Volume 2

Data Management and Analysis Tools

Volume 2

DSSAT v4
Data Management and Analysis Tools

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IBSNAT, The International Benchmark Sites Network for Agrotechnology Transfer, was a network consisting of the contractor (University of Hawaii), its subcontractors and many global collaborators. Together they created a network of national, regional, and international agricultural research for the transfer of agrotechnology among global partners in both developed and lesser developed countries.

From 1982 to 1987, IBSNAT was a program of the U.S. Agency for International Development under a cost-reimbursement Contract, No. DAN-4054-C-00-2071-00, with the University of Hawaii. From 1987 to 1993, the contract was replaced with a Cooperative Agreement, No. DAN-4054-A-00-7081-00, between the University of Hawaii and USAID.

In 1994, the International Consortium for Agricultural Systems Application or ICASA was established as a non-profit corporation in Honolulu, Hawaii. The ICASA is governed by a Board of Directors consisting of former members of the IBSNAT network and international systems scientists. The ICASA network will oversee the continued development of systems tools, including DSSAT.

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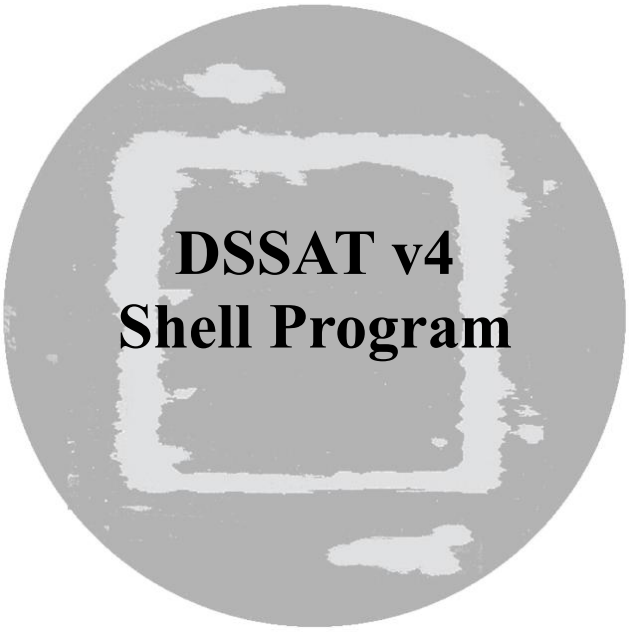
Chapter 1



DSSAT v4
Shell Program

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The University of Georgia
University of Florida
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DSSAT v4.0
User's Guide to
Cropping System Models

Decision Support System for Agrotechnology Transfer (DSSAT)
March 31, 2004 CSM Version 4.0

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The University of Georgia, Griffin, Georgia
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1 Introduction

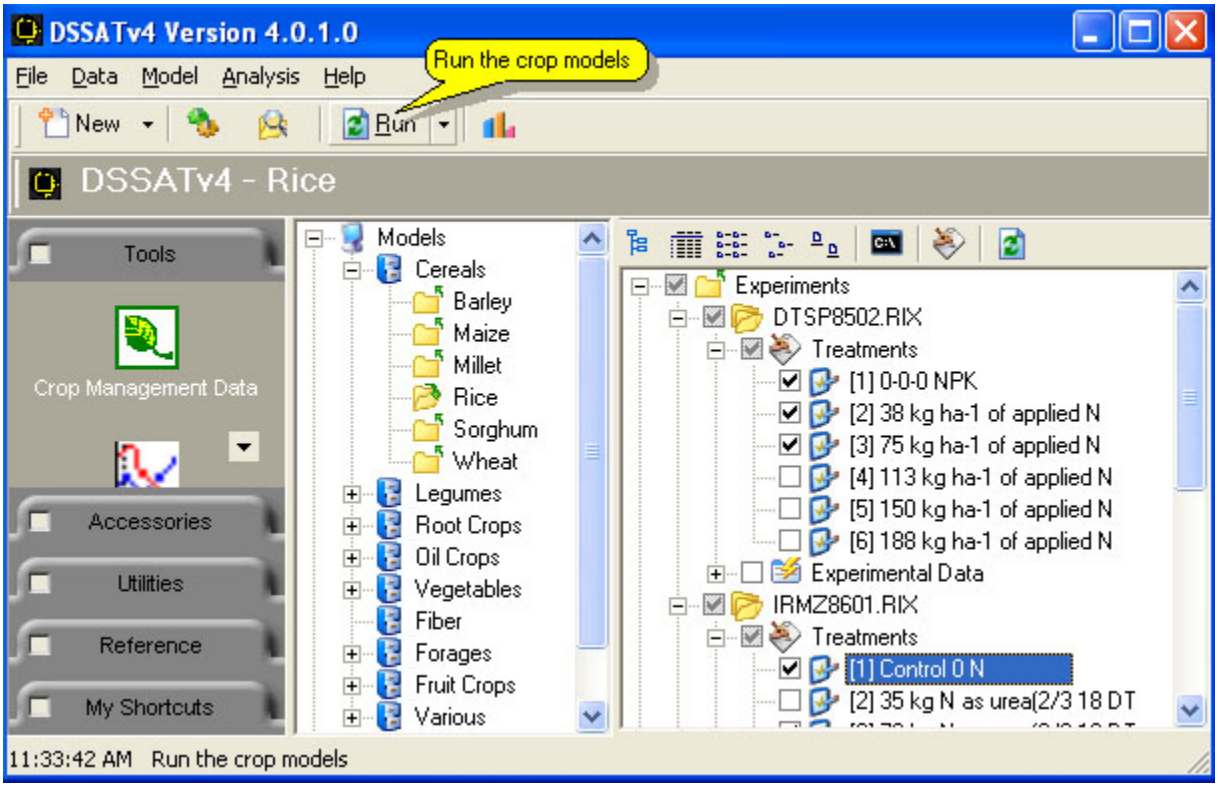
The DSSAT4 Shell program provides a user-friendly working environment in which various stand-alone tools and applications are seamlessly integrated with the DSSAT4 crop models. Within the shell, the user can launch applications for creating and modifying data files, running the crop models, and analyzing the results. Each of the component applications of the DSSAT4 system are installed separately so that the user can customize the DSSAT4 setup and the shell program recognizes the components which are present.

The following sections give a brief overview of the menu system and capabilities of the DSSAT4 shell program.

2 Running the Crop Models

The CSM model is run by first selecting the experiments and treatments to be simulated. A group of experiments and treatments can be run in a single simulation in "batch" mode. A single experiment/treatment can be run either as a batch simulation or in sensitivity mode.

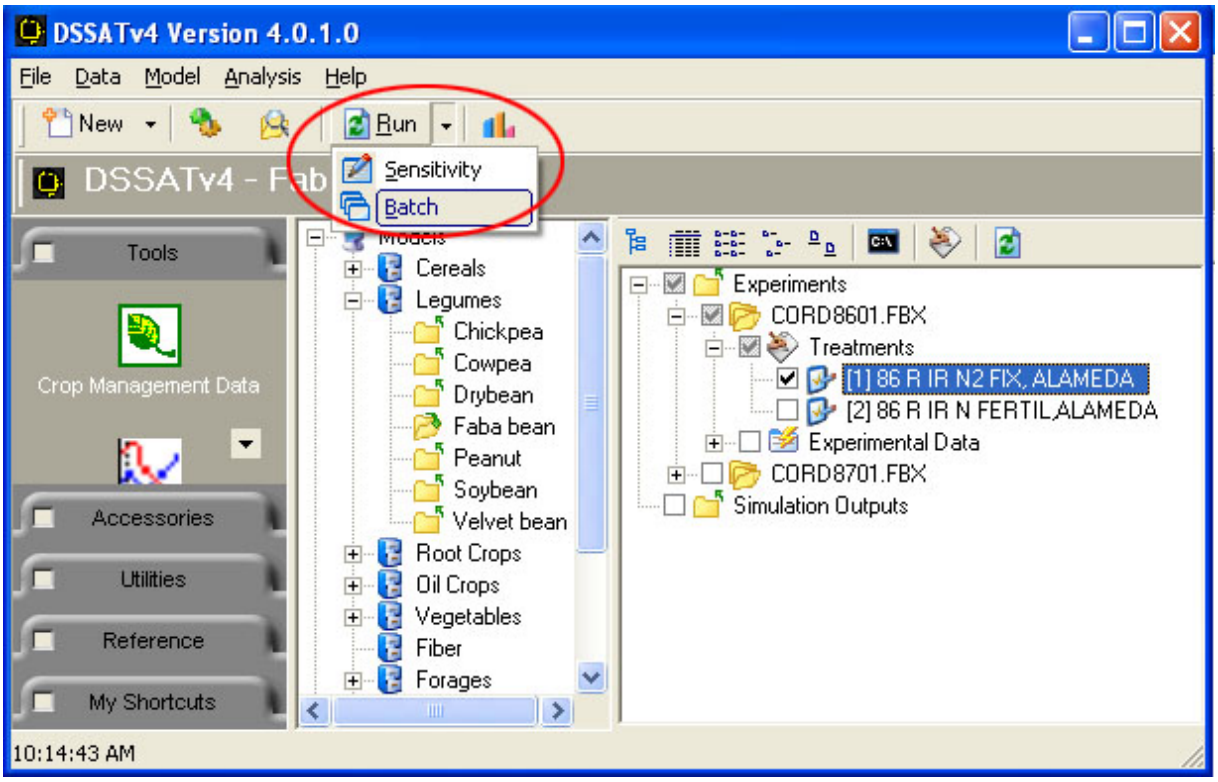
The list of installed experiment files can be seen by expanding the "Models" directory tree. Crops are organized by type, i.e., cereals, legumes, etc. within the "Model" category. Each crop can be expanded to show a list of available experiments and under each experiment, a list of treatments can be viewed. In the screen shot below, treatments 1, 2 and 3 of the rice experiment, DTSP8502, and treatment 1 of IRMZ8601.RIX, have been selected for simulation.



When an experiment is highlighted, the first line of the file is shown in the information bar at the bottom of the DSSAT4 screen to give the user additional information about the experiment:

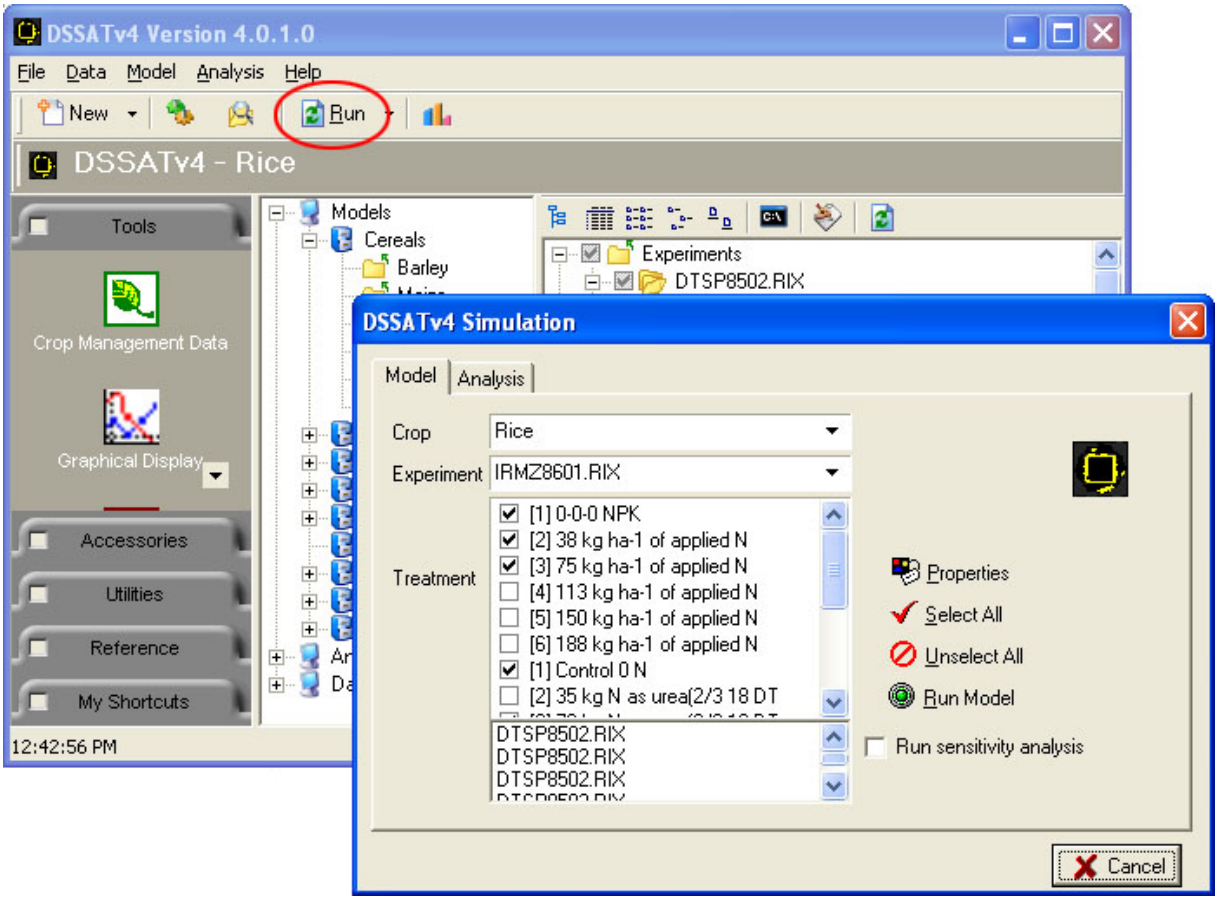
2.1 Run Modes

Once the experiments and treatments have been selected, the model can be run in two ways. The run icon can be selected from the menu bar. In addition to starting a batch run directly from the "Run" menu icon, either batch or sensitivity mode simulations can be started from the "Run" pull-down menu.



