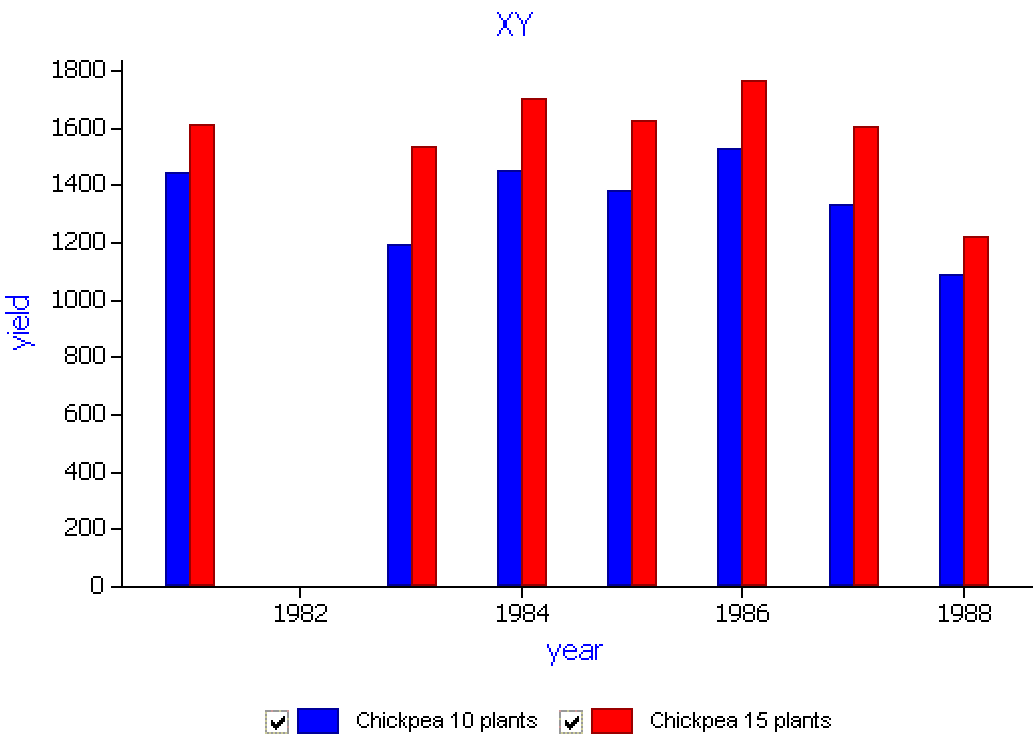
   sowing window start date: 1-may
   sowing window end date: 1-aug
   must sow: no
   amount of rainfall: 15
   number of days of rainfall: 3
   amount of soil water: 200

   crop is chickpea
   sowing density plants/m2: 10
   sowing depth: 30
   variety: amethyst
   crop growth class: plant
   row spacing: 350

10. Remove the sowing fertiliser rule.
11. Make sure the harvesting rule will harvest chickpea, not wheat.
12. Add the rule: *Reset water, nitrogen and surfaceOM on fixed date.* Use 1-may for the reset. Make sure the name of the soil module and the name of the surface organic matter module is correct (we renamed the soil to Vertosol). We want to reset water, nitrogen and surface organic matter to remove the year to year effects. (move it up to make sure it the first rule under Manager component. The order is important in the Manager Component. It is the order the rules are checked in)(right click on the rule and select "Move up")
13. Choose these variables to report:

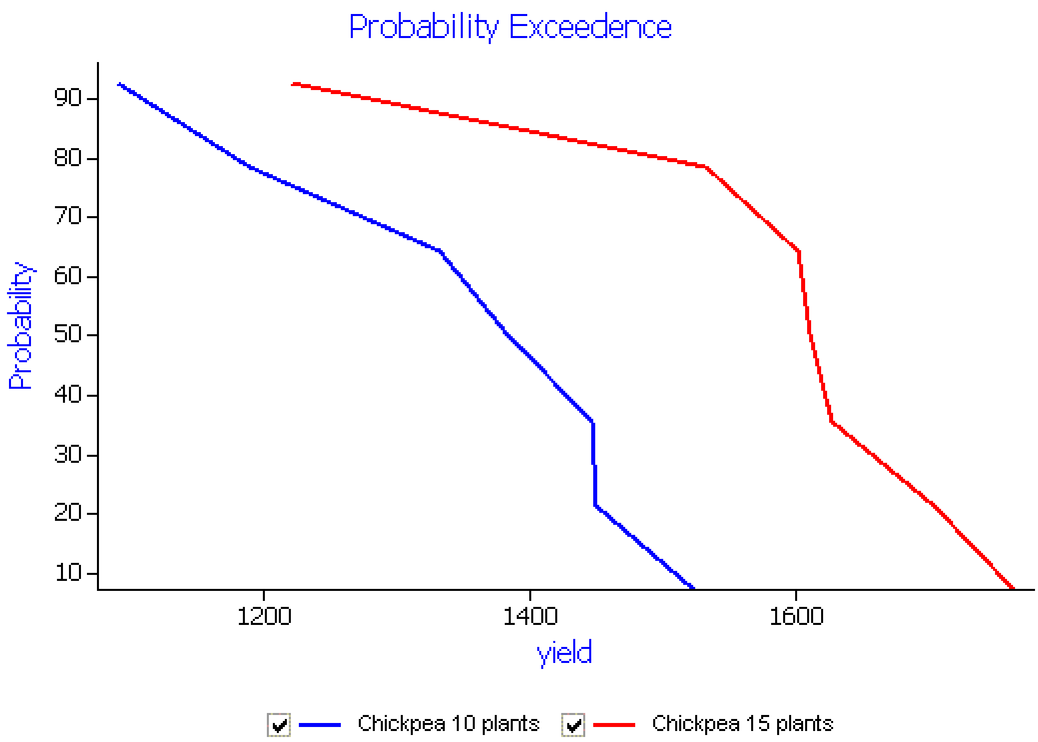
Component	Variable name
Global	year
Chickpea	yield

14. Make sure the reporting frequency is set to harvesting.
15. Rename simulation to *Chickpea 10 plants*
16. Make a copy of the simulation and create a new one with 15 plants/m2
17. Rename this copy to *Chickpea 15 plants*.
18. Save the simulations as *Sowing Rates.apsim*
19. Run simulations.
20. Graph both output files creating a Year vs Yield by using a Graph component. Drag an "XY Chart" onto the *Simulations* node from the Graph toolbox.



Question 1: Why aren't there any bars in 1982?

21. Create a probability of exceedance plot of Yield by using a Graph component. Drag a "Probability Exceedence" component onto the *Simulations* node from the Graph toolbox. Select the Yield as the X variable and leave Probability as the Y variable. It is that easy.



Wheat / mungbean opportunity cropping

In this exercise you will use sowing rules to opportunistically plant mungbean and wheat crops over a 10 year period without resetting water or nitrogen at sowing. You will observe the effect of this rotation on soil biomass nitrogen and the response of the rotation to different sowing rules.

The examples assume you have read and walked through the previous document: How to Build, Run and Graph a Simulation

1. Start a fresh simulation using *Continuous Wheat Simulation* as a template
2. Choose the Goondiwindi weather 1/4/1974 - 30/4/1984
3. Select the "Grey Vertosol-Merwood (Croppa Creek No068)" soil (Soils->Australia->New South Wales->North West Slopes and Plains) **and rename it to Vertosol**

   This soil doesn't have crop lower limits for mungbean, so add a new crop to the soil. Make sure you call it *mungbean*. For this exercise, instead of changing LL, PAWC, KL and XF values just leave the default values. If you do not know how to add a new crop see the following document: How to: Adding crop properties to a soil .

4. Set the Starting water to 50% full - filled from top.
5. Set the Starting nitrogen to 140 kg/ha NO_3 and 0 kg/ha NH_4
6. Add mungbean to the simulation tree, leaving wheat alone.
7. Replace the *Sowing rule* with the *Sow using a variable rule* from the toolbox and rename to *Wheat sowing - Janz*.
8. Set the properties of *wheat sowing* to:

   sowing window start date: 1-Jun
   sowing window end date: 14-Jun
   must sow: no
   amount of rainfall: 15
   number of days of rainfall: 3
   amount of soil water in profile: 200
   crop: wheat
   sowing density: 100
   sowing depth: 50
   cultivar: Janz
   crop growth class: plant
   row spacing: 250

9. We want to sow an earlier maturing cultivar if the sowing is later so make a copy of this rule but change the window to 15-jun to 1-aug and the cultivar to hartog. Rename this new rule to *Wheat sowing - Hartog*
10. Rename the harvesting rule to *Wheat harvesting* - make sure it points to wheat.
11. Rename the *Sowing fertiliser* rule to *Wheat sowing fertiliser.* Make sure it points to wheat and set the amount to 70kg/ha of urea_n.
12. Duplicate one of the wheat sowing rules and rename it to *Mungbean sowing*. Set the parameters to:

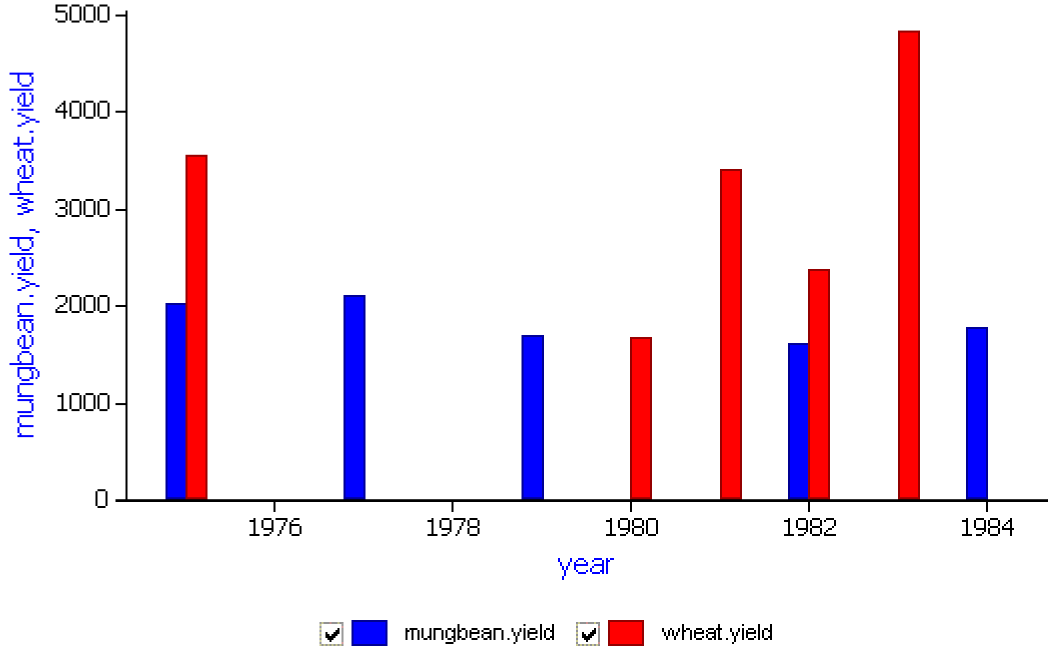
   sowing window start date: 1-Dec
   sowing window end date: 15-Jan
   must sow: no
   amount of rainfall: 20
   number of days of rainfall: 3
   amount of soil water in profile: 200
   crop: mungbean
   sowing density: 36
   sowing depth: 50
   cultivar: Berken
   crop growth class: plant
   row spacing: 500

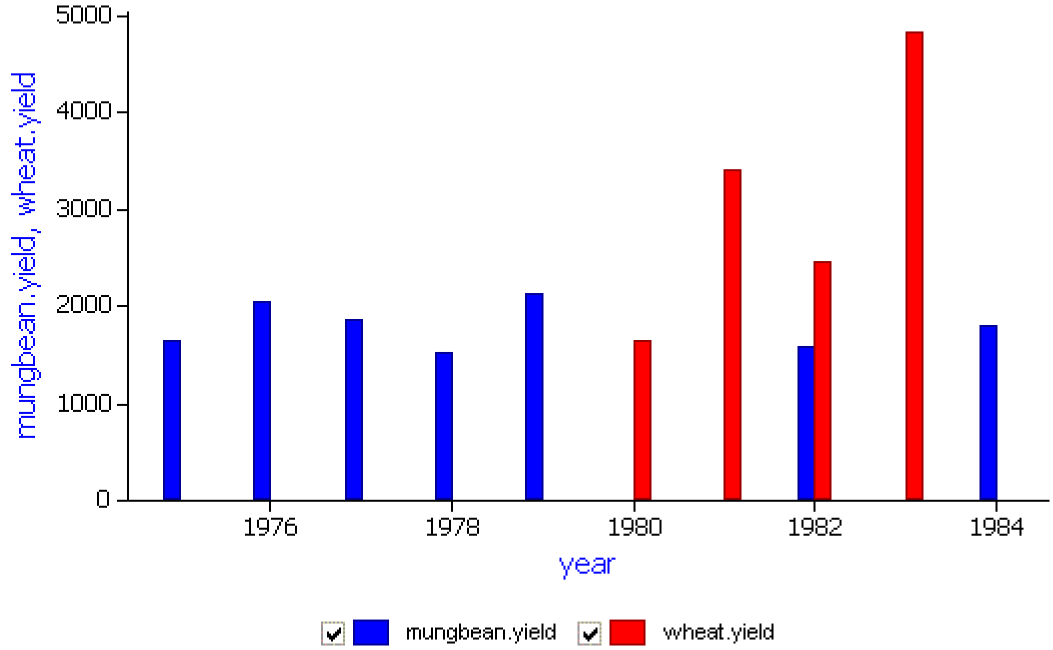
13. Duplicate the *Wheat harvesting* rule and rename to *Mungbean harvesting*. Make sure it points to mungbean, not wheat.
14. Choose these variables to report:

Component	Variable name

Global	Year
Soil (we renamed it to Vertosol)	BIOM_N - layered.
Mungbean or Wheat	yield (this will output the yield for all the crops in the simulation. Mungbean yields and Wheat yields will BOTH be outputed in different columns)

15. Choose a reporting frequency of *harvesting*.
16. Rename simulation to *Mungbean-Wheat.* Save the filename to the same name.
17. Create a *linked* copy of this simulation via drag and drop and rename this new one to *Mungbean-Wheat Early* (to find out how to do this see: How To: Use linking to reduce simulation duplication)
18. *Unlink* the mungbean sowing rule and change sowing window to 1-nov to 1-jan.
19. Run simulations.
20. Create **separate** graphs of Year vs Mungbean Yield and Wheat Yield **for each simulation**. Drag an XY Chart on each simulation.
21. Add Titles to each graph identifying them as *Mungbean-Wheat* and *Mungbean-Wheat Early*. To find out how to add a title to a graph see How To: Modify a Graph component





Question: Why is there no wheat yield in 1984?