2.2 Batch Run

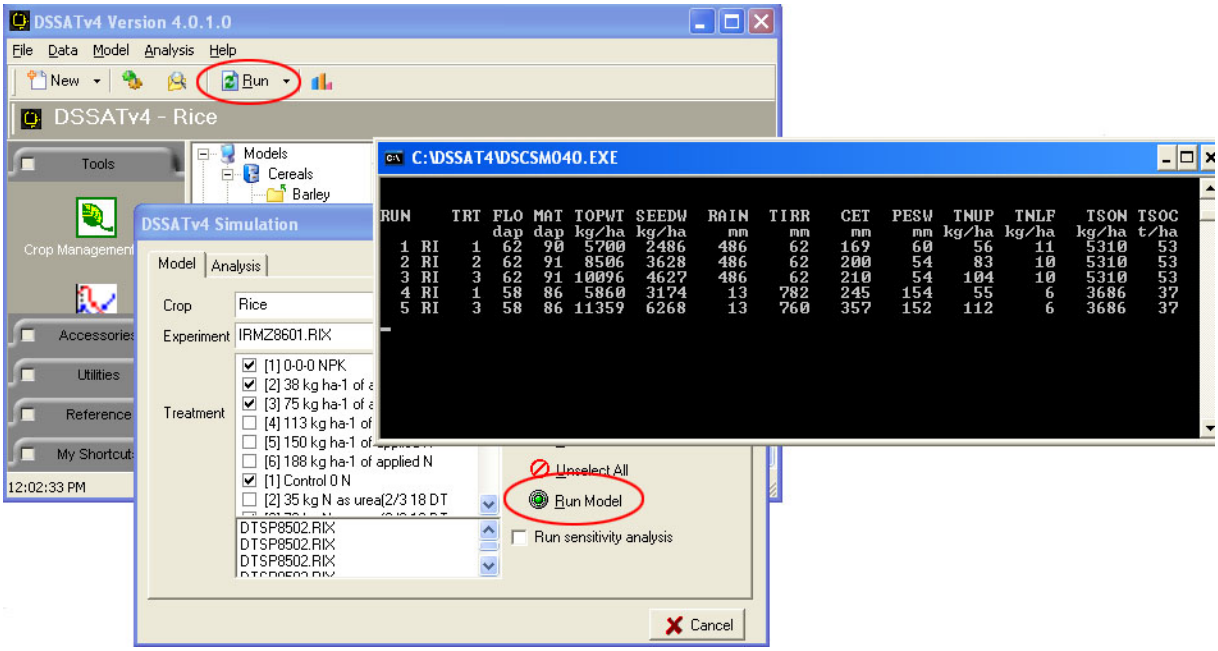
When batch run mode is selected, treatments can be selected or de-selected, the experiement file viewed (Properties icon), and the model simulation started.



When the "Run Model" selection is made, the list of experiments and treatments are written to a batch file. By default, this file is called "D4Batch.dv4". If the batch file exists, the shell program will inquire if it can be overwritten. The user can opt to give an alternate name to the batch file for future retrieval or to accept the default name.

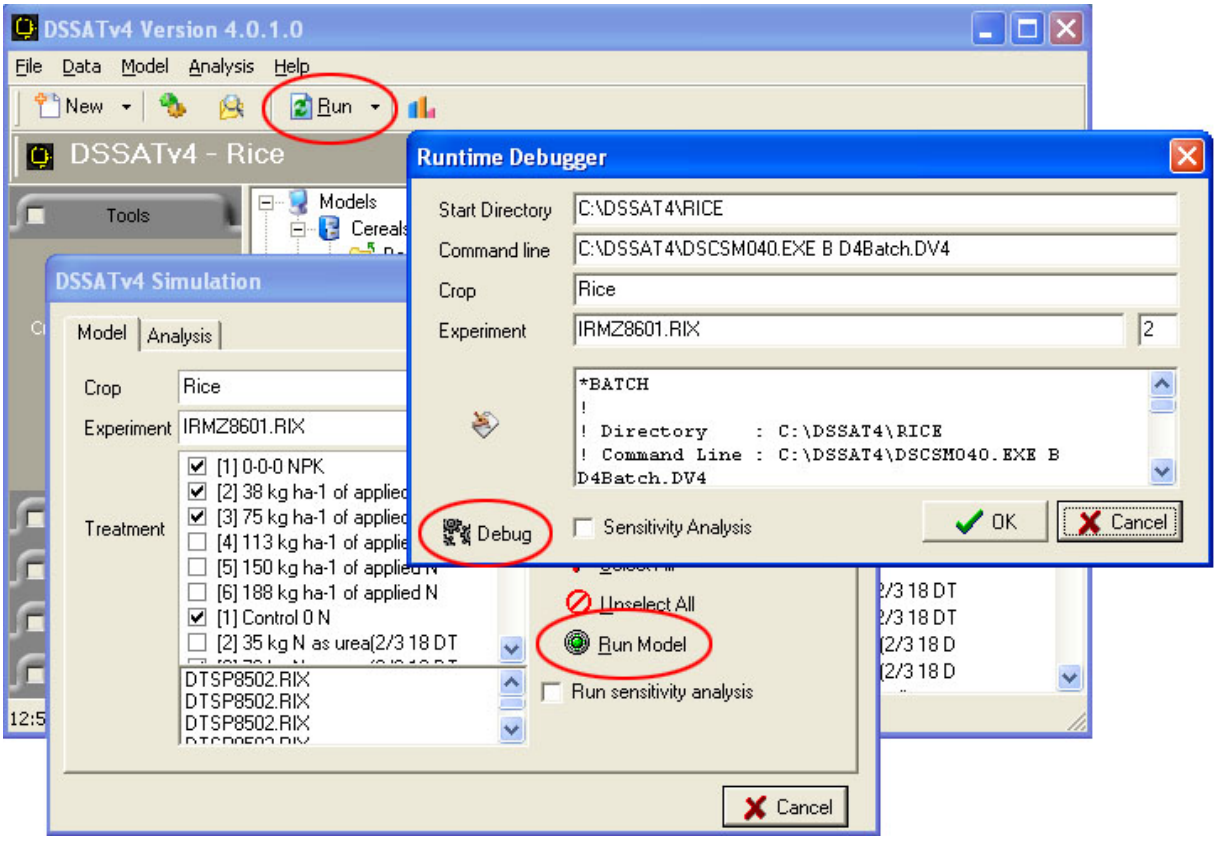
If the debug option is set (see "Configuration"), another window opens so that the user can run the program in a debug window, which can be useful if problems are encountered. (See "Simulation in Debug window " for more information.)

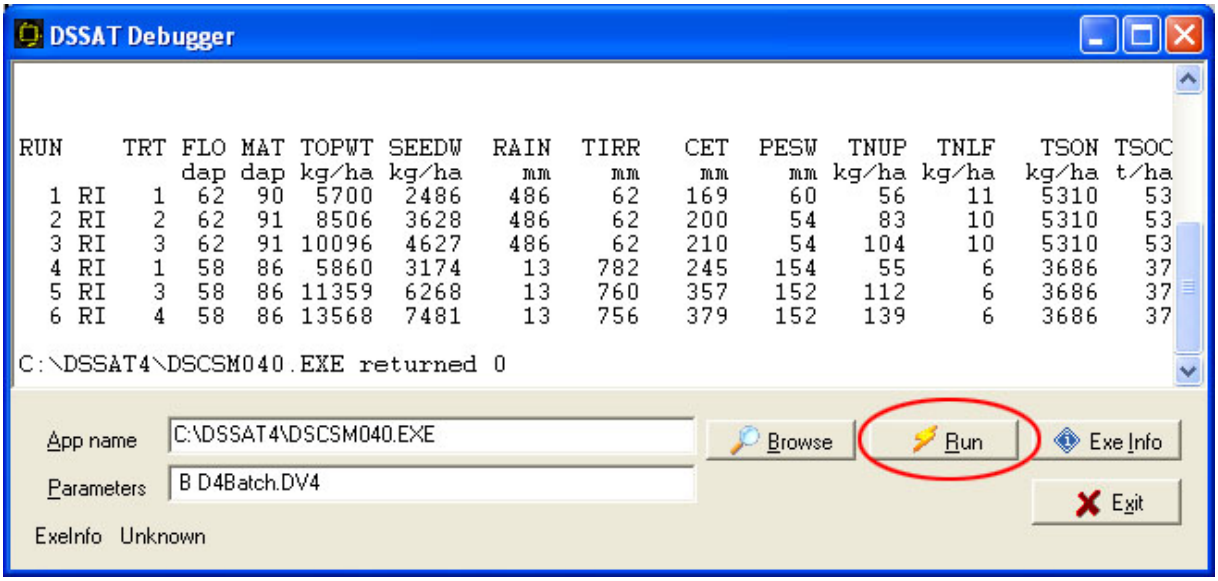
When the "Run Model" icon is selected, the CSM model simulation runs in a DOS shell.


DSSATv4 Version 4.0.1.0
File Data Model Analysis Help
New
Run
DSSATv4 - Rice
Tools
Crop Management
Accessories
Utilities
Reference
My Shortcuts
12:02:33 PM
Models
Cereals
Barley
C:\DSSAT4\DSCSM040.EXE
RUN TRT FLO MAT TOPWT SEEDW RAIN TIRR CET PESW TNUP TNLF TSON TSOC
dap dap kg/ha kg/ha mm mm mm mm kg/ha kg/ha kg/ha t/ha
1 RI 1 62 90 5700 2486 486 62 169 60 56 11 5310 53
2 RI 2 62 91 8506 3628 486 62 200 54 83 10 5310 53
3 RI 3 62 91 10096 4627 486 62 210 54 104 10 5310 53
4 RI 1 58 86 5860 3174 13 782 245 154 55 6 3686 37
5 RI 3 58 86 11359 6268 13 760 357 152 112 6 3686 37
DSSATv4 Simulation
Model
Analysis
Crop
Rice
Experiment
IRMZ8601.RIX
Treatment
[1] 0-0-0 NPK
[2] 38 kg ha-1 of
[3] 75 kg ha-1 of
[4] 113 kg ha-1 of
[5] 150 kg ha-1 of
[6] 188 kg ha-1 of applied N
[1] Control 0 N
[2] 35 kg N as urea(2/3 18 DT
DTSP8502.RIX
DTSP8502.RIX
DTSP8502.RIX
Unselect All
Run Model
Run sensitivity analysis
Cancel

2.3 Simulation in Debug Window

When the debug option is selected, the simulation occurs in a debug window, allowing the user more opportunity to view the output if problems arise.



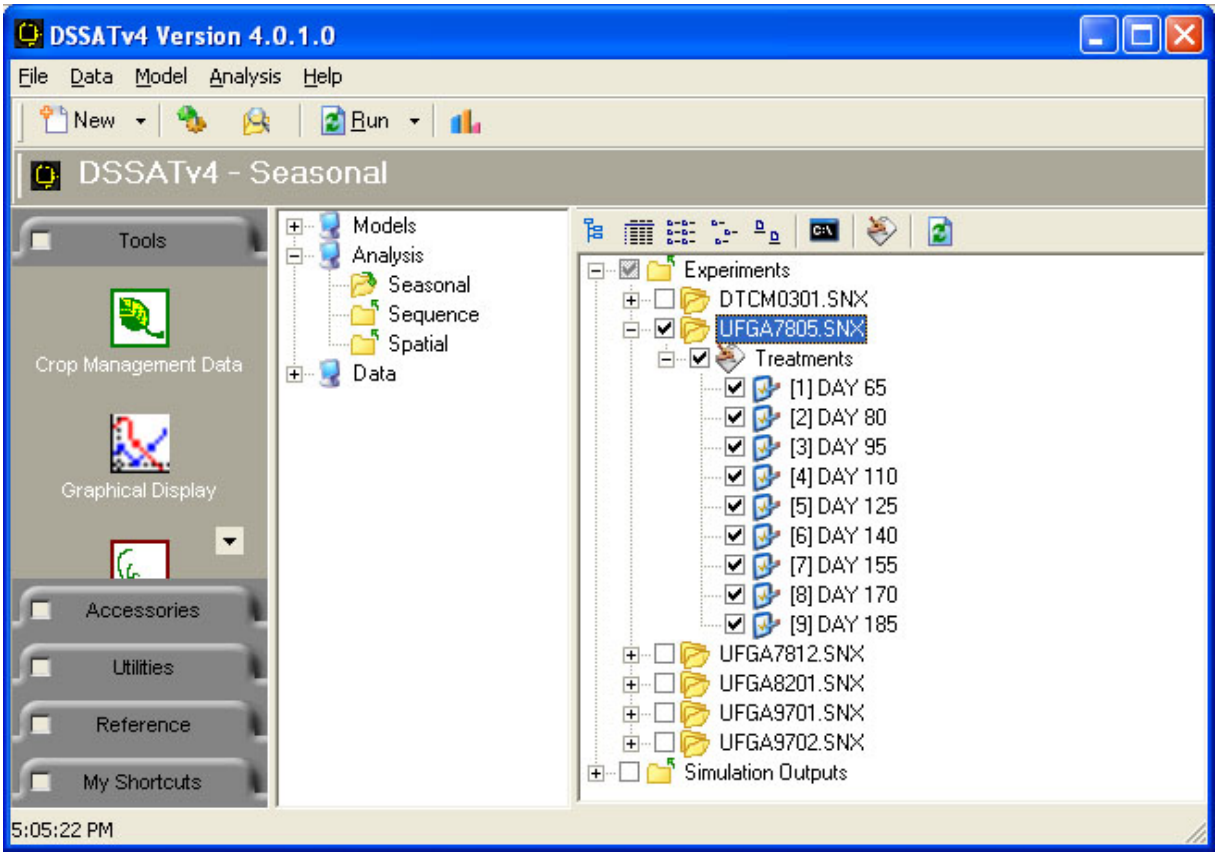


2.4 Sensitivity

Sensitivity analyses are run on a single experiment and treatment in an interactive mode. The user interface is the same as that of DSSAT v3.5 and documentation for this mode of run can be found in the DSSAT v3.0 documentation (Volume 2, Chapter 7).

2.5 Seasonal, Sequence and Spatial Analyses

Seasonal, sequence and spatial analyses are selected and run in the same way as batch simulations.



2.6 CSM vs. Legacy models

Most of the crop simulations in DSSAT4 will use the modular Cropping Systems Model (CSM). This model incorporates the previous CROPGRO, Ceres-Maize, millet and sorghum, Ceres-Rice, and SUBSTOR-potato models into an single system with shared soil and weather simulation routines. Some of the crop models which were available in previous versions of DSSAT, and have not yet been adapted to the CSM model, but are still available as "legacy models".

Legacy models:
-- sugarcane
-- cassava
-- pineapple
-- sunflower

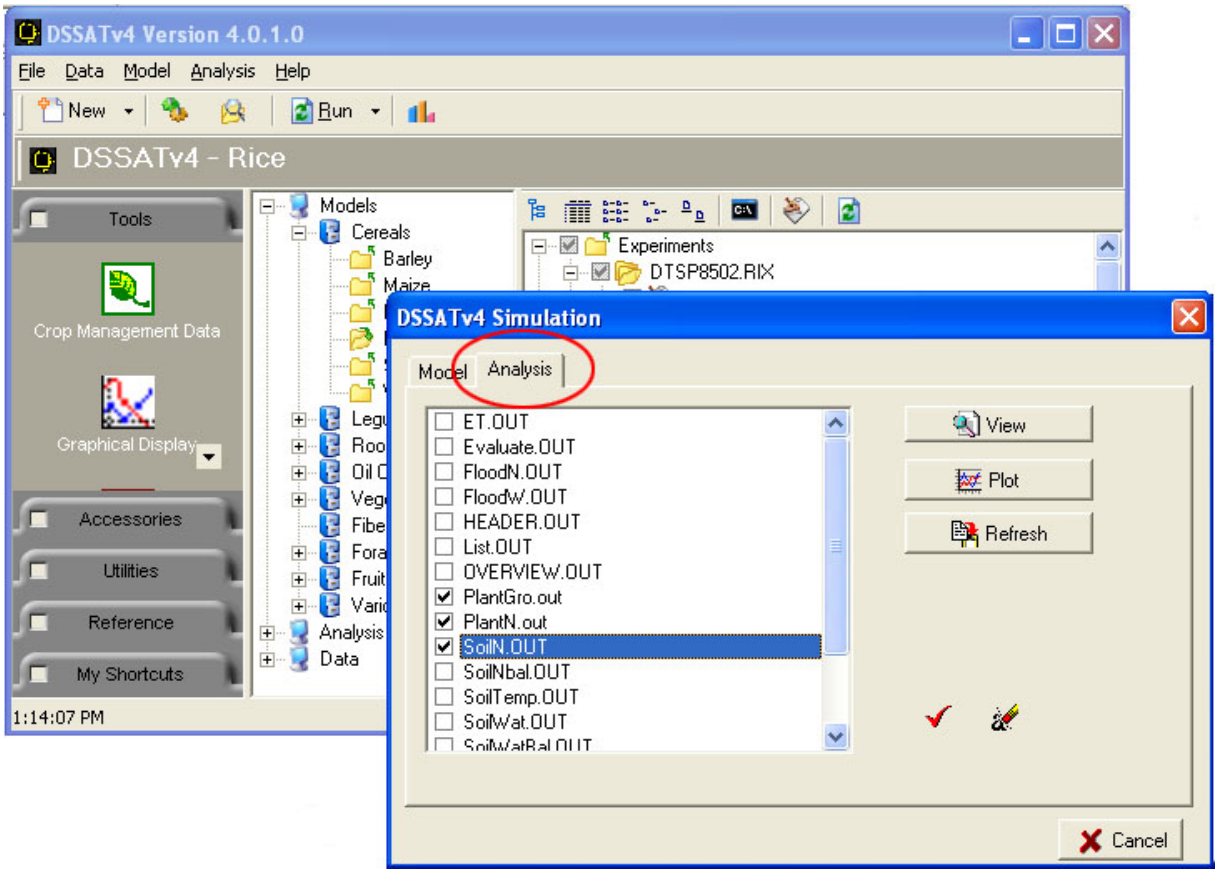
In addition, two crops have been added to the DSSAT4 system in legacy format:
-- taro
-- tanier

Selection of experiment and treatment for legacy models is done interactively through the model, while selection for CSM crops is done through the DSSAT4 shell.

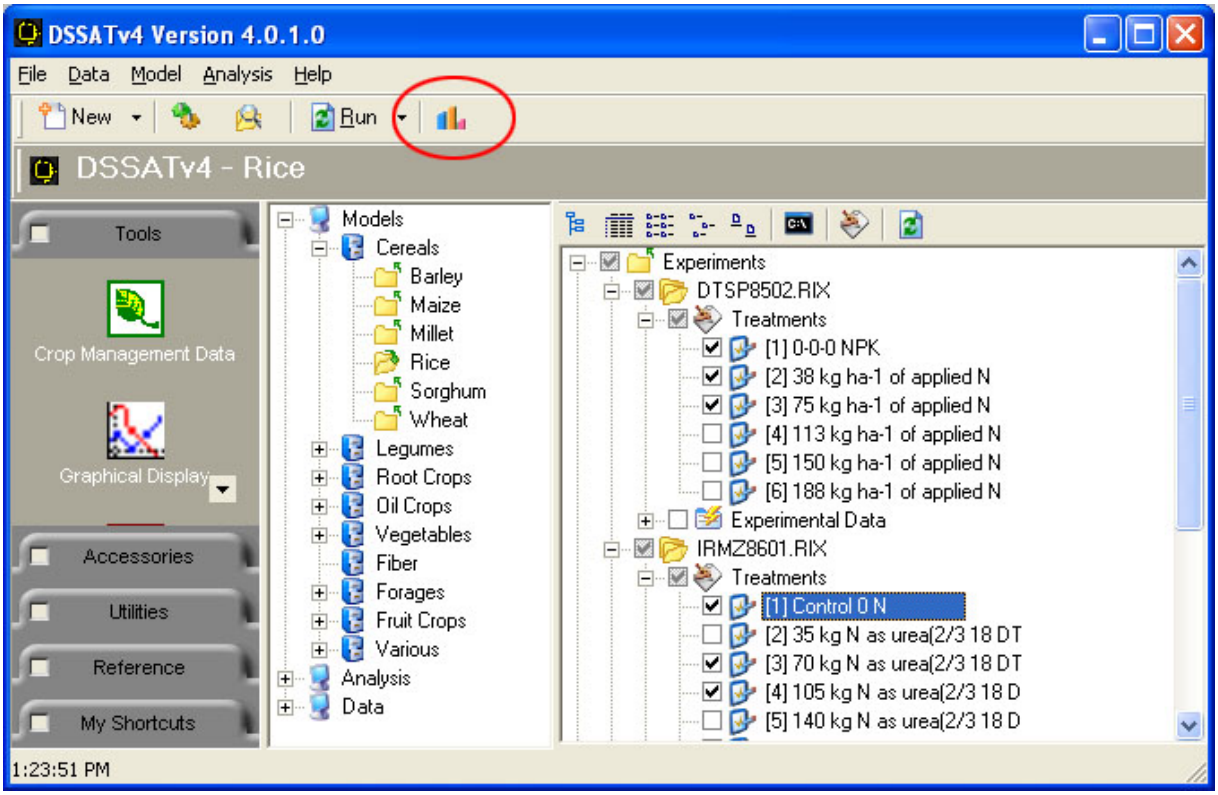
3 Analysis of Results

At least four methods can be used to start a graphical analysis of the results of a simulation.

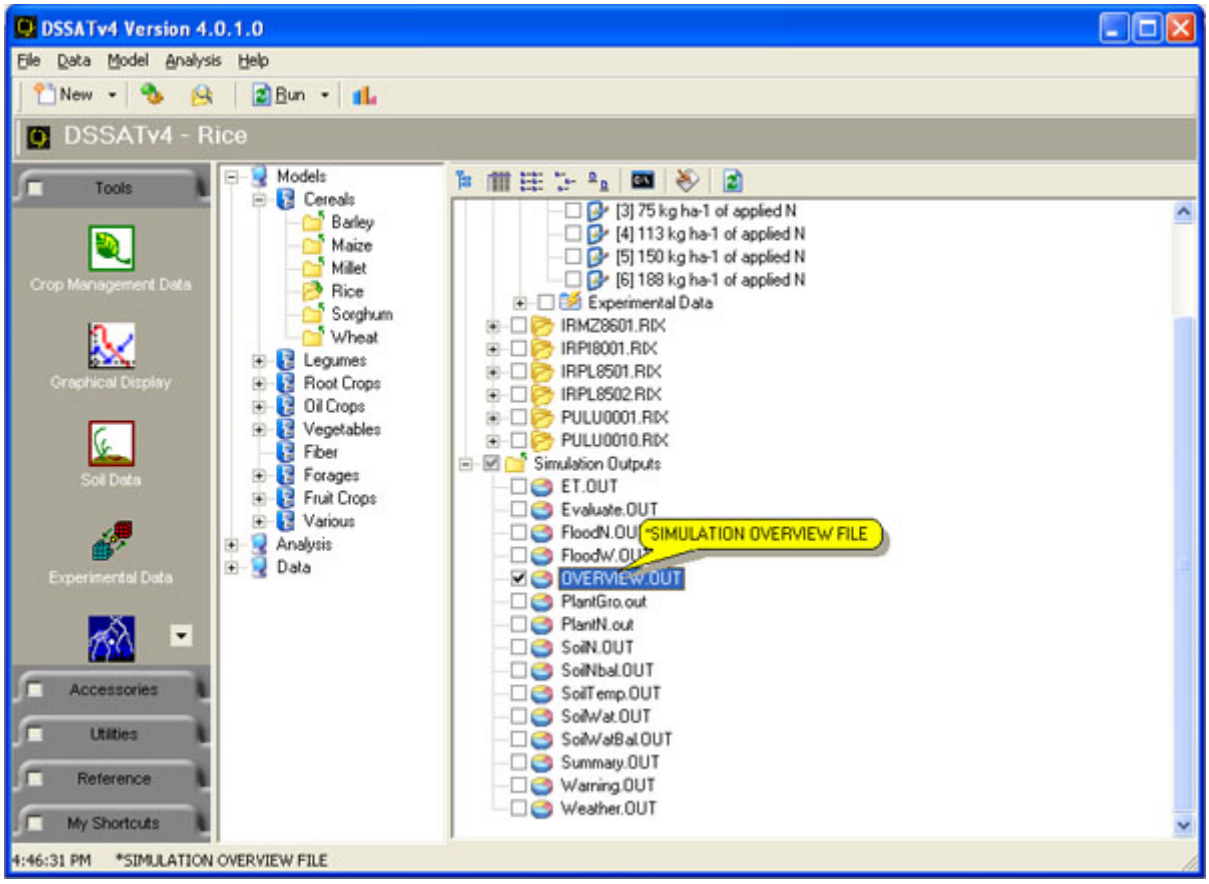
1. From the "Analysis" tab of the Run dialog box, the output files of interest can be selected. Choose "Plot" from the buttons at the right. The appropriate application for the type of file(s) selected will be started.



2. Select the "Graph" icon from the top menu. This will bring up a dialog box which prompts the user for the files to be analyzed.



3. The simulations outputs tree can be expanded, and files selected. To plot, right-click and select "Plot".



Additonally, the graphics programs can be started from the Tools menu and the files selected within the application.

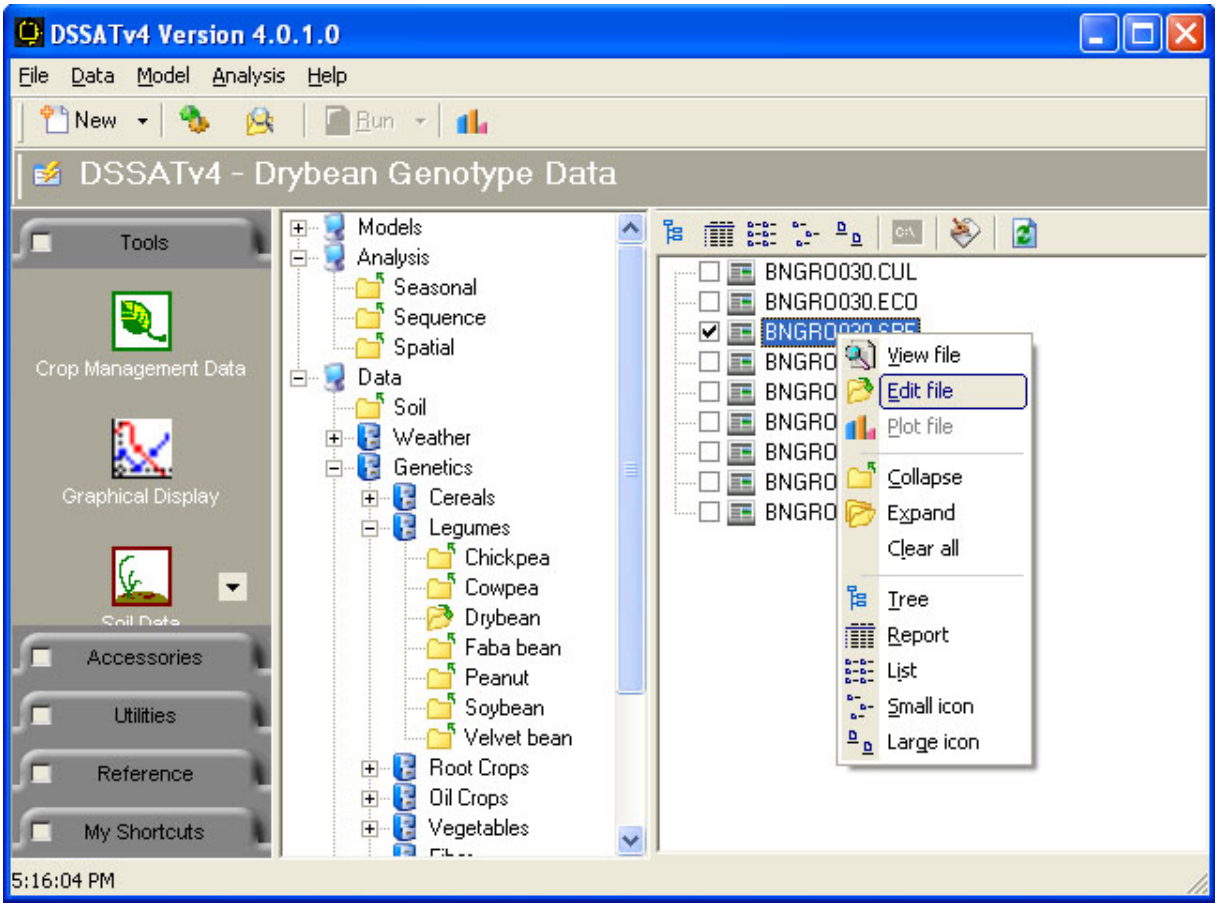
3.1 Output Files

The following table summarizes the output files generated by CSM and the Application associated to analyze each.