SOI phase and Economic analysis

In this exercise, you will examine the effect of SOI phase on yield probability, and gross margin outcomes. Exercises will also be conducted using manual generation of a probability distribution and the application of economic principles.

1. Create a new simulation using *Continuous Sorghum Simulation*.
2. Rename simulation to *A* (we are choosing this short name to save space on the graph later on)
3. Choose Goondiwindi weather (long term 1940 to 1989)
4. Starting date 01/01/1940 Ending date 31/12/1989
5. Choose "Black Vertosol-Anchorfield (Brookstead No006)" soil. (Soils->Australia->Queensland->Darling Downs) (remember to rename)
6. Set the starting soil water to 33% full – filled from the top
7. Use default initial soil nitrogen
8. Set initial surface organic matter to sorghum and is 1500 kg/ha. (rename the pool name, but leave everything else)
9. Modify sowing rule to:

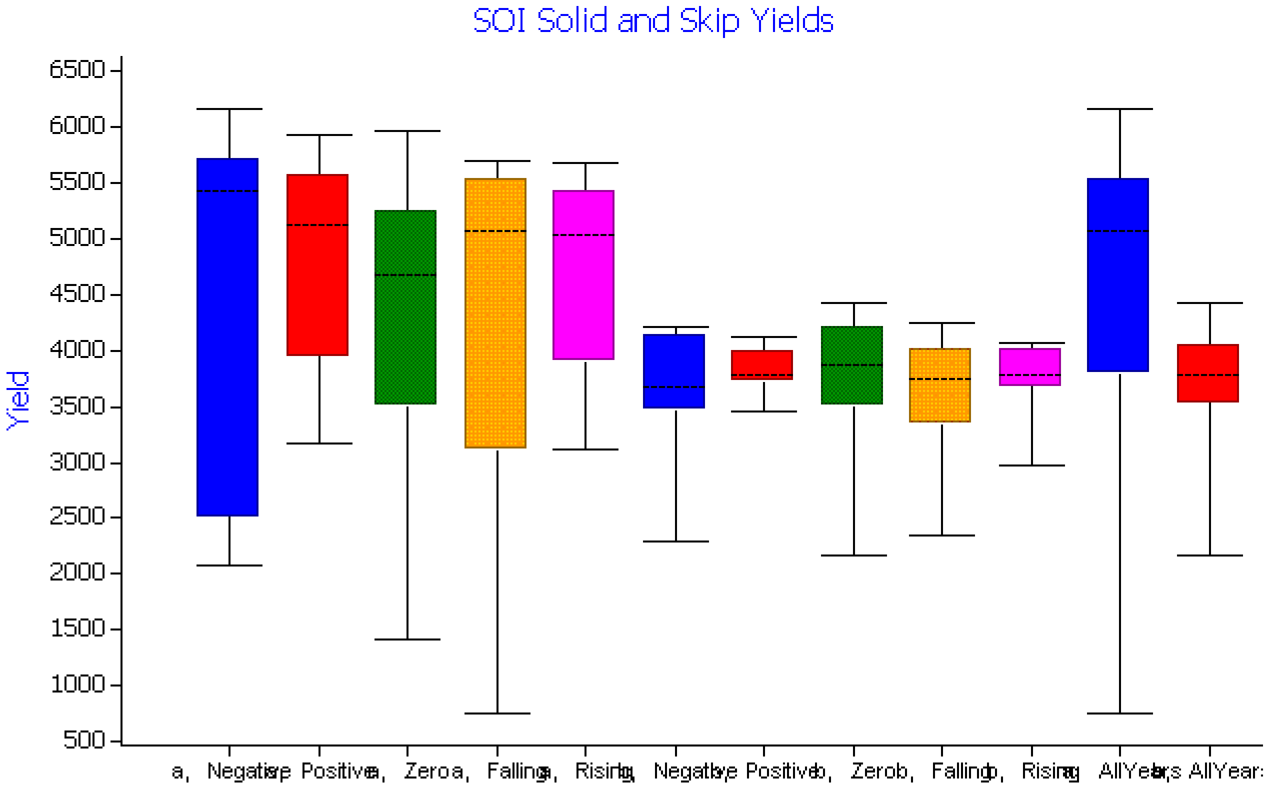
   Force sowing to 10-Dec
   Enter sowing density at 5 pl/m2
   Cultivar as early
   Skip row as soild
   (leave everything else as is)

10. Set fertiliser at sowing to 100 kg/ha of urea_no3. (move this rule up so that it comes before harvesting rule)
11. From the Standard toolbox drag in a "Yield moisture correction" and a "Simple gross margin (put before harvesting rule)" rule. (make sure the "Yield moisture correction" rule comes before the "Simple gross margin" which obviously comes before the harvest rule)
12. Report year, yield and Bank in the output file. (Just type "Bank" in manually into the variable list)
13. Create a *linked* copy of this simulation via drag and drop and rename this new one to *B* (to find out how to do this see: How To: Use linking to reduce simulation duplication)
14. *Unlink* the sowing rule and change change the "Skip row" property to "double".
15. Click on the "Simple gross margin" rule, then click on the "post" tab. Replace all the words "Fertili**z**er" with "Fertili**s**er" (we changed the name of this variable in the last release but still haven't got around to changing it in all the rules yet).
16. Run both simulations (check the simulations run error-free)
17. Graph Yield of both simulations using an *SOI Box Plot* from the Graph toolbox.

    Fully expand the graph component. For the "SOI" component, given we used a sowing date of December, use the SOI from November to split the years.

    You may want to resize your ApsimUI window to make the graph more visibile.

18. Give your graph a different label perhaps *SOI Solid and Skip Yields* To find out how see: How To: Modify a Graph component)



The output demonstrates the differing probability distributions of solid vs double skip configuration in negative and positive SOI phases

19. Compare with "SOI CDF" and "SOI Probability Exceedence" graphs.

Economic analysis

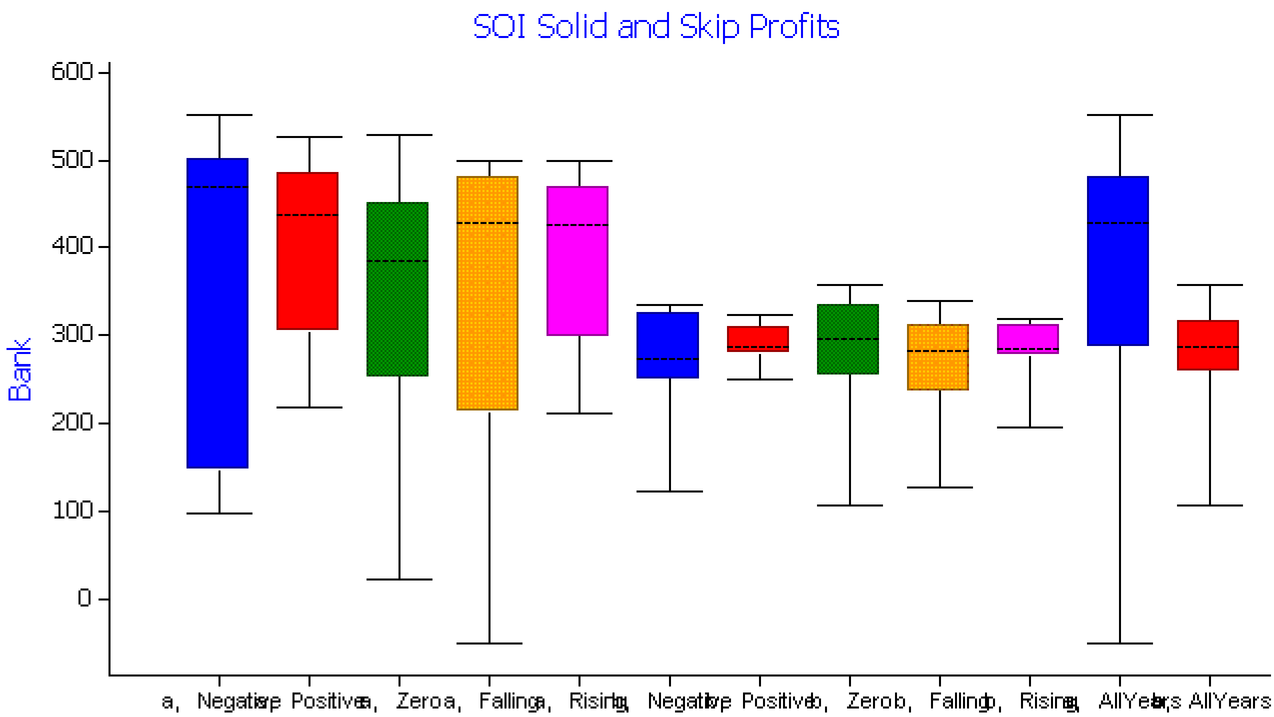
This simulation has two rules from the Standard toolbox that we dragged in. A "Yield moisture correction" and a "Simple gross margin" rule.

You also remember how you manually typed in Bank into the output variable list. To see where it comes from click on the "post" tab of the "Simple gross margin" rule.

You can create your own economic calculations by using these kind of manager rules.

Keep in mind though when using these rules, that yield in APSIM is calculated as *dry* yield. So this assumes no water content. Much economic analysis requires a *wet* yield which is what a farmer will actually harvest from his paddock. This is why in our simulations we used a "Yield moisture correction" to do a simple calculation to work out this wet yield. (see its "start_of_day" tab)

1. Graph gross margin using the SOI graph you have already created. (In "Plot" window delete "Yield", and add "Bank")
2. Change the label to *SOI Solid and Skip Profits*.



Note: Similar output can be obtained via the WhopperCropper program that allows selection of the required input variables from a pre-determined set (usually 3 to 6 options for each variable).

Further economic analysis in Excel

1. Select the top component *Simulations* then click the *Excel* button on the top toolbar.
2. You will notice that the output files have been exported to 2 separate Excel windows.

3. *** At this point you can manipulate the data however you like in the EXCEL program ***

Rotations

Creating a wheat long fallow rotation

In this exercise, you will create a wheat long fallow rotation where wheat is potentially sown every second year.

1. Create a new simulation based on *Rotation Sample*
2. Change the name of the simulation to *LongFallowV* and save to the same filename.
3. SaveAs LongFallowV.apsim
4. Check met file is Goondiwindi 1940-1989 and make the simulation run for entire length of met file (1/01/1940 to 31/12/1989).
5. Change the soil to "Black Vertosol-Waco (Jimbour No016)". (Soils->Australia->Queensland->Darling Downs)(remember to rename it)
6. Delete the cotton and chickpea crops from the simulation. (we will only be doing wheat and summer and winter fallows in this simulation)
7. Delete all the sowing rules and harvesting rules for every crop other than Wheat
8. Change *minimum allowable soil water* criteria of the Wheat sowing rule to 0 so that it doesn't play a part in the sowing criteria.

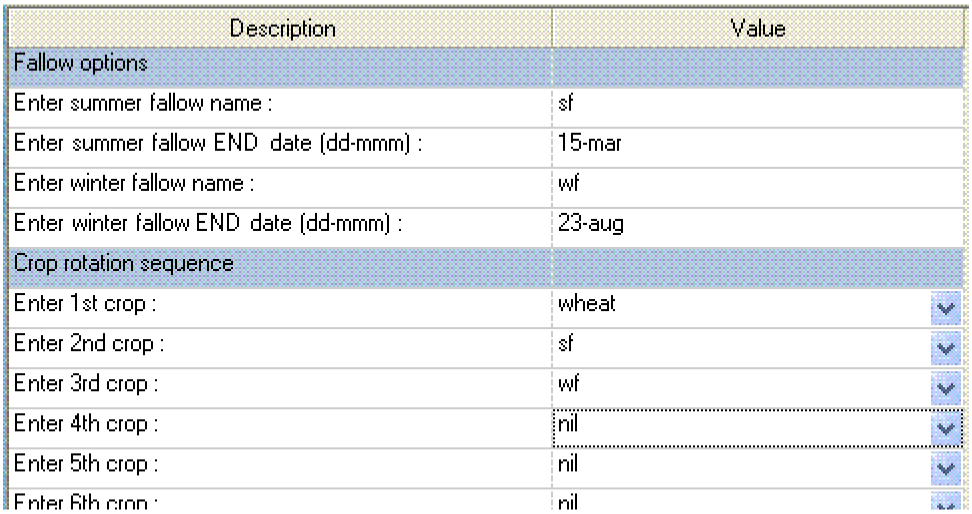
Sowing criteria	
Enter sowing window START date (dd-mmm) :	15-may
Enter sowing window END date (dd-mmm) :	10-jul
Must sow? :	no
Amount of rainfall :	25
Number of days of rainfall :	3
Enter minimum allowable available soil water (mm) :	0
Sowing parameters	
Enter name of crop to sow :	wheat
Enter sowing density (plants/m2) :	100
Enter sowing depth (mm) :	30
Enter cultivar :	hartog
Enter crop growth class :	plant
Enter row spacing (mm) :	250

9. Set the crop order in the *Rotations* rule to the following:

1st crop	wheat
2nd crop	sf
3rd crop	wf
4th crop	nil

(set 5th and 6th crop to *nil* as well. Just so you don't get confused later)

sf, wf and nil are standard abbreviations. *sf* for summer fallow, *wf* for winter fallow and *nil* for the point where the rotation will return to the beginning and repeat. APSIM will not recognise anything else.