Output file name	Application	Type of File	Description
Error.OUT	N/A	Detail	Echo of screen errors
ET.OUT	Gbuild	Daily	Soil-Plant-Atmosphere (evaporation and transpiration)
ETPhot.OUT	Gbuild	Daily	Leaf level photosynthesis (CROPGRO crops only)
Evaluate.OUT	Gbuild (evaluate mode)	Summary	Measured vs. observed values
FloodN.OUT	Gbuild	Daily	Flooded field nitrogen processes
FloodW.OUT	Gbuild	Daily	Flooded field management
List.OUT	N/A	Auxiliary	List of unit assignments for output files
OUTPUT.LST	N/A	Auxiliary	List of output files
Overview.OUT	Stats	Summary	Detailed seasonal summary of plant growth processes
Pest.OUT	Gbuild	Daily	Pest and disease damage
PlantC.OUT	Gbuild	Daily	Plant carbon (CROPGRO crops only)
PlantGro.OUT	Gbuild	Daily	Plant growth
PlantN.OUT	Gbuild	Daily	Plant nitrogen
PlantNbal.OUT	N/A	Summary	Seasonal balance of plant nitrogen processes (CROPGRO crops only)
SoilC.OUT	Gbuild	Daily	Soil carbon
SoilN.OUT	Gbuild	Daily	Soil nitrogen
SoilNbal.OUT	N/A	Summary / Daily	Seasonal and daily balances of soil nitrogen processes
SoilTemp.OUT	Gbuild	Daily	Soil temperature
SoilWat.OUT	Gbuild	Daily	Soil water
SoilWatbal.OUT	N/A	Summary / Daily	Seasonal and daily balances of soil water processes
Somlit1.OUT	N/A	Detail / Daily	Soil organic matter detailed by soil layer
SOMLITC.OUT	Gbuild	Daily	Soil organic carbon
SOMLITN.OUT	Gbuild	Daily	Soil organic nitrogen
Summary.OUT	N/A	Summary	Seasonal summary of simulation
Warning.OUT	N/A	Detail	Warnings issued by various modules related to conditions of simulation
Weather.OUT	Gbuild	Daily	Weather
Work.OUT	N/A	Detail	Simulation details for CSCERES wheat or barley simulations only

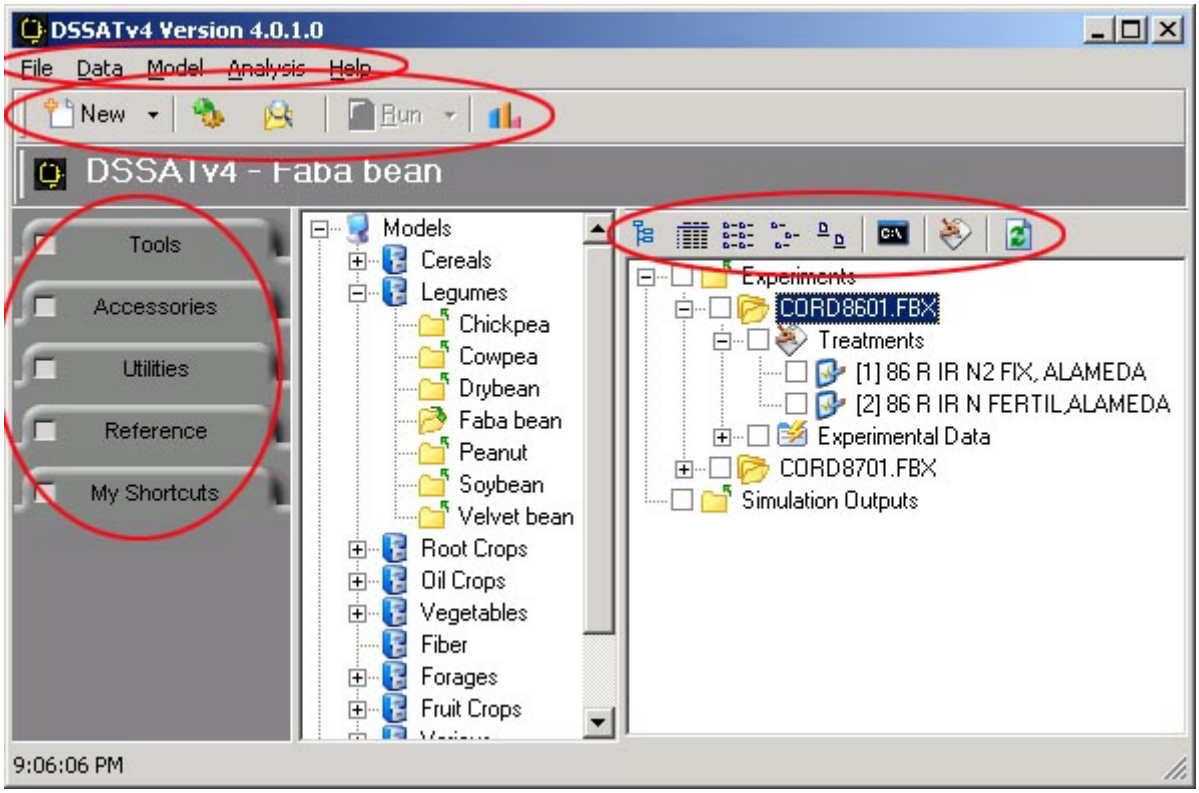
4 Data

The soil, weather, genetics, economics and pest files can be selected, viewed and edited using the Data directory tree. Right-click on a selected file to bring up the menu.

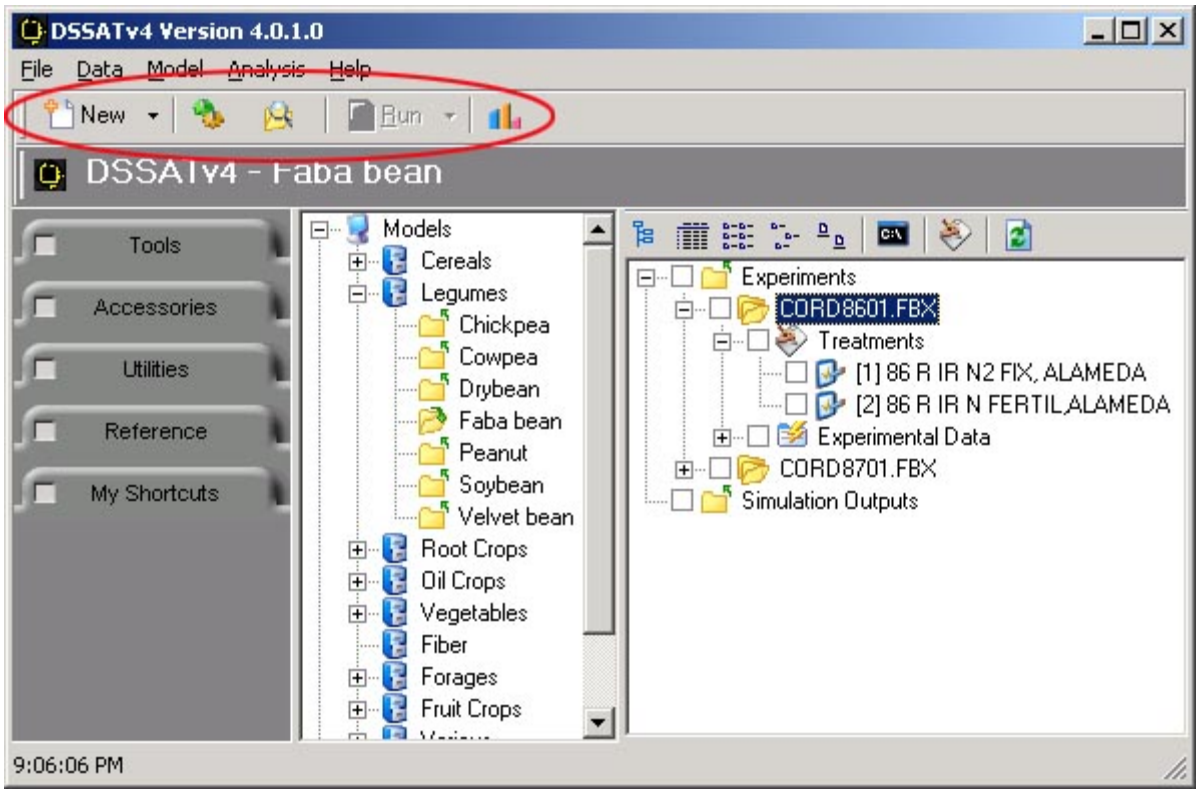


5 Menus and Icons

The following screens list the capabilties of the DSSAT4 shell which can be enacted thorugh the various menus and icons.

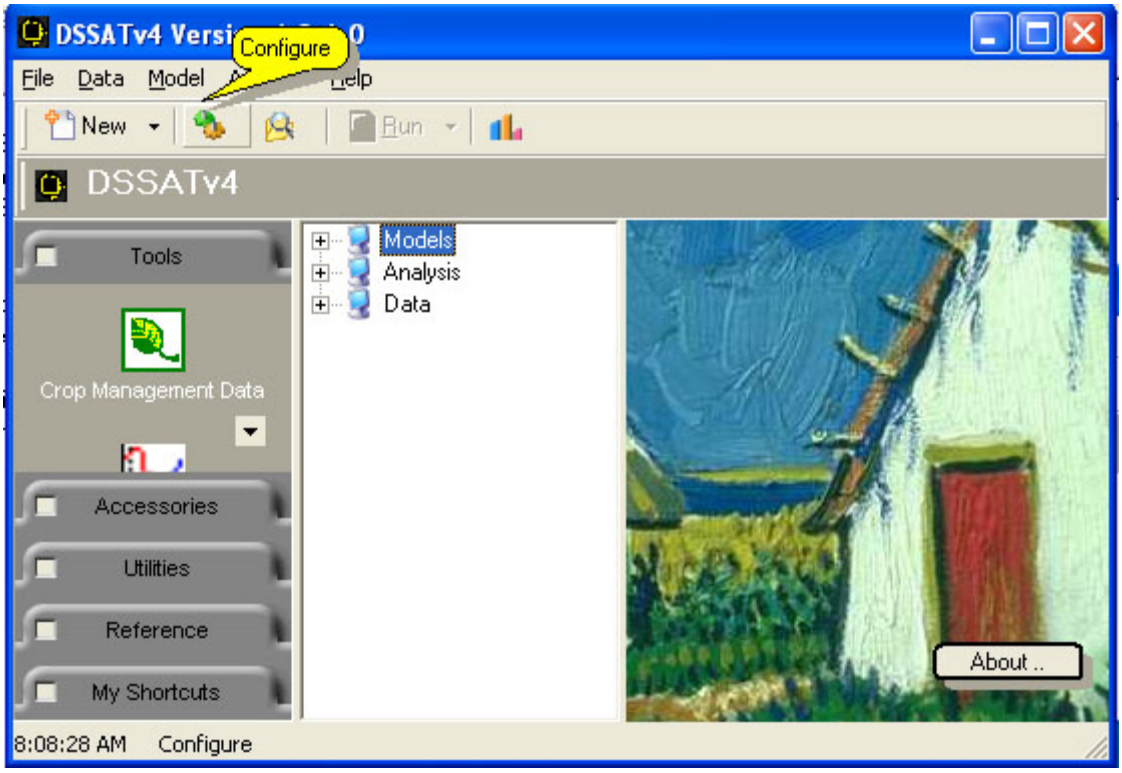


5.1 Menu Bar Icons



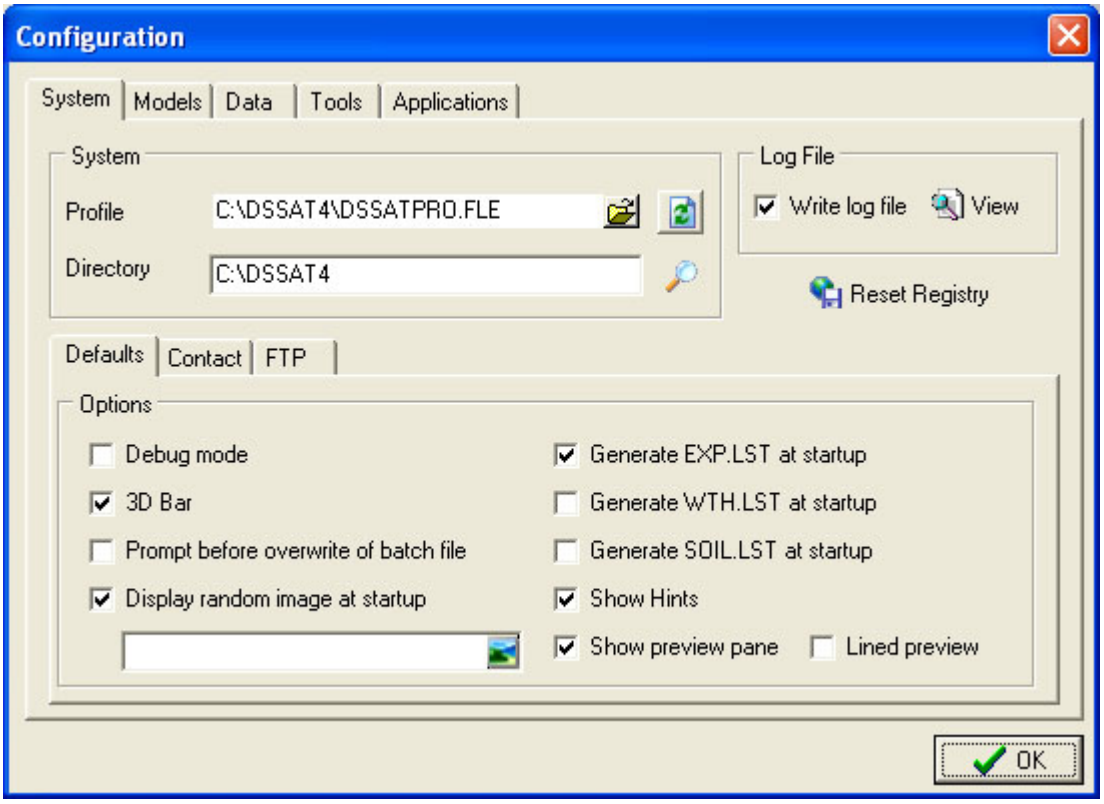
5.1.1 Configuration

The shell environment can be tailored to the user's needs using the configuration menu.



5.1.1.1 System

The system configuration menu allows the user to specify file locations (System), general operating procedures (Options) and whether or not to generate a log file for a particular DSSAT4 session (Log File).



(1) System:
- Profile: Specify the name and location of the DSSATPRO.FLE file
  Refresh new or changed file in memory
- Directory: Specify the root directory for the DSSAT4 directory structure

(2) Log File:
- Specify whether to write a log file for this DSSAT4 session
- View current log file.

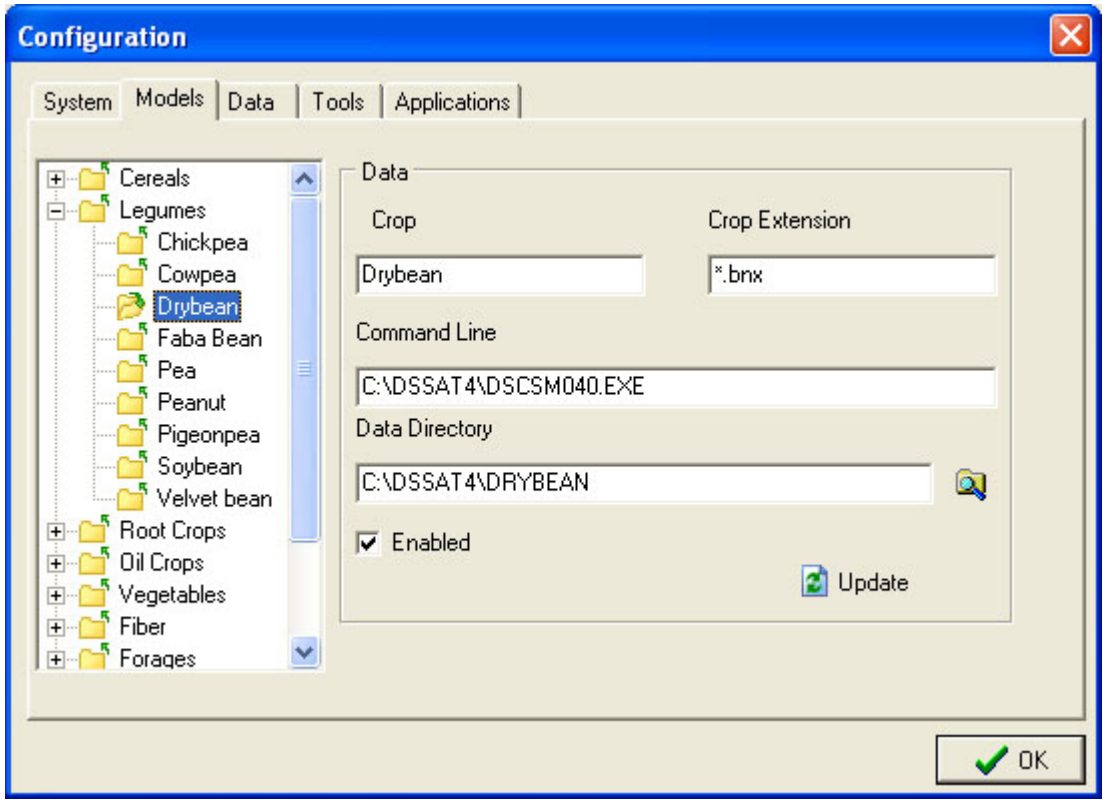
(3) Reset Registry

(3) Default Options:
- Enable or disable Debug Mode
- Change DSSAT4 window to 3D look
- Specify whether user should be prompted for overwrite of batch file
- Enable or disable random image at startup
- Generate LST files at startup (these can also be refreshed by user in _____menu)
- Show hints when cursor is placed over icon
- Shows a preview of a FILEX when highlighted

Additionally, contact information for DSSAT4 (Contact) and location of the ftp site where updates are found (FTP) are provided.

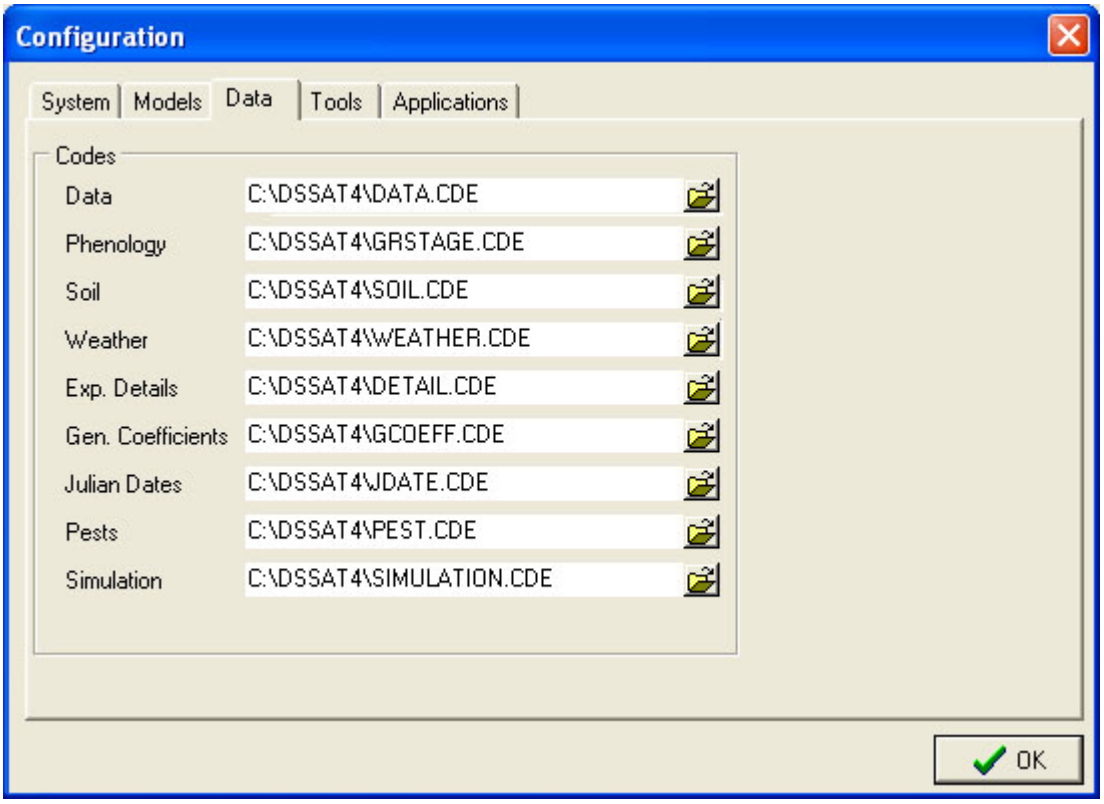
5.1.1.2 Models

The location of data files for each crop can be modified with the Configuration -- Models menu. The "Update" icon writes the revisions to the DSSATPRO.FLE file for use by CSM and the various applications.



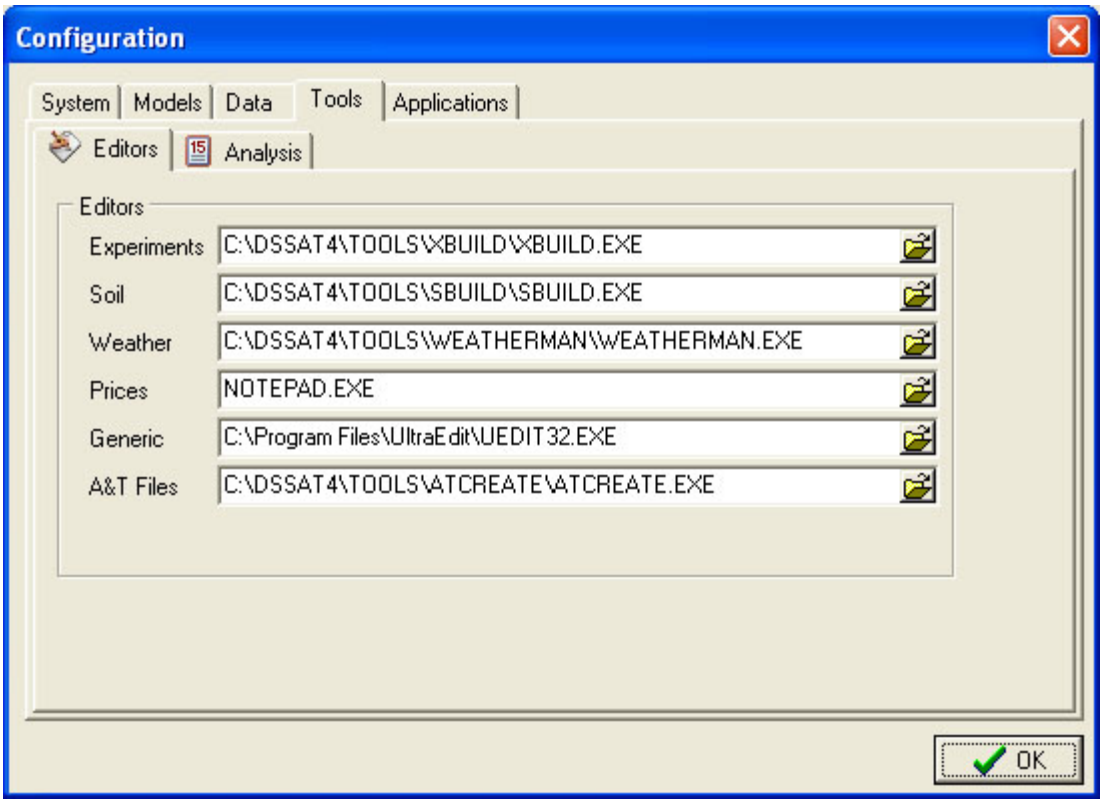
5.1.1.3 Data

Much of the data which control the input files, output data and general information about the DSSAT4 system are controlled by external files. These files can be edited by the experienced user via this menu.



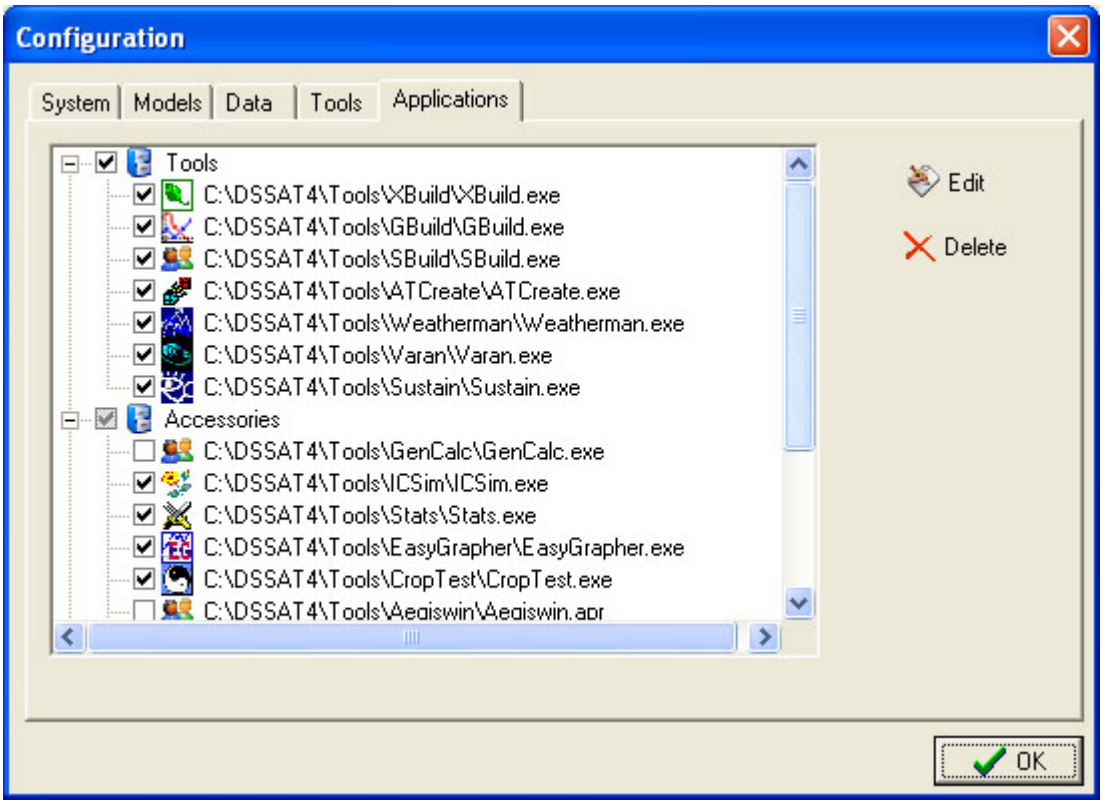
5.1.1.4 Tools

This menu allows the user to specify the tools which are to be used to analyze, edit or create files for various aspects of the DSSAT4 system. Most users will not modify these selections, with the exception of the "Generic" category, which can be used to specify an alternate text editor (default: Notepad).



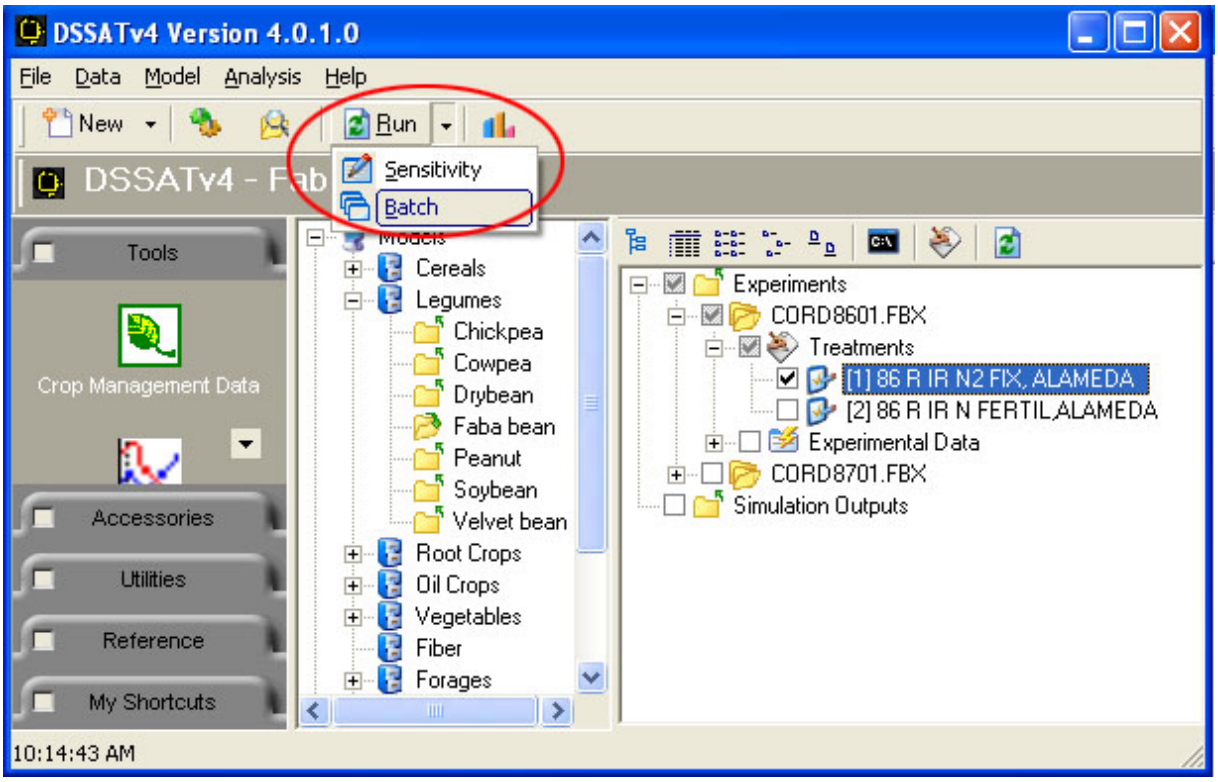
5.1.1.5 Applications

This menu allows the user to specify the tools and accessory application which can be accessed through the DSSAT4 Toolbar menu.