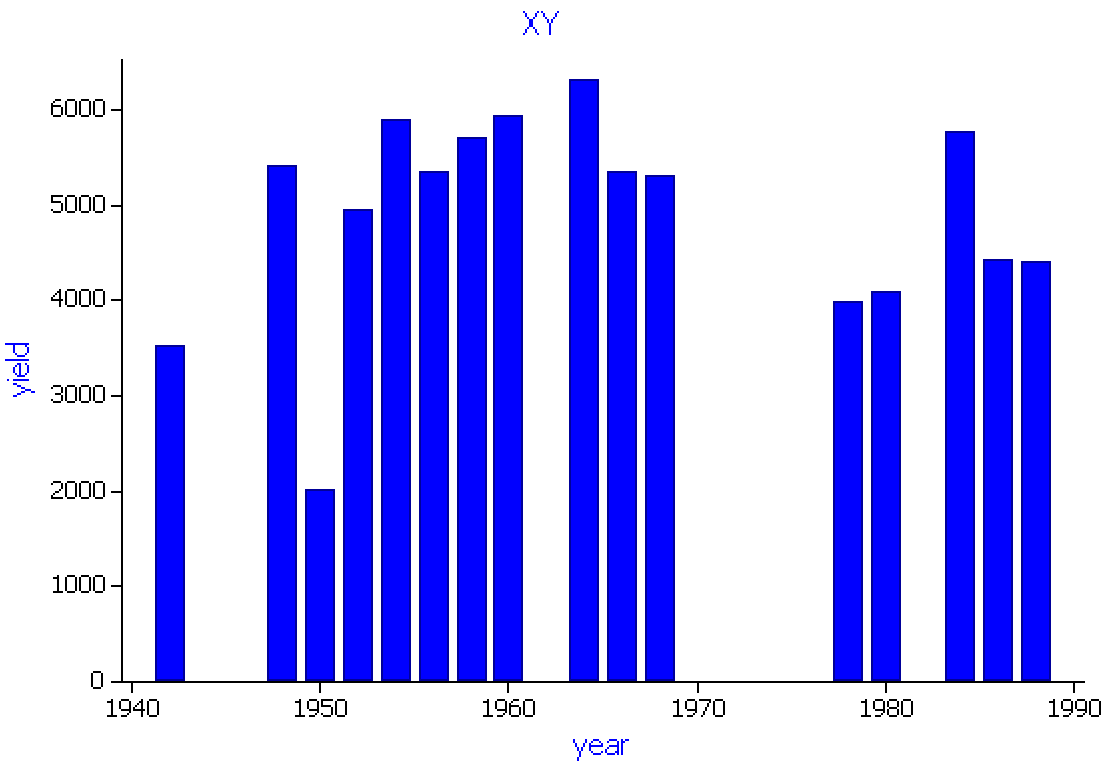


Description	Value
Fallow options	
Enter summer fallow name :	sf
Enter summer fallow END date (dd-mmm) :	15-mar
Enter winter fallow name :	wf
Enter winter fallow END date (dd-mmm) :	23-aug
Crop rotation sequence	
Enter 1st crop :	wheat
Enter 2nd crop :	sf
Enter 3rd crop :	wf
Enter 4th crop :	nil
Enter 5th crop :	nil
Enter 6th crop :	nil

10. Reorder the rules in the Manager component so that Rotations rule comes first followed by the sowing rules then the harvest rule
11. Choose these variables to report:

Component	Variable name
Global	Date (dd/mm/yyyy)
	year
Wheat	yield

12. Change the output frequency to harvesting.
13. Run APSIM and plot year vs yield using a graph component.

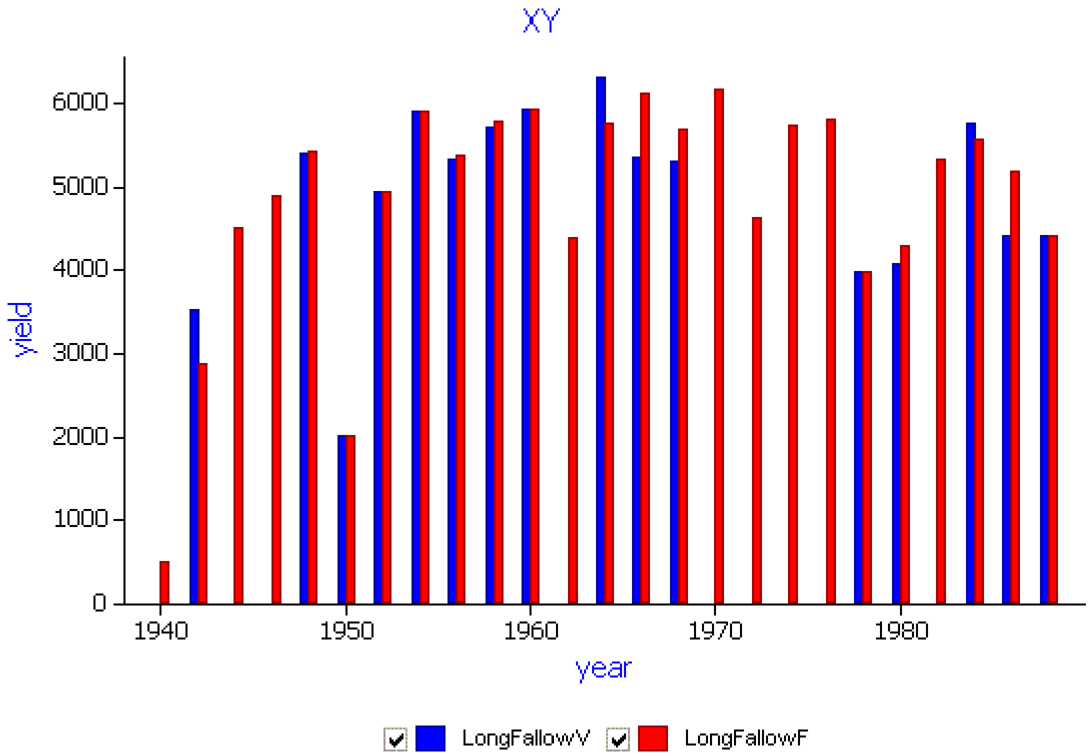


Fixed vs variable rotation

1. Duplicate the previous simulation and name it *LongFallowF*
2. Change the wheat sowing rules in the LongFallowF simulation from

must sow = No to Must sow = Yes

3. Run this second simulation and plot year vs yield for both simulations on the same graph using a graph component

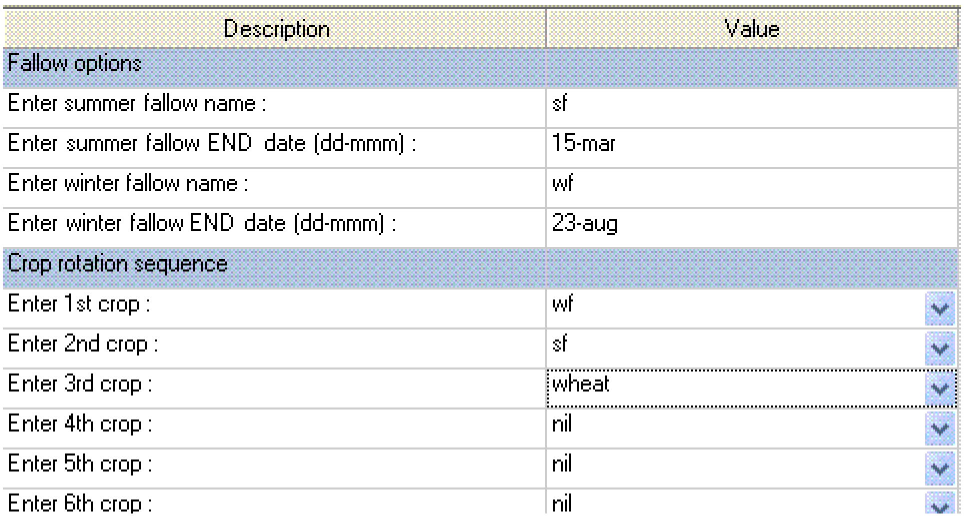


What are the differences between fixed and variable ?

Off-Setting the Rotations

1. Duplicate the *LongFallowF* simulation and name the new one *LongFallow0*
2. Set the crop order in the *Rotations* rule to the following:

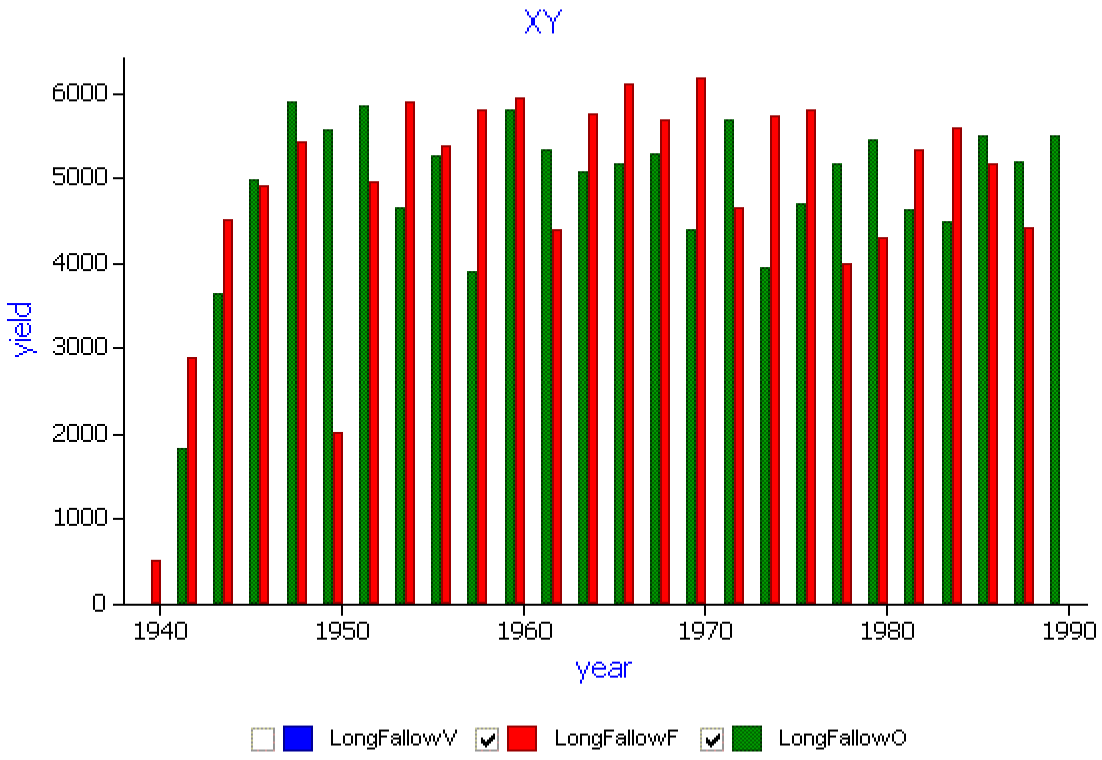
1st crop	wf
2nd crop	sf
3rd crop	wheat
4th crop	nil



Description	Value
Fallow options	
Enter summer fallow name :	sf
Enter summer fallow END date (dd-mmm) :	15-mar
Enter winter fallow name :	wf
Enter winter fallow END date (dd-mmm) :	23-aug
Crop rotation sequence	
Enter 1st crop :	wf
Enter 2nd crop :	sf
Enter 3rd crop :	wheat
Enter 4th crop :	nil
Enter 5th crop :	nil
Enter 6th crop :	nil

3. Run this simulation.

4. Plot year vs yield for both *LongFallowF* and *LongFallowO* on the same graph using a graph component. To do this, do it as if you were going to plot all the simulations on the one graph. When you view the graph of all three simulations you will notice some checkboxes below the graph. One for each of the simulations. Just untick the *LongFallowV*



If you worked out the average yield for LongFallowF and worked out the average yield for LongFallowO, would they necissarily be the same ?

Wheat sorghum rotation

1. Rename *LongfallowF* simulation to *SorghumWheat Rotation,* remove other simulations and save to a new file called *SorghumWheat.apsim*. (remember to use *Save as* button. Not *Save*)
2. Add *Sorghum* crop from the toolbox.
3. Add *Sorghum sowing* rule from the toolbox, rename to *SorghumSowing*. Set cultivar to early and must sow to yes.
4. Rename *Fertilise at sowing* rule to *WheatFertilise*. Copy it, and rename the copy *SorghumFertilise* (make sure to change the "On which module should the event come from" property to sorghum).
5. Add a *Harvest Rule* from the toolbox, rename to *SorghumHarvesting* and change crop from wheat to sorghum.
6. Make sure the sowing windows for sorghum and wheat sowing rules match those in the table above.
7. Set Rotation sequence to sf, wf, sorghum, wf, sf, wheat, nil.