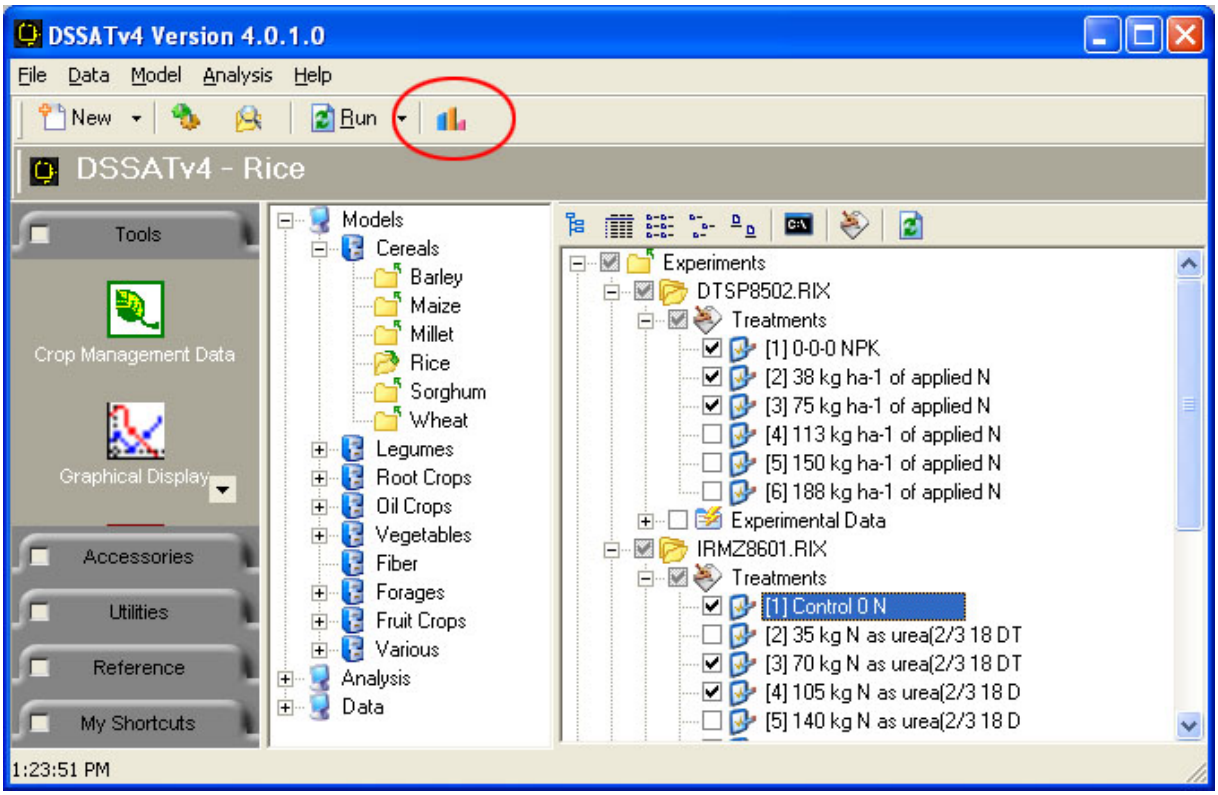
5.1.2 Run

The "Run" icon can be used to start a simulation in either sensitivity (single-treatment, interactive) or batch (multiple treatment) mode. See "Running the Crop Models" for more information.

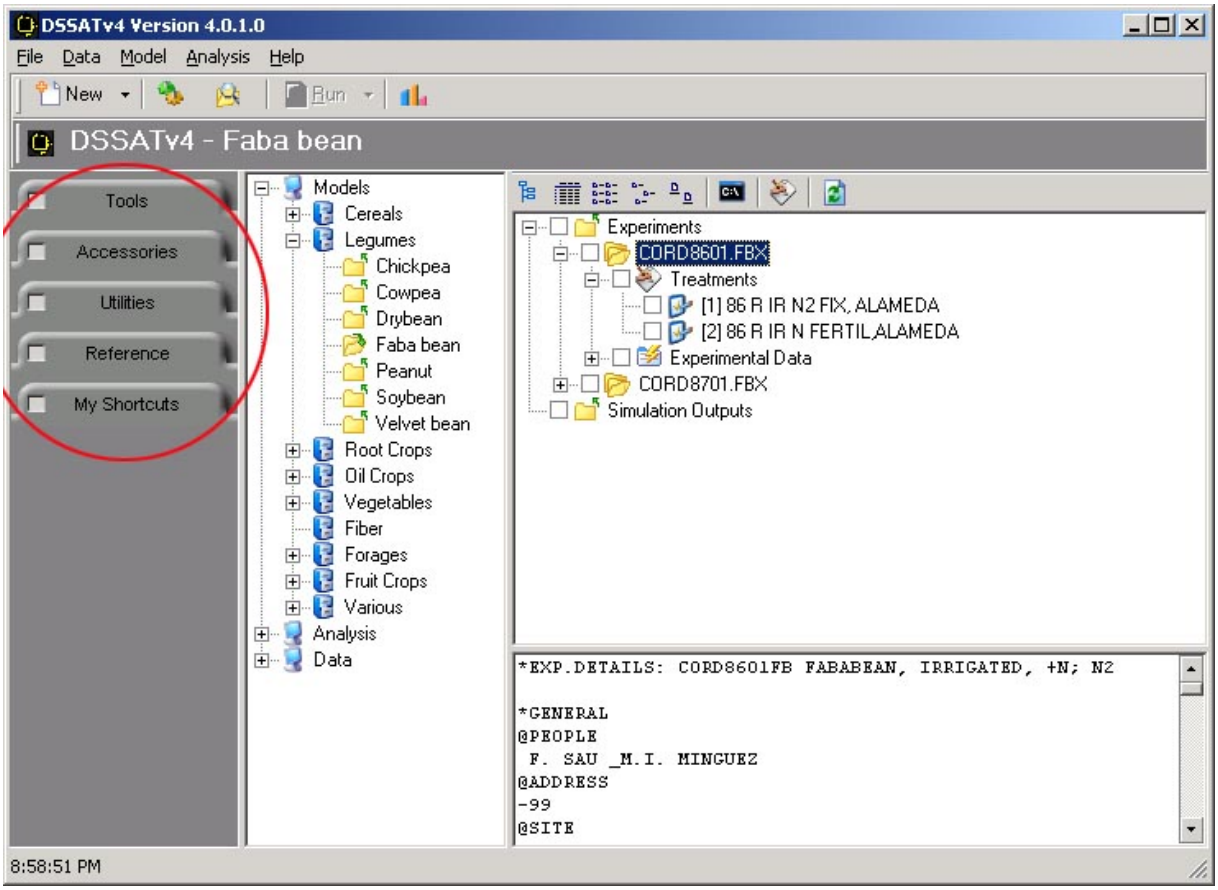


5.1.3 Graph

This icon provides the user with one method of initiating the graphical analysis program (GBuild). See "Analysis of Results" for more information.

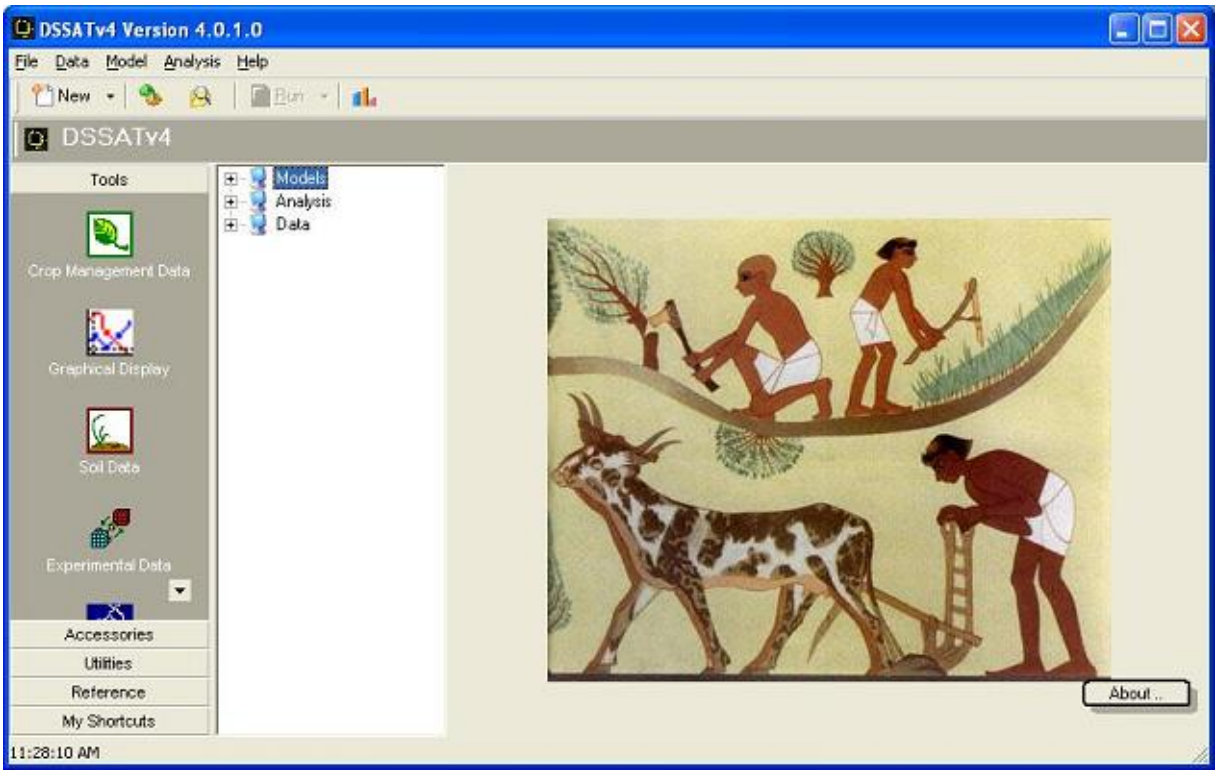


5.2 Toolbars


DSSATv4 Version 4.0.1.0
File Data Model Analysis Help
New
Run
DSSATv4 - Faba bean
Tools
Accessories
Utilities
Reference
My Shortcuts
Models
Cereals
Legumes
Chickpea
Cowpea
Drybean
Faba bean
Peanut
Soybean
Velvet bean
Root Crops
Oil Crops
Vegetables
Fiber
Forages
Fruit Crops
Various
Analysis
Data
Experiments
CORD8601.FBX
Treatments
[1] 86 R IR N2 FIX, ALAMEDA
[2] 86 R IR N FERTIL,ALAMEDA
Experimental Data
CORD8701.FBX
Simulation Outputs
*EXP.DETAILS: CORD8601FB FABABEAN, IRRIGATED, +N; N2
*GENERAL
@PEOPLE
F. SAU _M.I. MINGUEZ
@ADDRESS
-99
@SITE
8:58:51 PM

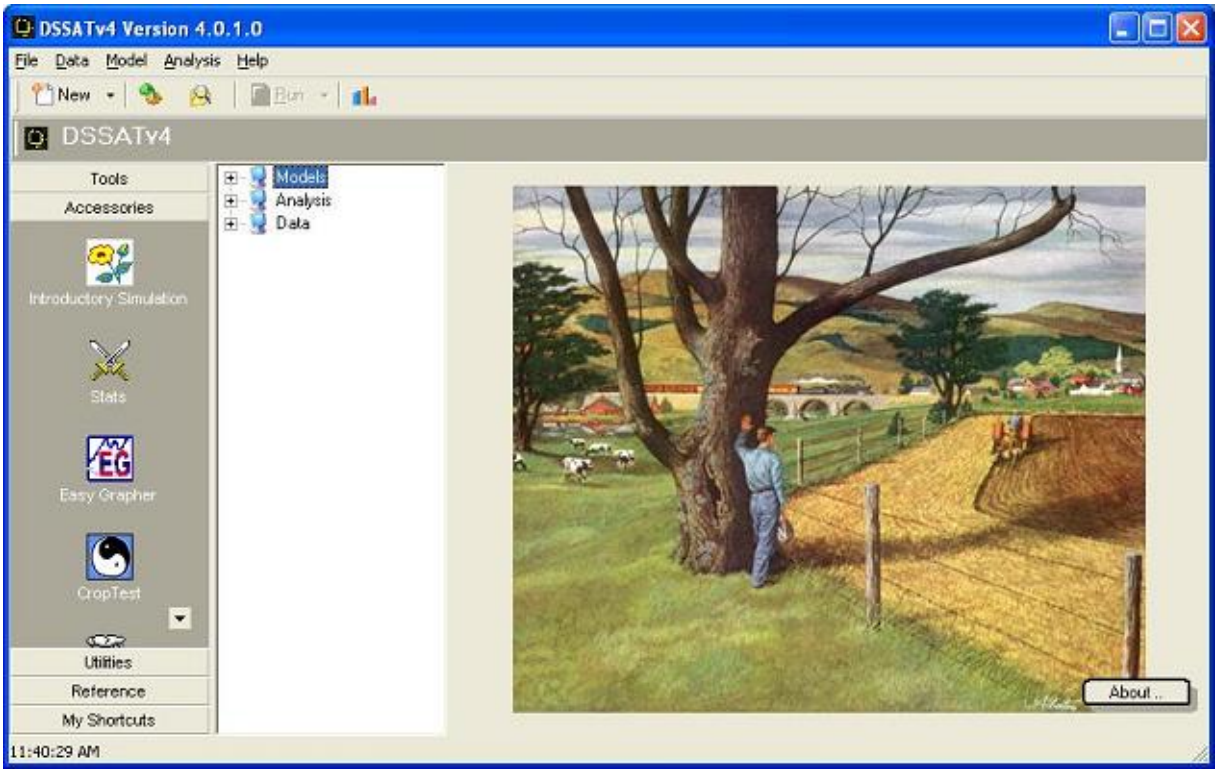
5.2.1 Tools

The standard DSSAT4 applications are recognized by the shell program and when these applications have been installed they appear automatically in the "Tools", "Accessories" and "Utilities" sections of the the menu system. As shown in the screen shot below, the "Tools" menu includes the Crop Mangement Data editor (XBuild), the Graphical Display Tool (GBuild), the Soil Data Editor (SBuild) and the Experimental Data Editor (ATCreate). Each of these application programs is documented separately in Volume 2 of the DSSAT4 Documentation.

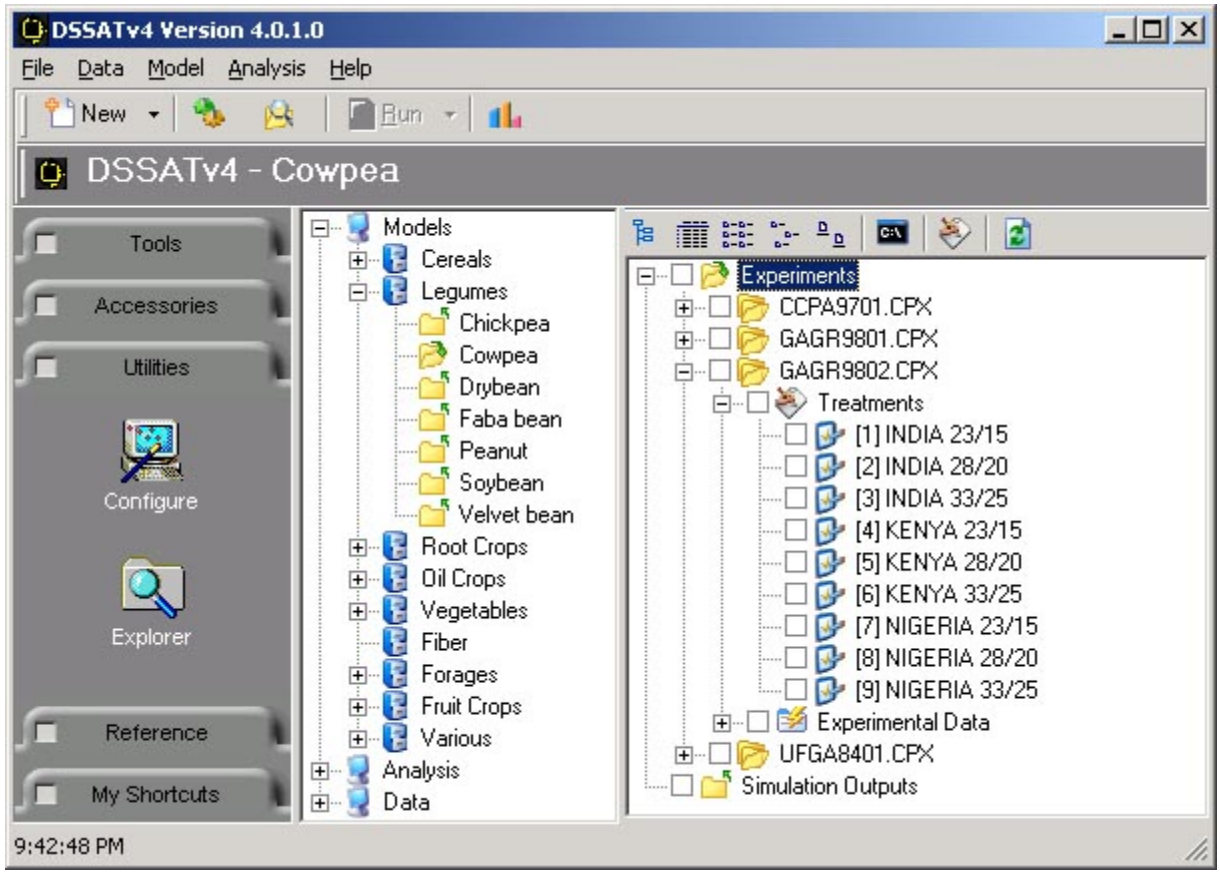


5.2.2 Accessories

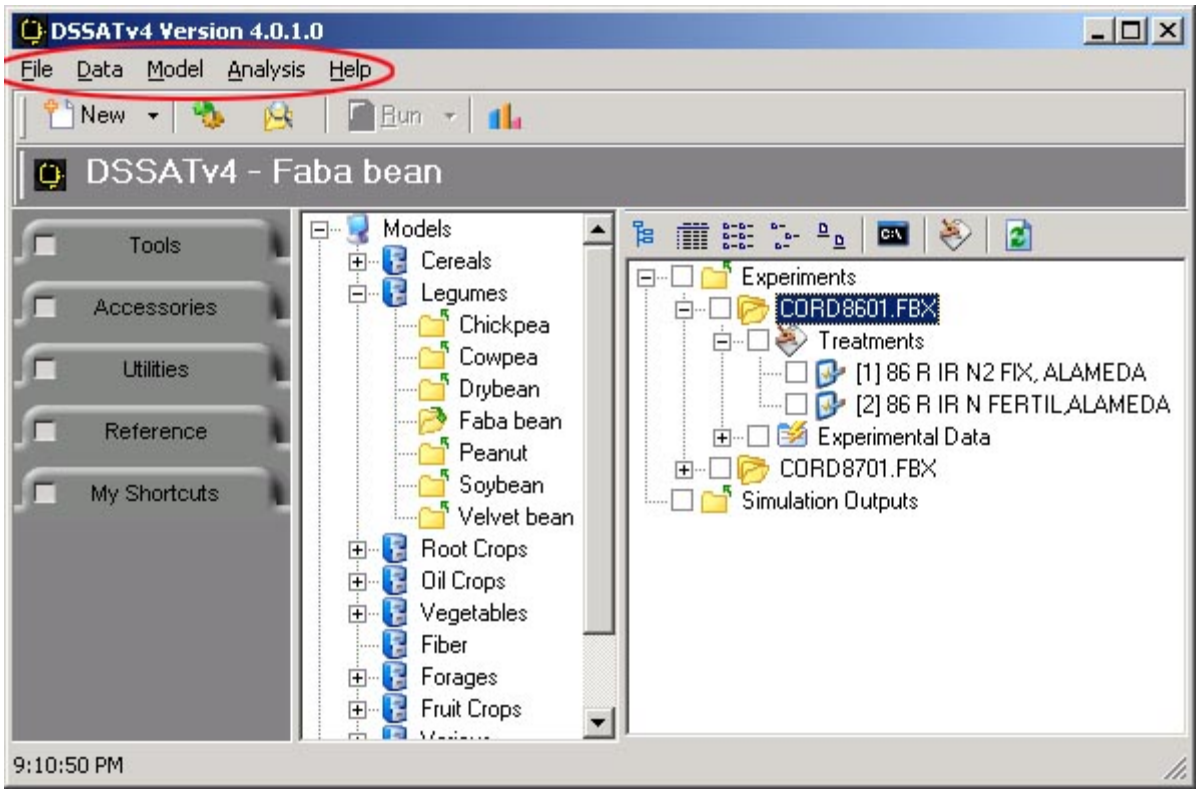
Accessory programs and tools appear in the "Accessories" menu as shown below. These accessory programs include the Introductory Simulation Program (ICSIM), Statistical Evaluation program (STATS), Easy Grapher, and CropTest. Each of these application programs is documented separately in Volume 3 of the DSSAT4 Documentation.



5.2.3 Utilities



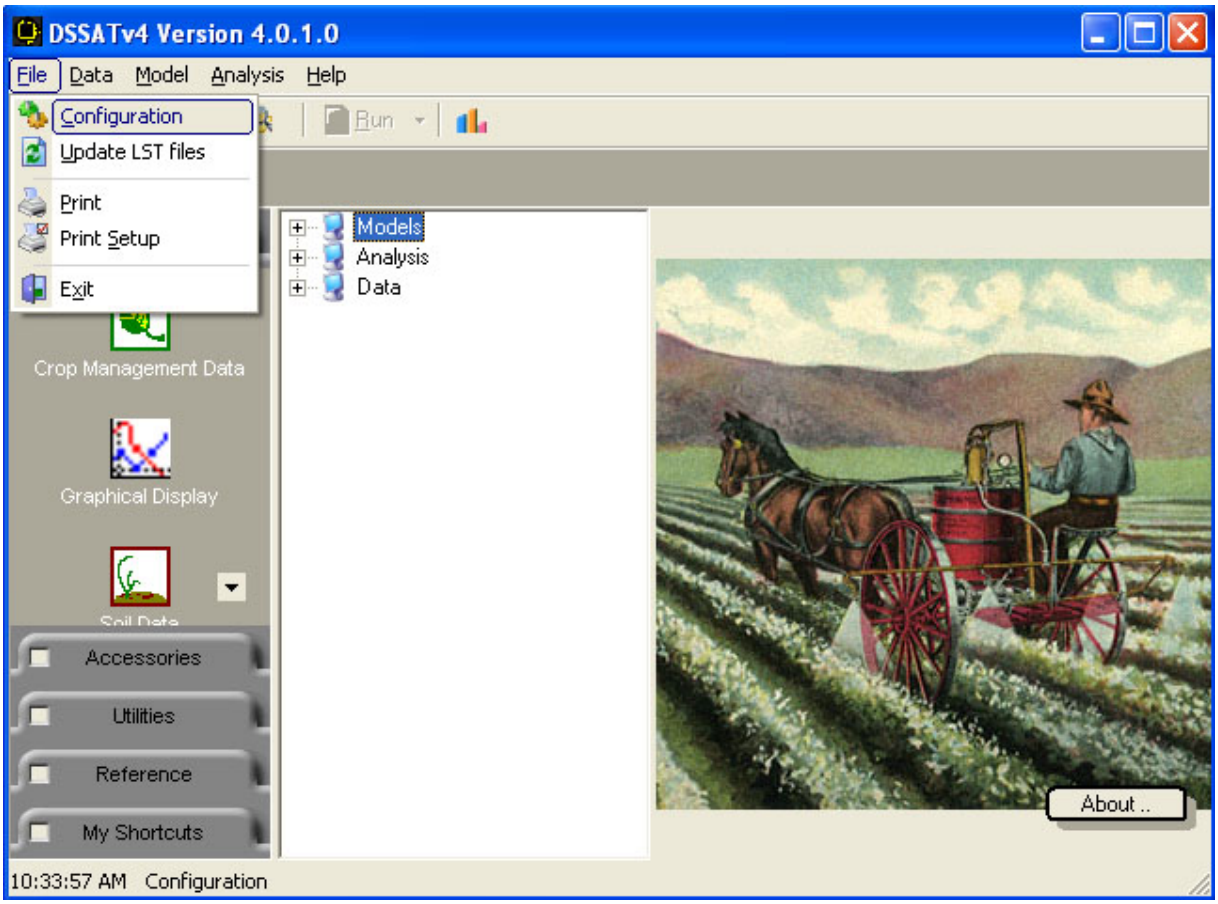
5.3 Pull-Down Menus



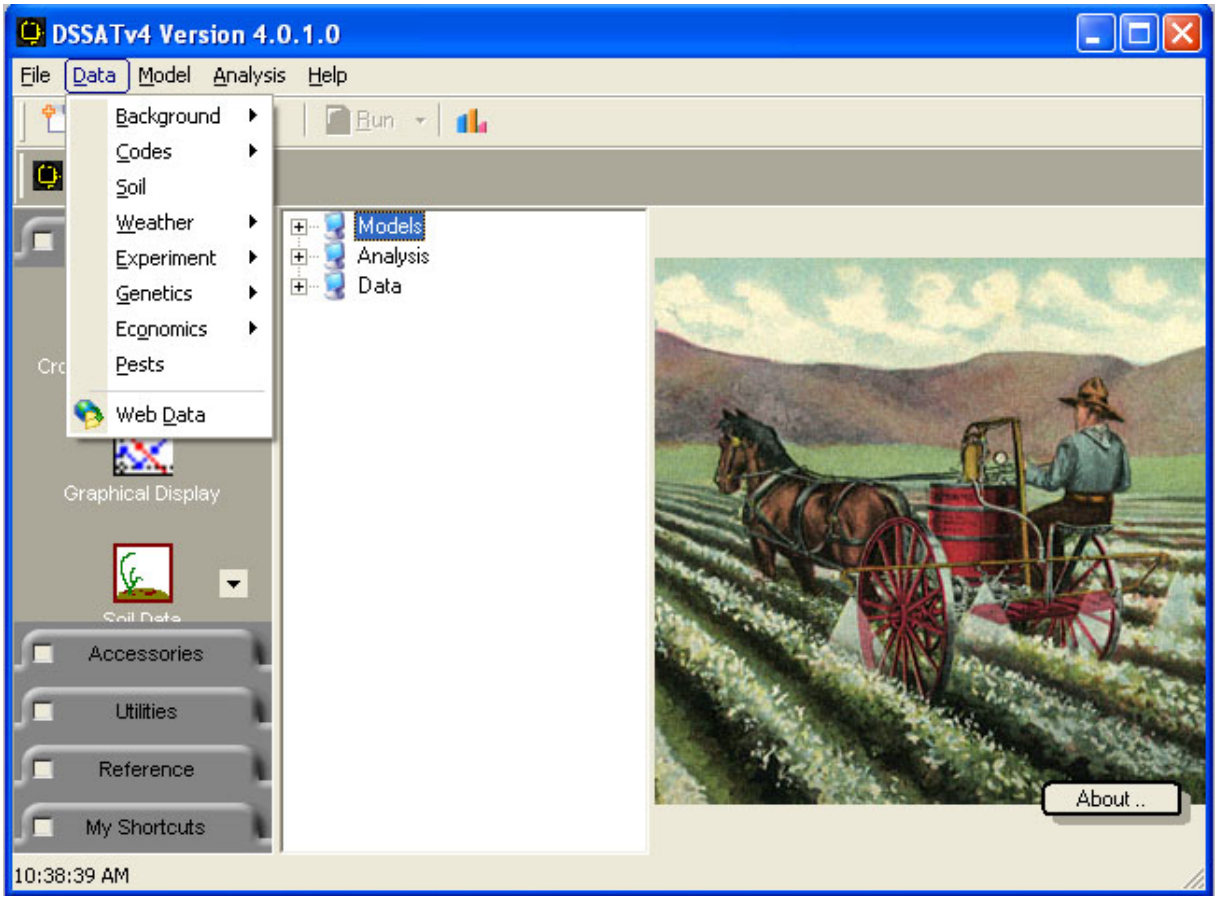
5.3.1 File Menu

The file menu provides a means to:

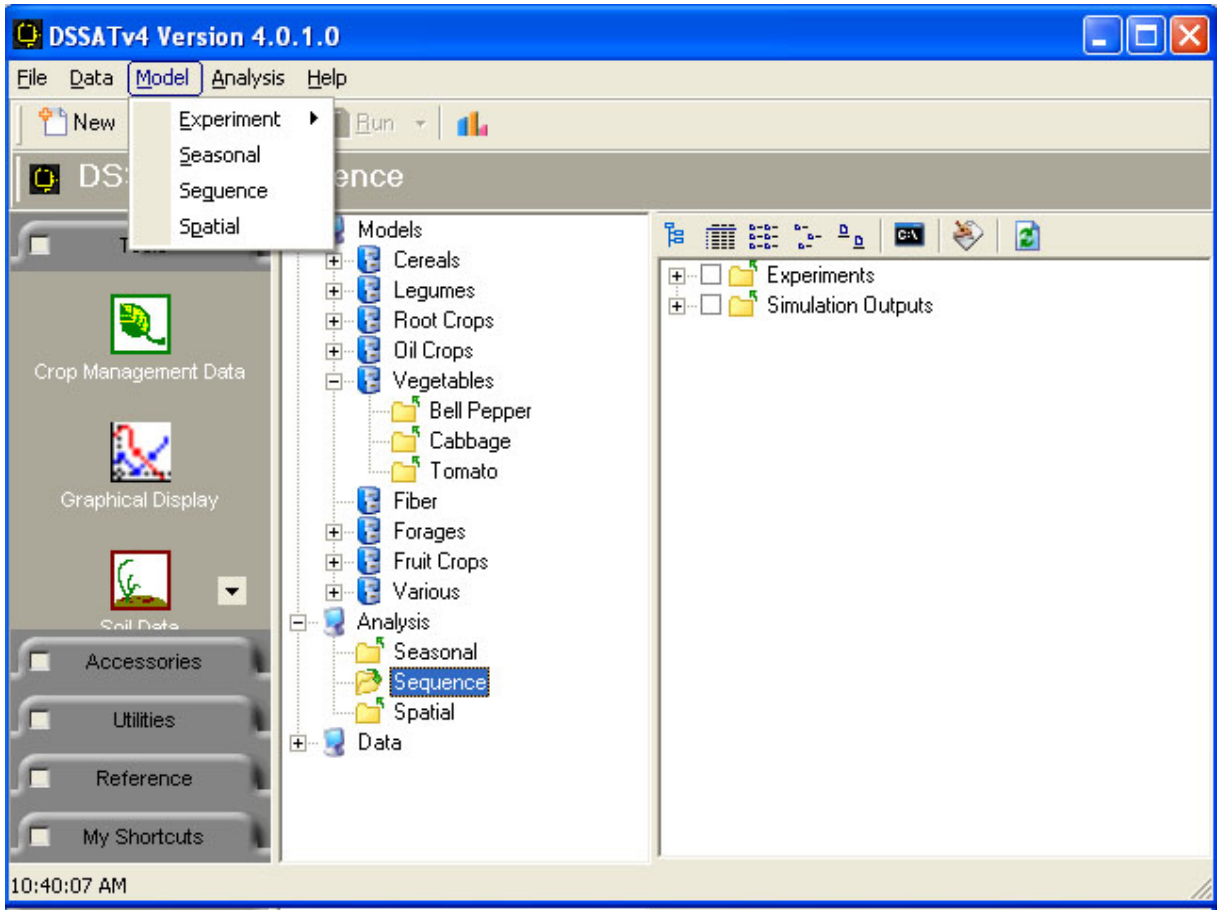
-- Access the configuration menu (See "Configuration")
-- Update LST files, which list experiments (EXP.LST), weather (WTH.LST) and soils (SOL.LST)
-- Print file
-- Printer setup
-- Exit DSSAT4