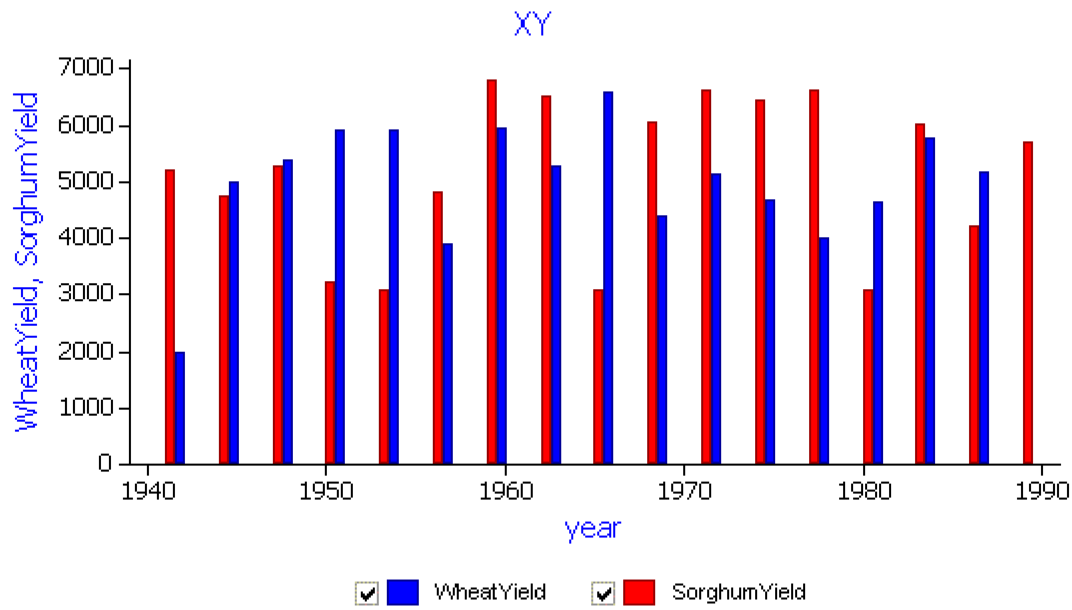
Description	Value
Fallow options	
Enter summer fallow name :	sf
Enter summer fallow END date (dd-mmm) :	15-mar
Enter winter fallow name :	wf
Enter winter fallow END date (dd-mmm) :	23-aug
Crop rotation sequence	
Enter 1st crop :	sf
Enter 2nd crop :	wf
Enter 3rd crop :	sorghum
Enter 4th crop :	wf
Enter 5th crop :	sf
Enter 6th crop :	wheat
Enter 7th crop :	nil
Enter 8th crop :	nil

8. Add the following variables to your simulation:

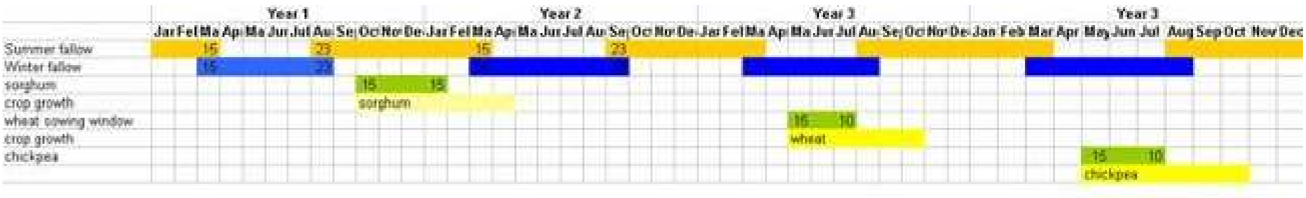
Output file columns:

Variable name	Array?	Description
dd/mm/yyyy	No	Date (dd/mm/yyyy)
year	No	Year
wheat.yield as WheatYield		
sorghum.yield as SorghumYield		

9. Run simulation and plot year vs WheatYield and SorghumYield using a graph component.



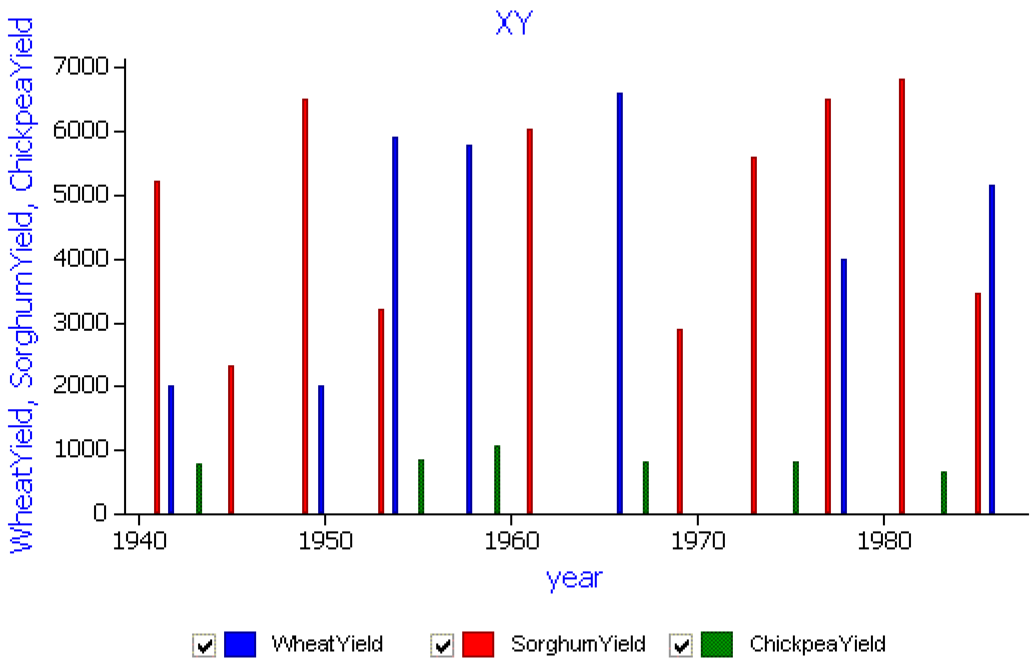
Sorghum Wheat Chickpea rotation (advanced)



In this exercise, you will create a sorghum wheat chickpea rotation that looks like the above diagram without step by step instructions. Use the previous wheat / sorghum rotation as a starting point.

Use these default sowing properties for wheat, sorghum and chickpea:

must sow = no, minimum soil water = 0, cultivar for chickpea is "amethyst", default everything else.



Creating an APSIM met file using EXCEL

APSIM met files consist of a section name, which is always **[weather.met.weather]**, several constants consisting of *name* = *value*, followed by a headings line, a units line and then the data. Spacing in the file is not relevant. Comments can be inserted using the **!** character.

At a minimum three constants must be included in the file: latitude, tav and amp. The last two of these refer to the annual average ambient temperature and annual amplitude in mean monthly temperature.

The met file must also have a year and day column (or date formatted as yyyy/mm/dd), solar radiation (MJ/m2), maximum temperature (oC), minimum temperature (oC) and rainfall. The column headings to use for these are year and day (or date), radn, maxt, mint, rain.

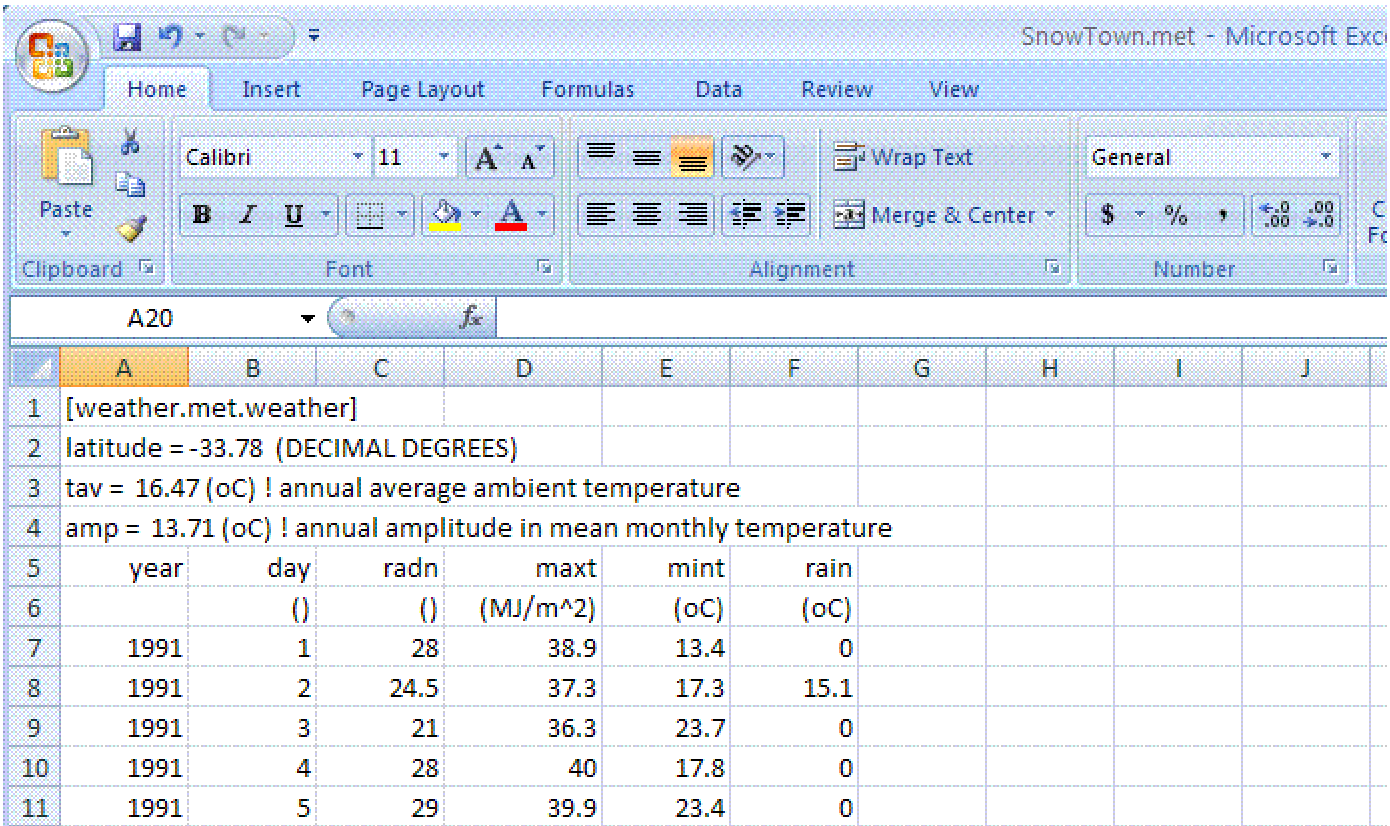
Other constants or columns can be added to the file. These then become available to APSIM as variables that can be reportted or used in manager script.

Example met file:

[weather.met.weather]
latitude = -33.78 (DECIMAL DEGREES)
tav = 16.47 (oC) ! annual average ambient temperature
amp = 13.71 (oC) ! annual amplitude in mean monthly temperature

year	day	radn	maxt	mint	rain
()	()	(MJ/m^2)	(oC)	(oC)	(mm)
1991	1	28.0	38.9	13.4	0.0
1991	2	24.5	37.3	17.3	15.1

To create one of these files in Microsoft EXCEL, open EXCEL and enter data into columns like this:



It is important that the column widths are a bit wider than the data in them. Notice in the figure the maxt column is wider than it needs to be.

The next step is to save the file as a *Formatted Text (Space delimited)(*.prn)* file, giving it a .met file extension. It is recommended that you keep your toolboxes, met files etc in a folder *not* under the APSIM installation directory. Perhaps you could create a folder called *c:/apsim_toolboxes* for storing these types of files.

Easy way to calculate the tav and amp constants

The software team provides a tool called TAV_AMP that will calculate these 2 constants and insert them into a met file. To download the tool goto: http://www.apsim.info/apsim/Downloads/tav_amp.exe

Full instructions for using the tool can be found here: http://www.apsim.info/apsim/Products/tav_amp.pdf

Create your own or Add someone else's toolbox

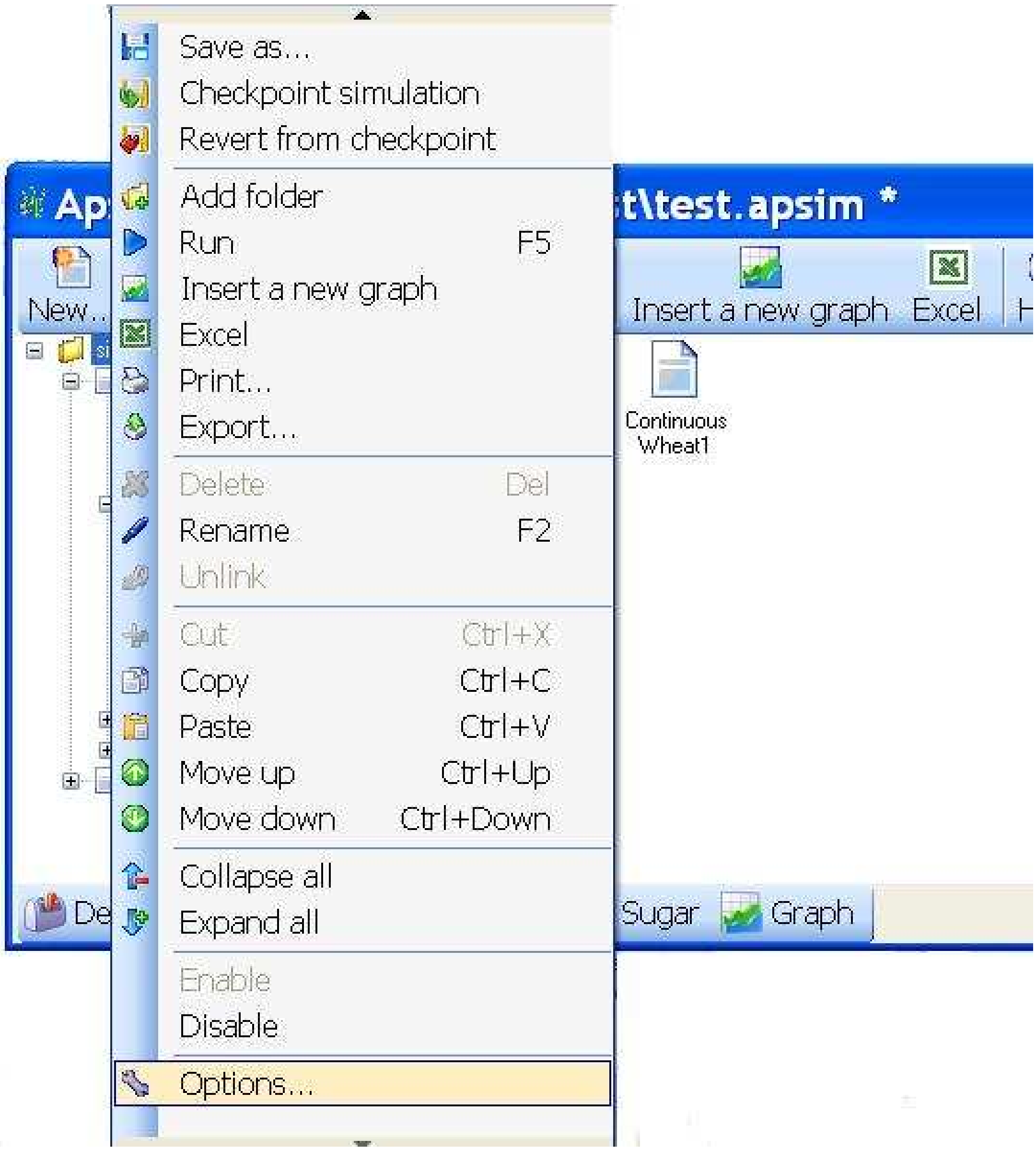
Quite often you may find yourself parameterising components the same way over and over again in your simulations. The user interface allows you to easily reuse these components in many simulations via your own toolboxes. You can create your personal toolbox and then drag components or even entire simulations to it. Next time you want to create a simulation or a part of a simulation, you can then goto your toolbox and reuse entities that you've used before.

Toolboxes can also allow you to save and reuse soils that you have created, although these should be kept in a seperate toolbox to your simulations.

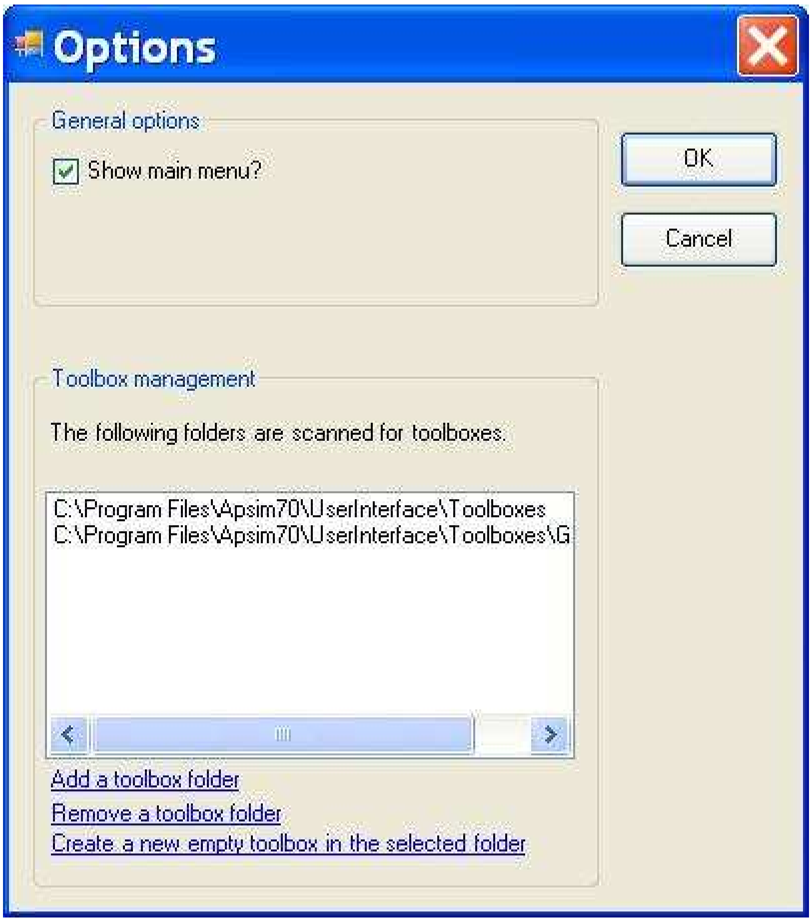
You can also add toolboxes that other people have created, allowing you to quickly and easily collaborate with colleagues.

Create your own toolbox

To create a new empty toolbox, either for simulations or for soils, right click anywhere on the simulation tree



Click the *Options* link.



The first thing you must do is to create a toolbox folder to store you toolboxes in. To do this click the *Add a toolbox folder* link. Browse to the location you want to save the folder then make a new folder there. It is recommended that you keep your toolboxes in a folder *not* under the APSIM installation directory. Call it something like *c:/apsim_toolboxes*. After adding the toolbox folder you should now see the folder added to the list in the Options window.

Now click the the *Create a new empty toolbox in the selected folder* link, making sure the folder you just created is selected in the list in the Options window. The window will let you specify the filename for the new empty toolbox. The filename that you use will become the toolbox name that is displayed on the bottom toolbar, so choose something that is appropriate and preferably short.

In the Options window just click *OK*

Your toolbox will then be displayed on the bottom toolbar. You can then drag components or entire simulations to it or soils you have created. Toolboxes are saved automatically when they are closed or when the user interface is shut down.

Add someone else's toolbox

Any toolboxes that you create can be shared with others by simply giving them a copy of the .xml or .soils file for the relavent toolbox. Once you have obtained a copy of the another persons .xml or .soils file it is a very simple process to add it to APSIM.

It is the exact same procedure as above for "Creating your own toolbox" except that in the "Options" window instead of making a new folder you just browse to the location on your hard drive where you have saved the folder containing the .xml or .soils file that you wish to add.

Add Soils in a .par file to a Toolbox

Users of past versions of APSIM may have soils in a .par file that they may whish to use in the latest version of APSIM.

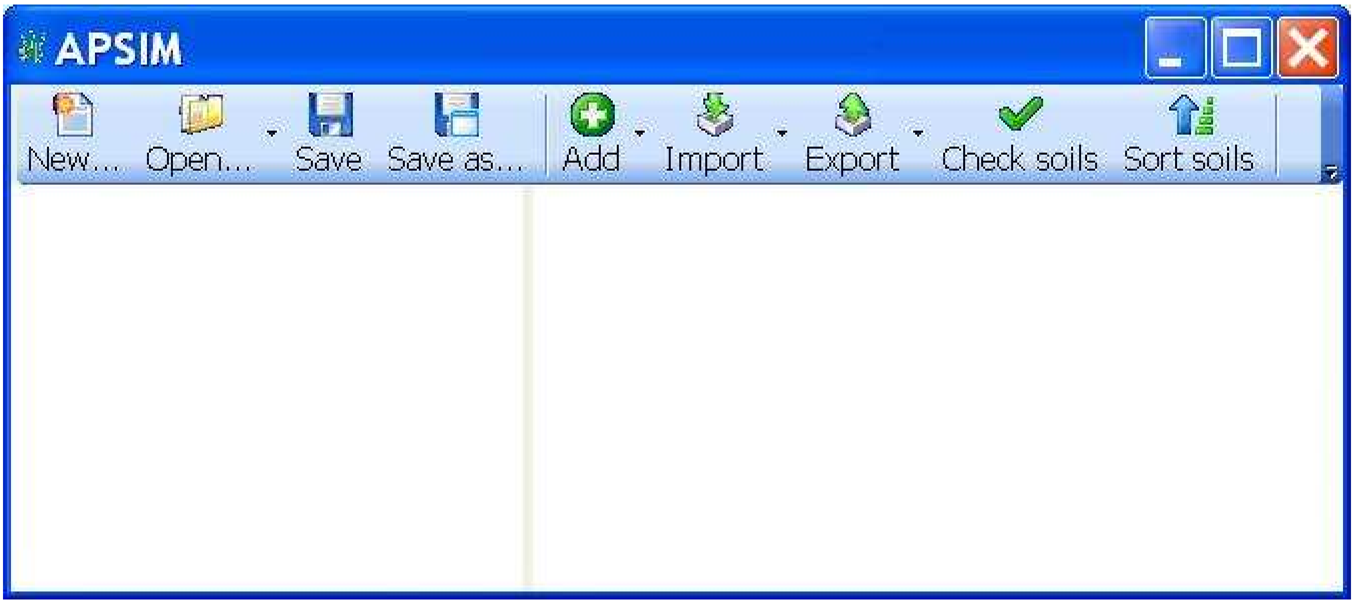
The best way to use these old soils in the new version of APSIM is to add them as a toolbox. To do this you need to convert the .par file containing the soils into a .soils file and then add the .soils as a toolbox.

To convert the .par file into a .soils file, you need to use another product that comes with apsim called *Apsoil*

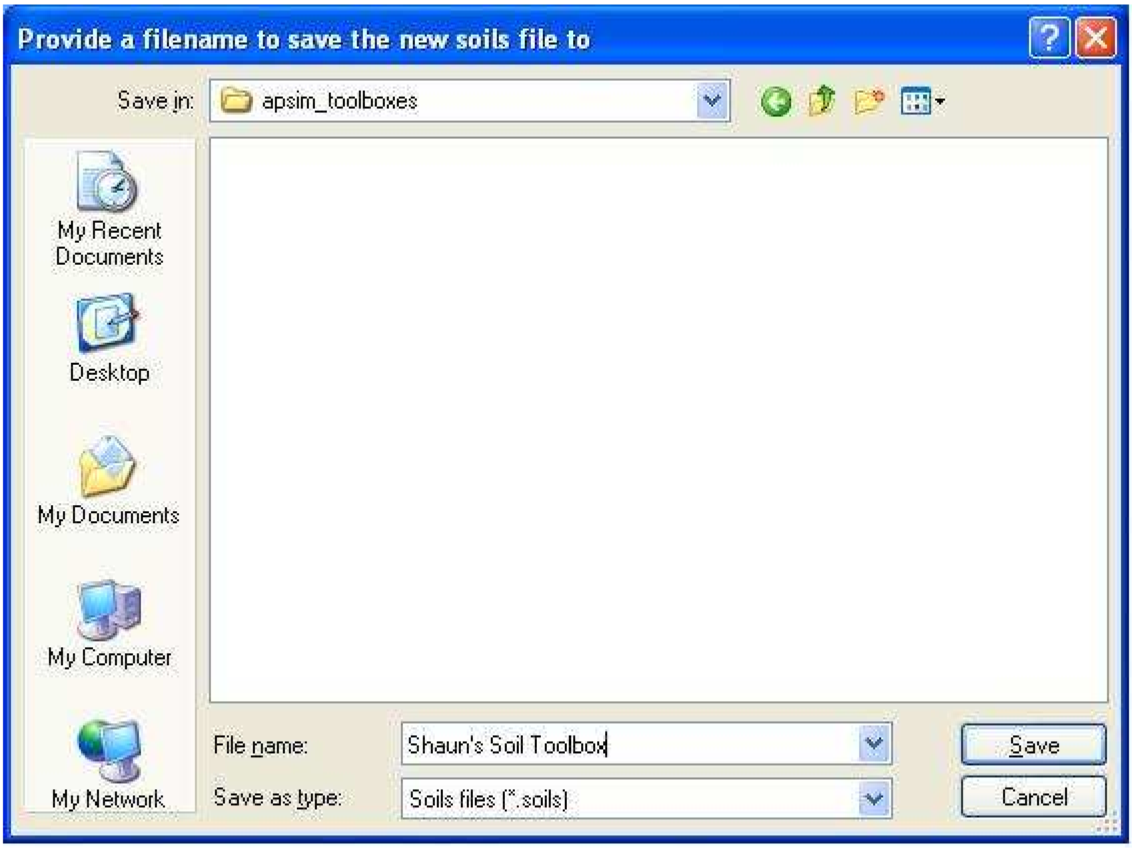
To open it, click on the Apsim icon on your desktop, then choose *Apsoil*.

Click OK when the introduction screen comes up.

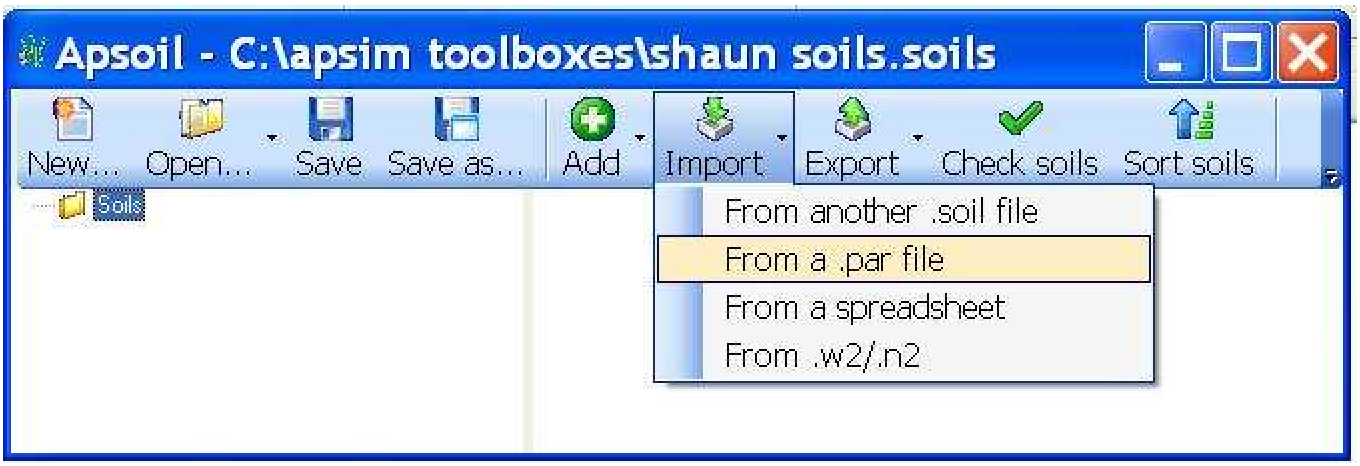
In the window that appears, click *New...*



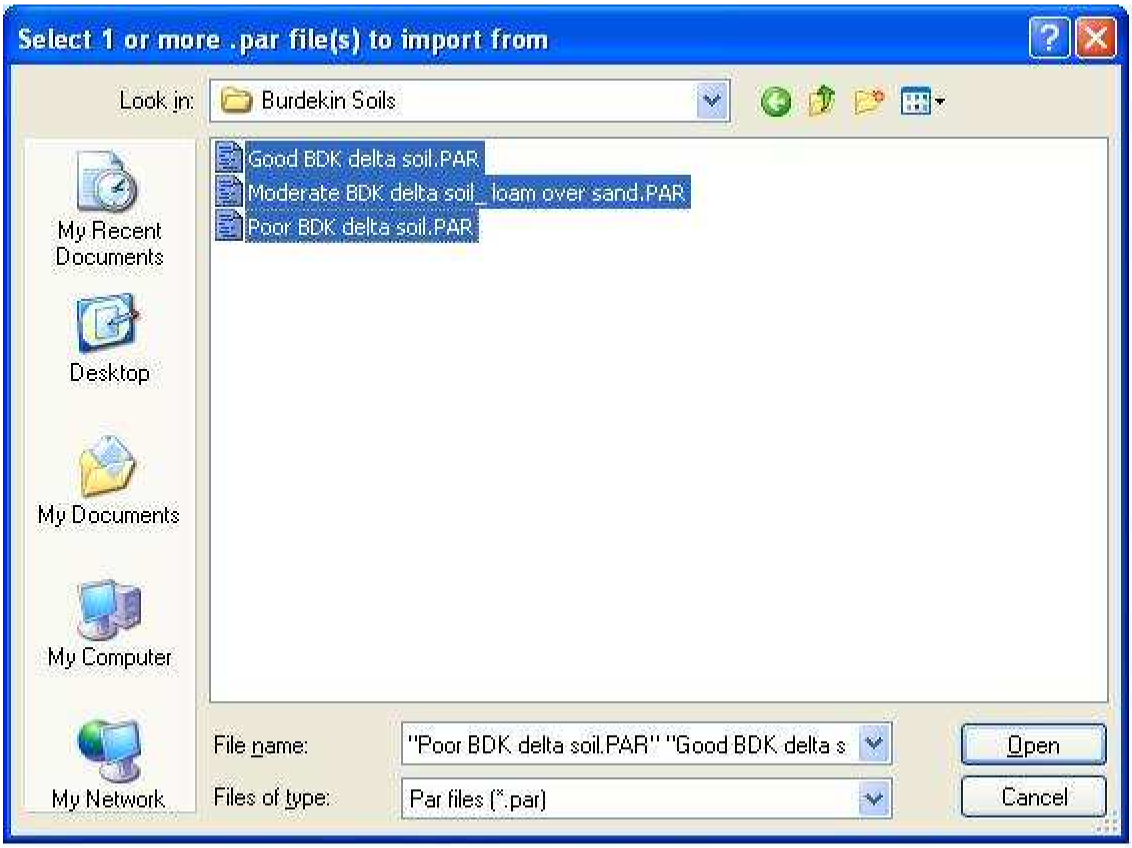
Save the new .soils file to anywhere you like but preferably the same folder that you have saved any previous toolboxes to. Choose an appropriate filename but also preferably a short one as this is the name that will be used for your toolbox when you add it to ApsimUI later. Click *Save*



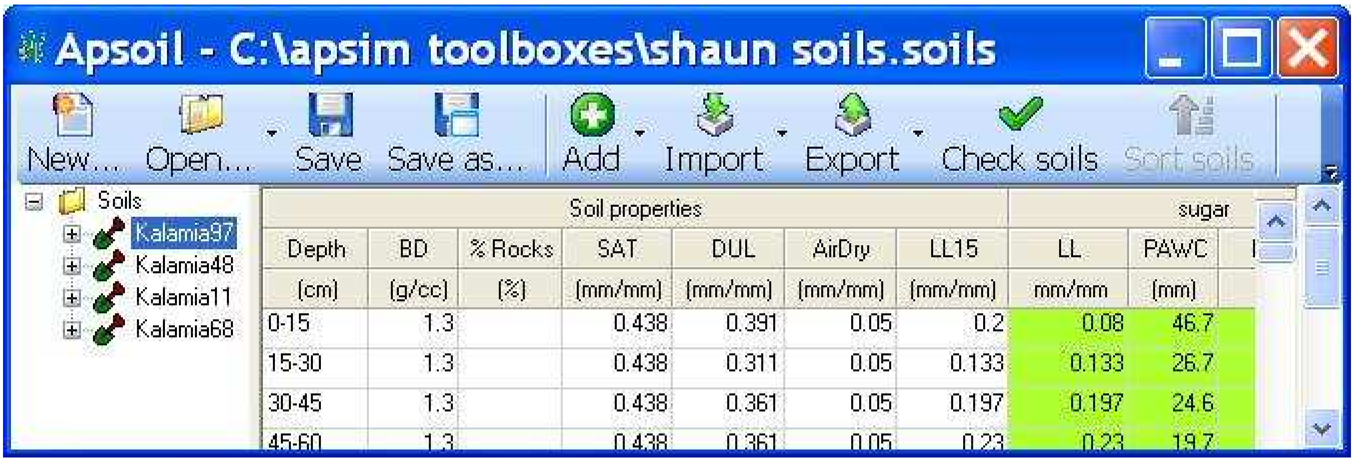
Now click the *Import* button on the toolbar at the top of the window, and choose *From a .par file*



Now you can browse to your folder that contains the .par file with the soils. (nb. if there is more then one .par file in the folder that contains soils that you wish to add, you can use the "Shift" key to select multiple .par files)



You will now see a *Soils* folder added to the tree pane. You can expand the tree and click on the soils to see if they were imported sucessfully. The table is fully editable so you can change any values in it just by clicking on the cell and typing in a new value.



You can import more soils from other .par files to this .soils file by repeating the previous steps.

You can check to see if the soil or soils you have imported are correct by selecting the soil or the root node in the tree and then clicking on the *Check Soils* button on the toolbar.

Cnce you are satisfied that you have all the soils you want added to the .soils file. You can then close Apsoil.

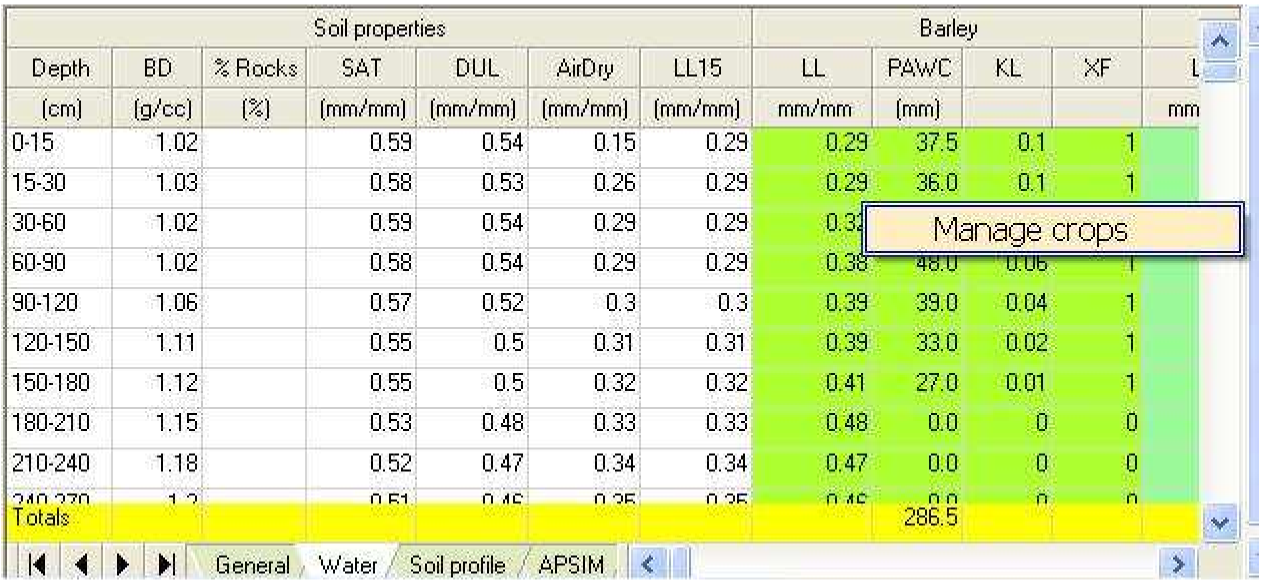
Now that you have created your .soils file with all your soils in it, it is a simple matter of adding the .soils file as a toolbox in APSIM. See Create your own or Add somone else's toolbox to see how to do this.

Adding crop properties to a soil

It is important to remember that the soil must be parameterised for the crops that you're going to sow. If your simulation is going to sow wheat, then the soil must have LL, KL and XF values for wheat.

If the soil you wish to use does not have these values for the crop you desire, then you can add them.

Start by clicking on the soil component in your simulation tree, make sure the *Water* tab is selected, then right click anywhere on the table. Click the "Manage crops" pop up.



Soil properties							Barley			
Depth	BD	% Rocks	SAT	DUL	AirDry	LL15	LL	PAWC	KL	XF
(cm)	(g/cc)	(%)	(mm/mm)	(mm/mm)	(mm/mm)	(mm/mm)	mm/mm	(mm)		
0-15	1.02		0.59	0.54	0.15	0.29	0.29	37.5	0.1	1
15-30	1.03		0.58	0.53	0.26	0.29	0.29	36.0	0.1	1
30-60	1.02		0.59	0.54	0.29	0.29	[illegible]	[illegible]	[illegible]	[illegible]
60-90	1.02		0.58	0.54	0.29	0.29	0.38	48.0	0.06	1
90-120	1.06		0.57	0.52	0.3	0.3	0.39	39.0	0.04	1
120-150	1.11		0.55	0.5	0.31	0.31	0.39	33.0	0.02	1
150-180	1.12		0.55	0.5	0.32	0.32	0.41	27.0	0.01	1
180-210	1.15		0.53	0.48	0.33	0.33	0.48	0.0	0	0
210-240	1.18		0.52	0.47	0.34	0.34	0.47	0.0	0	0
Totals								286.5		

In the window that appears, click the green plus symbol "+" button to add a new crop.

Type in the name of the new crop that you wish to add. (nb. It must match the name of the crop component that you are going to drag onto the simulation tree exactly). Click OK.

In the "Soil / Crop Management" window you will now see it in the list with the other crops for this soil. If you made a make with the name you can delete the crop by selecting it in the list an clicking the red "X" button. You can move it up and down the list by clicking on it and using the up and down buttons in the window. This order is the order the crops will be listed in the *Water* tab. The order is purely cosmetic. Once satisfied with the order. Click OK again.

In the *Water* tab you should now see that your new crop has been added with default values filled in for LL, PAWC, KL and XF. (You may have to use the horizontal scroll bar along the bottom of the table to view your crop. Depending on what order you specified when you added it)

The table is editable so you may change any of the values in the table. Including those of other crops, SO BE CAREFUL.

Soil properties							Canola			
Depth (cm)	BD (g/cc)	% Rocks (%)	SAT (mm/mm)	DUL (mm/mm)	AirDry (mm/mm)	LL15 (mm/mm)	LL mm/mm	PAWC (mm)	KL	XF
0-15	1.02		0.59	0.54	0.15	0.29	0.29	37.5	0.06	1
15-30	1.03		0.58	0.53	0.26	0.29	0.29	36.0	0.06	1
30-60	1.02		0.59	0.54	0.29	0.29	0.29	75.0	0.06	1
60-90	1.02		0.58	0.54	0.29	0.29	0.29	75.0	0.06	1
90-120	1.06		0.57	0.52	0.3	0.3	0.3	66.0	0.06	1
120-150	1.11		0.55	0.5	0.31	0.31	0.31	57.0	0.06	1
150-180	1.12		0.55	0.5	0.32	0.32	0.32	54.0	0.06	1
180-210	1.15		0.53	0.48	0.33	0.33	0.33	45.0	0.06	1
210-240	1.18		0.52	0.47	0.34	0.34	0.34	39.0	0.06	1
240-270	1.2		0.51	0.46	0.35	0.35	0.35	33.0	0.06	1
Totals								541.5		

General / Water / Soil profile / APSIM

Once you have changed the values for LL, PAWC, KL and XF to what you want, you are done. You can now continue building the rest of your simulation or do a run.

Note, you can copy and paste these values from other crops by selecting all the cells you want to copy with the mouse, and then pressing "Ctrl + C" and then clicking on the top cell of the LL column for the new crop you have added, then pressing "Ctrl + V".

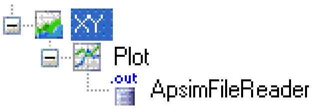
You can find out more about LL, PAWC, KL and XF in the Science Documentation for Soil.

Modify a Graph component and copying the graph or it's data

Modify a graph component

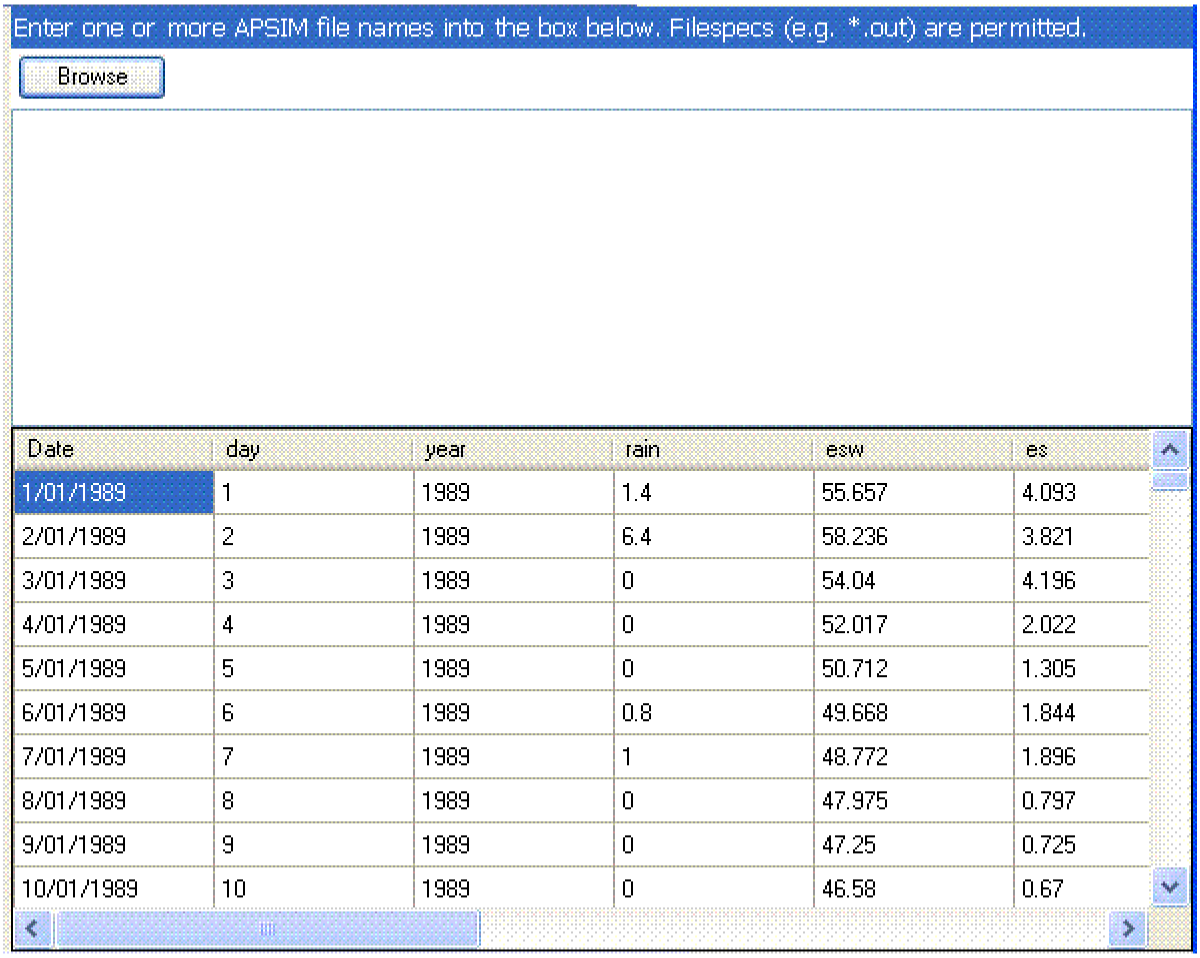
After you have dragged a graph component to the desired location in your simulation tree so that it can see the necessary output files your next task is to modify the graph component to plot your desired data.

1. You can expand the nodes of the graph component by clicking the "+" symbol next to it. This will reveal its child components. You should repeat this for each child until you have a fully expanded tree under the graph component.



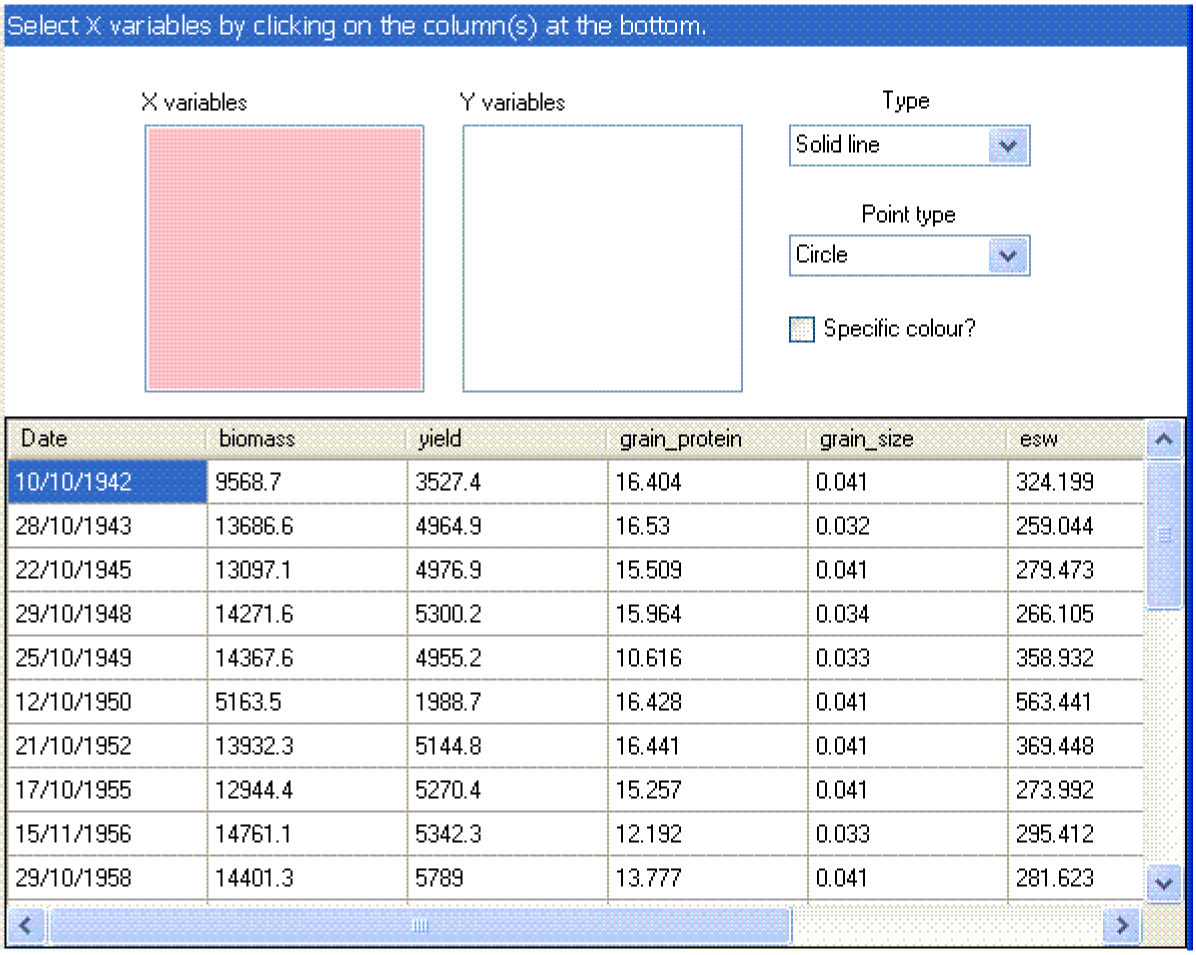
   Each different type of graph component is slightly different in what child components it has, but the general rule for configuring is to start at the bottom most child component and work your way back up towards the graph component.

2. Starting at the bottom is usually an "ApsimFileReader" component. This just lists the .out files that it has found and lets you preview the data. Use the browse button to view other .out files it has found.



Date	day	year	rain	esw	es
1/01/1989	1	1989	1.4	55.657	4.093
2/01/1989	2	1989	6.4	58.236	3.821
3/01/1989	3	1989	0	54.04	4.196
4/01/1989	4	1989	0	52.017	2.022
5/01/1989	5	1989	0	50.712	1.305
6/01/1989	6	1989	0.8	49.668	1.844
7/01/1989	7	1989	1	48.772	1.896
8/01/1989	8	1989	0	47.975	0.797
9/01/1989	9	1989	0	47.25	0.725
10/01/1989	10	1989	0	46.58	0.67

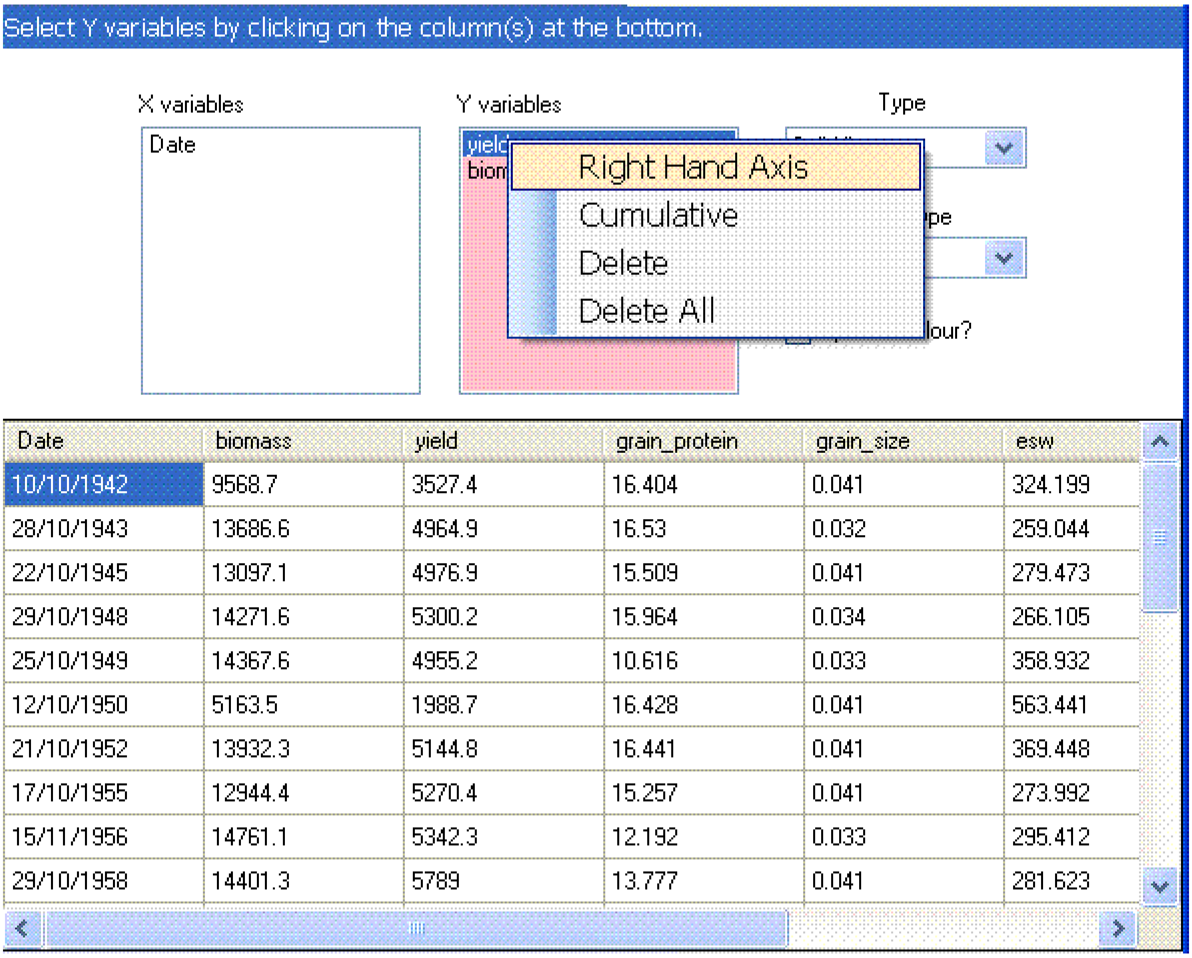
3. The "Plot" component is where you specify which columns from the .out file you want to plot. It also lets you specify what type of graph you would like to use (solid line, dashed line, bar etc.) and what you want to use to mark the individual points on the graph.



4. To specify which column to use as the X axis, you click on the "X variables" square to make its background pink. Then you click on the column heading of the column you wish to add. You will then see the column name appear in the "X variables" square. To delete it, just click on it in the square and press the delete button on your keyboard. You add specify the Y axis columns just click on the "Y variable" square to highlight it pink and once again click on the column heading. If you wish to plot multiple columns on the same graph just keep on clicking more column headings.

5. If you are plotting multiple columns and you want to plot one of the columns on the Y2 axis instead of on the Y axis. You can just click on the name in the "Y variables" square and then right mouse click on it again. In the popup menu just click on "Right Hand Axis".

   In the same way if you wish a column to be the cumulative total of that column you do the exact same thing as to plot it on the Y2 column only instead you click on "Cumulative" in the popup menu.



6. You can specify what type of graph and type of point markings you want to use by using the "Type" and "Point type" drop down lists respectively.

7. Finally, to view the graph just click on graph component in the simulation tree.

8. To give the graph a different label, simply rename the graph component (eg. from "XY" to "Shaun's Graph"). The name of the component is used as the label of the graph.

Copying the graph or it's data

1. Right mouse click on the graph and select either "Copy to clipboard" to copy the image, or "Copy data to clipboard" to copy the data that has been plotted. They can then be pasted just like any other windows application.

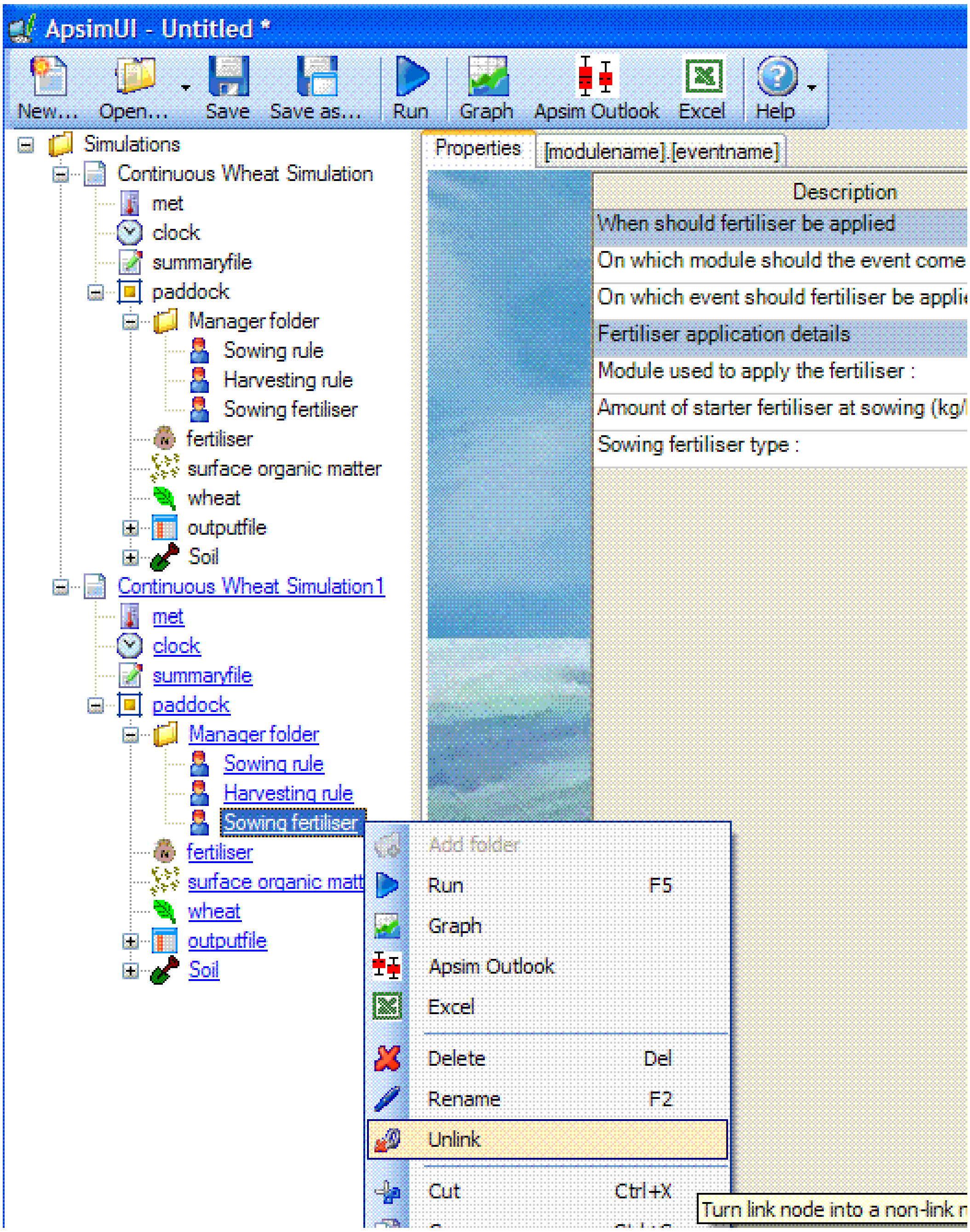
Using linkage to reduce simulation duplication

The APSIM user interface has the ability to create shortcuts to simulation components in much the same way as Windows Explorer can create shortcuts. Whole simulations, parts of simulations or individual components can be linked to another comoponent. When a component is modified in one place, it is automatically updated in all linked copies.

Take the example were a base simulation has been created for a given scenario. If the intention is to then take this simulation and apply different fertiliser applications or sowing dates or soils to it, the tendancy would be to take a copy of the simulation and change the one attribute (e.g. fertiliser amount), doing this many times for each permutation. A problem then arises when the original simulation needs to be changed (e.g. a new variable added). This change then needs to be propogated through all the permutation simulations.

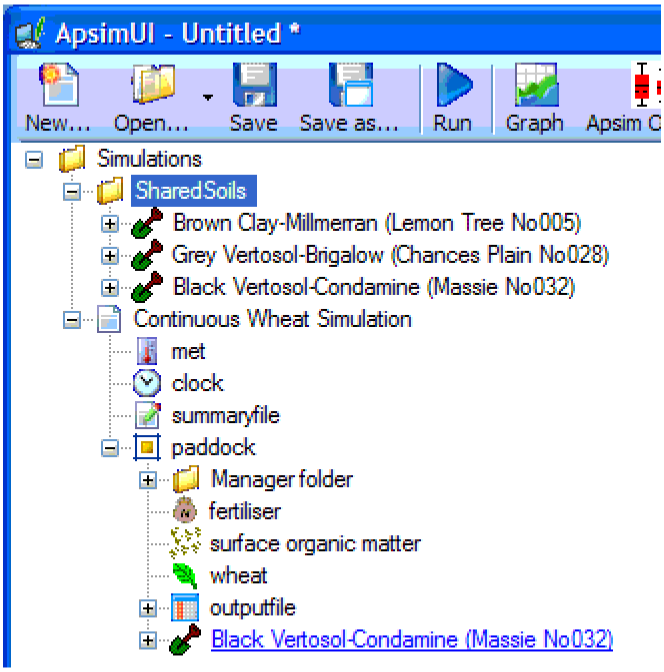
Instead of creating a copy of the base simulation and changing the copy, the user can create a link to the base simulation. Drag the simulation using the right mouse button and drop it on the parent node in the simulation tree and then select *Create link here*. This linked simulation is 'linked' to the base simulation. Changing the base simulation will change the linked version and vise versa.

Once a linked copy has been created, the user can unlink the specific node that needs to be different to the base simulation. This can be done by right clicking on the linked node and selecting *Unlink*.



This unlinked node can then be changed independently from the base node.

There is no limit to the number of links that can be created, nor what can be linked. As another example, a folder could be added to the top level "Simulations" node where multiple soils could be dropped into a soil folder. These soils could then be linked into the simulations that needs them. e.g.


ApsimUI - Untitled *
New…
Open…
Save
Save as…
Run
Graph
Apsim C
Simulations
SharedSoils
Brown Clay-Millmerran (Lemon Tree No005)
Grey Vertosol-Brigalow (Chances Plain No028)
Black Vertosol-Condamine (Massie No032)
Continuous Wheat Simulation
met
clock
summaryfile
paddock
Manager folder
fertiliser
surface organic matter
wheat
outputfile
Black Vertosol-Condamine (Massie No032)

Walkthrough of APSRU Website

If you look across the top of the **www.apsim.info** homepage you will see:

1. Home -> News, Training and Release Dates.

2. APSIM -> Downloads, Release Notes, Scientific Documentation, Model Performance, Licencing of Apsim.

3. Other Products -> this contains information and downloads for other helpful products that can be used with APSIM or use APSIM that might be of interest to you. Of particular interst is the APSoil database. This is a database of APSIM soils that you may find useful for choosing a soil in your particular region. There is even a tool that will allow you to view all the soil locations in Google Earth. Click the following link for a demonstration APSoil database in Google Earth.

4. Publications -> A list of scientific publications surrounding APSIM.

5. Source -> This is the source code for APSIM. APSIM has gone open source, so now you can get hold of the computer code that is used to create APSIM.

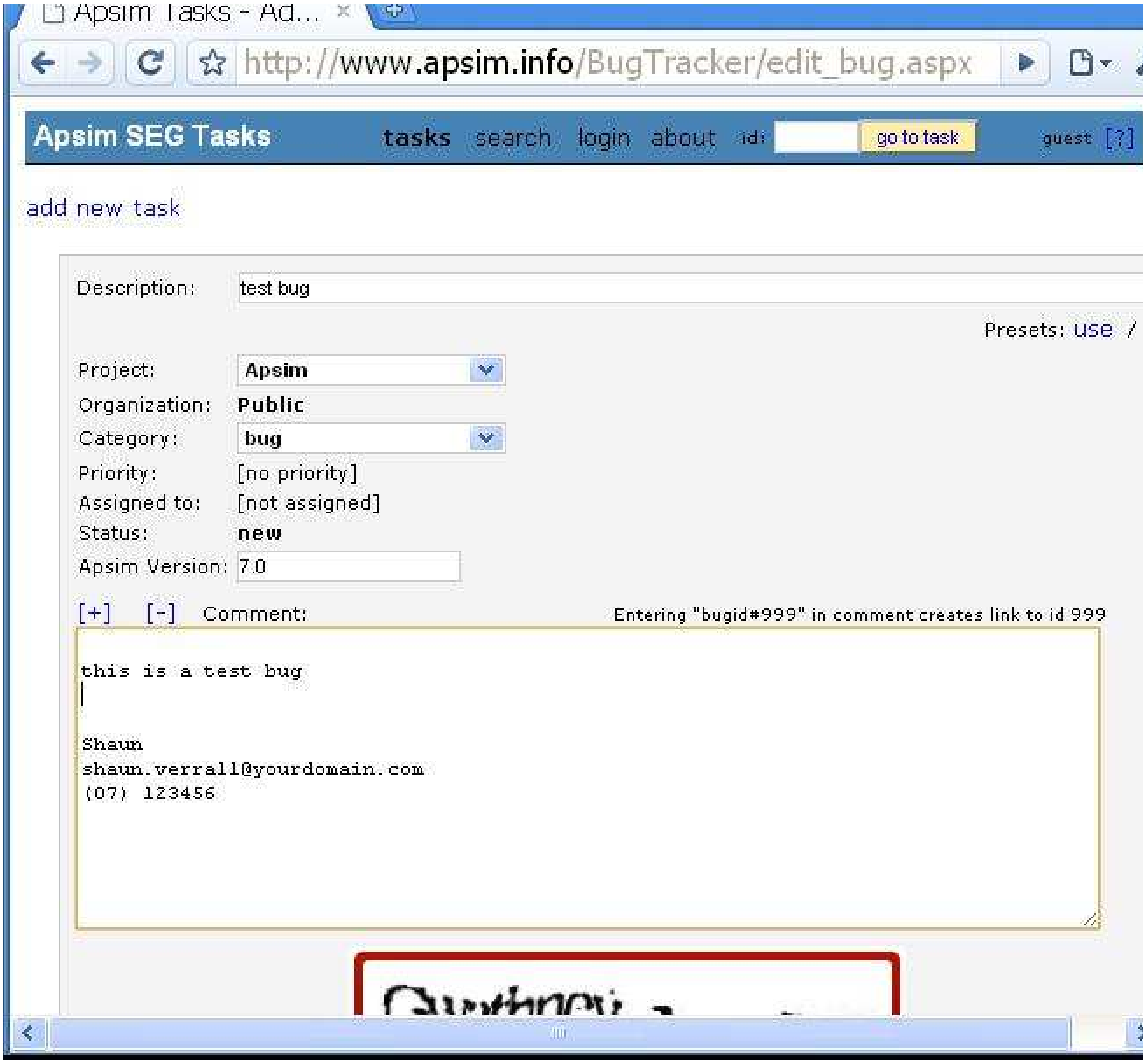
6. Tasks -> A link to the Bug Tracking or Feature Requesting website for APSIM. This website allows you to submit bugs or feature requests for APSIM. For more information click here

Submit a bug or feature request for APSIM

1. Go to **www.apsim.info** and click the "Defect" link at the top.
2. On the login page, just click the link called "Continue as "guest" without logging in". It is just below where you type your user name and password.

3. On the next page, you will see a list of all the bugs and feature requests that have been submitted to APSIM. Both by internal staff and external users such as yourself. It is suggested that you take a look at this list to see if someone else has already submitted the bug or feature request already. In the top left corner (as you look at it) click a link called "add a new bug"

4. This is the page that allows you to submit a bug or feature request. In the **Description** field just type a brief description, In the **Project** field choose which product your request is with regard to. In the **Category** choose what type of request it is. In **Apsim Version** just type in the version of APSIM that you noticed the bug in (if your request is not a bug then just leave it blank). Finally in the **Comment** box, write a detailed description of the bug or feature request. **IMPORTANT** leave your name and contact details (you don't have to but if you don't and we don't understand your request or we can not recreate the bug we will not be able to act on it).



5. When you are done, before you can create the bug you must first fill in the CAPTCHA. This is to stop automated hacking computer programs from entering fake bugs into our system.

Then just click the *Create* button. Once this button is clicked you have sucessfully submitted your bug.

6. After submitting the bug you will be now taken to the update page for the bug you just submitted. You will see some links on the left hand side of the page (as you look at it). Most of these are irrelavent to you except for the "add attachment" link. You can click this to add any files or screen captures to do with your bug. You will also see your previously submitted comments underneath the Comment text box. If you want to add anything you may have forgotten to put, you can just type it in the Comment text box and click the *Update* button and it will be added to the bug.

   If you click the "bugs" link at the top of the page, you will be taken back to the list of bugs page. You will notice that your bug has been added. If you click the link in the "desc" column, you will be taken back to this "update" page.

   You can come back at any time and add more stuff about the bug. If you fix the bug yourself, or if you made a mistake and it wasn't really a bug, just log back in and you will be taken to the bugs page. Just click the link in the desc column for the bug you want to update to get to the update page for the bug and add a comment to the bug so we know not to worry about it. You can also add comments to any other bugs on the bugs page in exactly the same way. Not only the ones you have created.