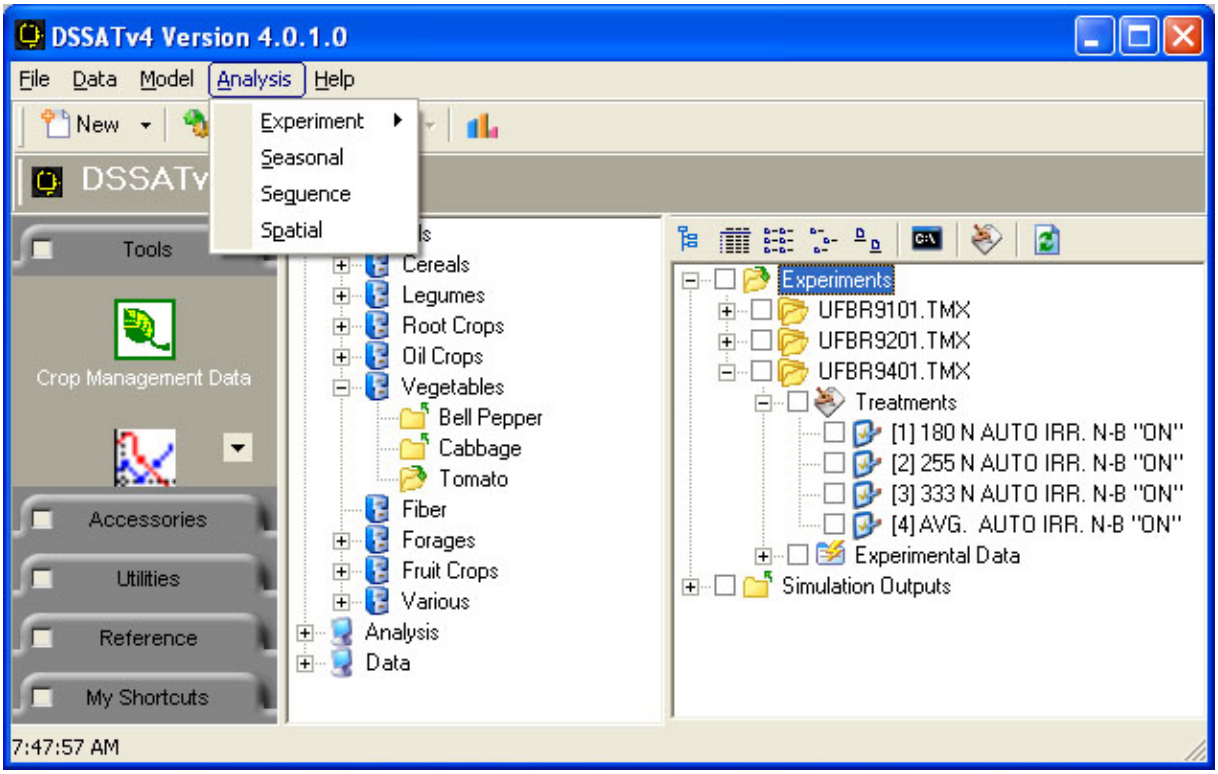
5.3.2 Data Menu



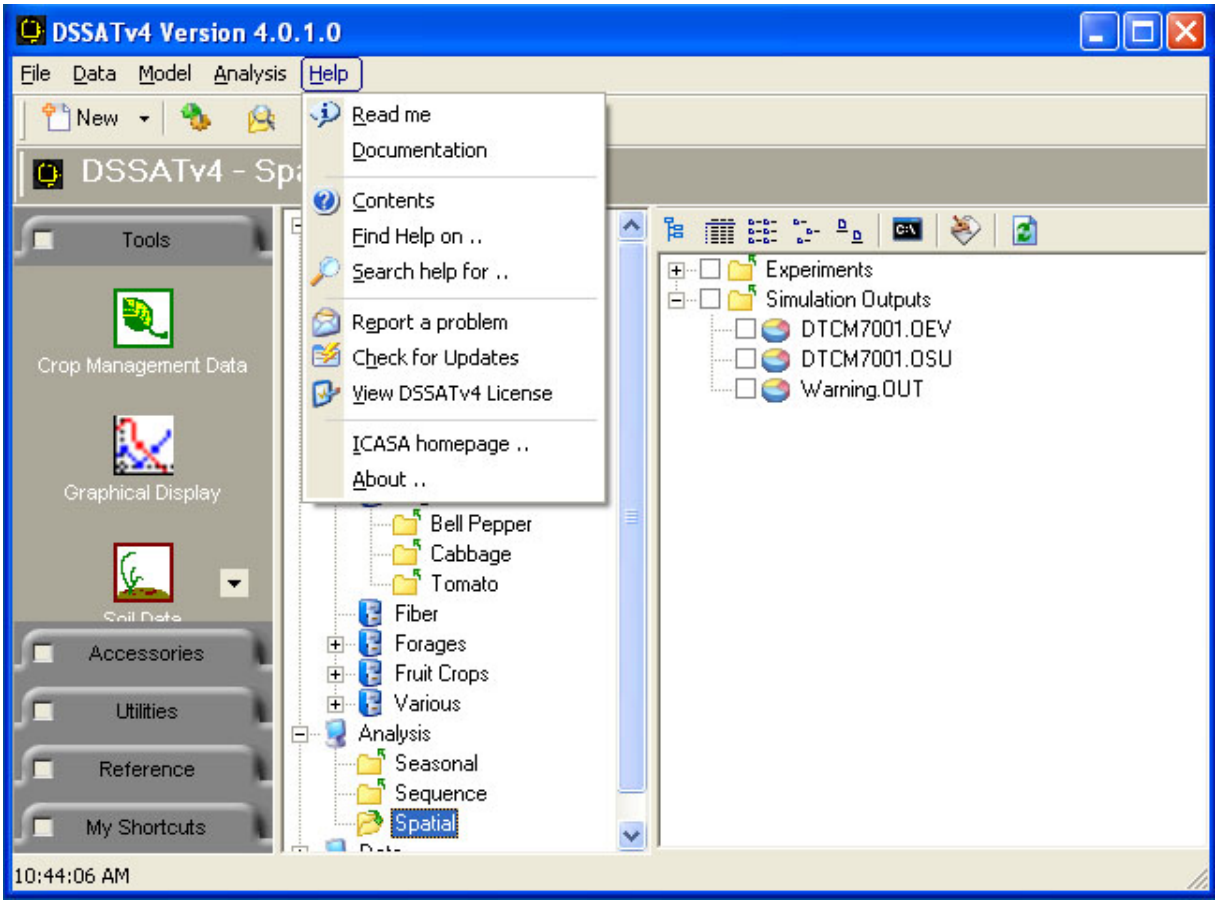
5.3.3 Model Menu



5.3.4 Analysis Menu



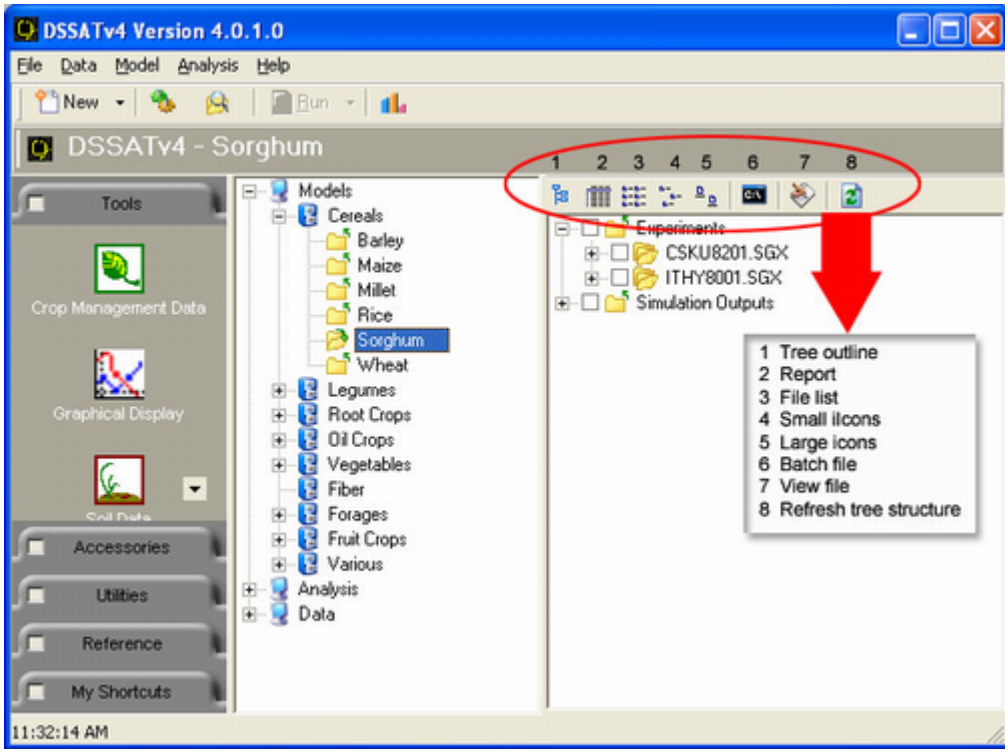
5.3.5 Help Menu



5.4 Directory Tree Icons

The right window contains the following menu capabilities:

1. Show directory tree structure
2. Show detailed file list
3. Show simple file list
4. Show small icons
5. Show large icons
6. Show saved batch files (*.dv4)
7. View selected file
8. Refresh tree structure



Chapter 2

DSSAT v4
Crop Management
Data Editing Program
(Xbuild)

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XBuild

Creating Crop Management Files for Documenting Experiments and Simulating Crop Growths and Yield for DSSAT v4[1]

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1.1 General Description

Crop simulation models rely on large amounts of data and information. Most use classic ASCII format. Classical information system, like ASCII files, had often shown their weakness in various data management aspects when working together with simulation models. The purpose of XBuild program is to provide more effective tool to access all of the functionality of the crop models. It allows users to specify any combination of management options for simulation of several crops for purpose of validation (comparison with observed data), seasonal analysis, crop rotations, and spatial analysis that are available in DSSAT.

XBuild program is based on a mouse driven windows program that allows the user to select the options from an interface, freeing the user from normally tedious tasks associated with the creating of a DSSAT FileX data file.

XBuild is a MS Windows application program. It makes use of the DSSAT directory structure, including the use of the DSSATPRO.FLE file, which designates the locations of all programs and data files used in DSSAT. Using a windows friendly environment, users can create/modify experimental files, run simulations and view results.

XBuild uses the DSSAT v4 files, directories, and crop models, and therefore the documentation available in Tsuji *et al*. (1994) applies to this software.

The purpose of this report is to provide a description of the installation of XBuild and introduce the main options of the program.

1.2 System Requirements

Hardware:

IBM or compatible PC

At least 35 MB of free disk space

Software:

Windows 95/98/2000/NT/XP Operating System

DSSAT v4

1.3 Installation

Insert the installation CD/Disk and run SetUp.exe. Windows will execute the setup program and display the dialog box in Figure1. Although the Setup program lets the user select the directory to install the program, it is recommended that the default directory be used. After clicking on the button shown in Figure 1, the installation begins.

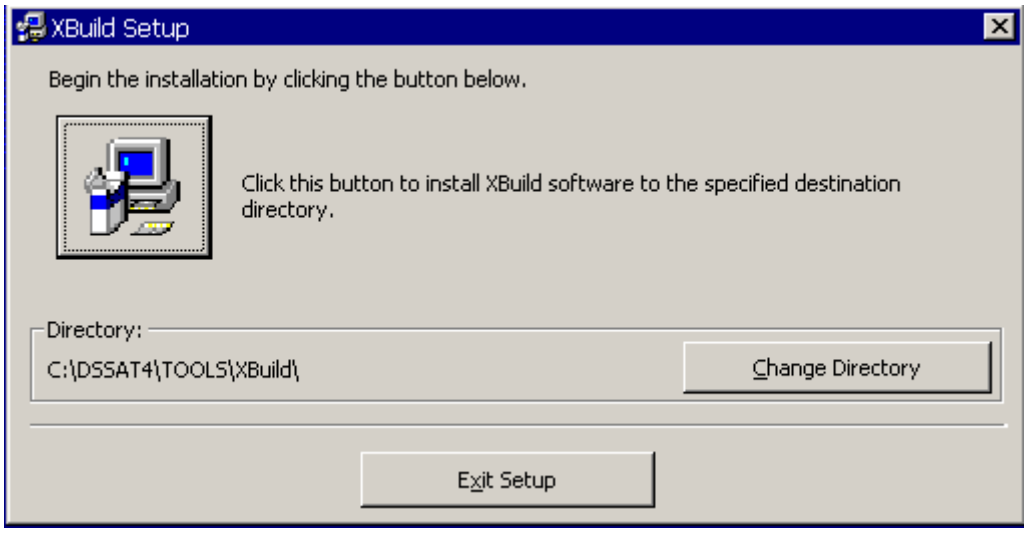

Figure 1. Start of the installation.

During the installation, the program registers any OCXs (ActiveX controls) and copies all necessary files. If some of the files already exist on your system, a warning message will be displayed. It is recommended that you keep the newest version of the files when you are prompted.
After installation is complete, XBuild is ready to use without rebooting the computer.

1.4 Tutorial User's Guide

1.4.1 Getting Started

XBuild was designed to help the users create experimental files easily to avoid major errors like typos, format errors, errors with dates, etc. An important role of the program is to make it easy to select information default values and retrieved information from DSSAT4 files. For a new designed scenario:

Defaults:
- Most of the numeric type values have defaults as numbers:'-99', '-9', '-99.0', etc.
- Planting date is a default year for all other inputs in a newly designed scenario. Planting date is a default date for starting simulation.
- Initial Condition layers are default values, which were retrieved from the soil profile, selected in Field section assuming Water 100% and Nitrogen 25kg/ha.

Default files: Simulate_Seasonal.def, Simulate_Sequence.def, Simulate_Spatial.def, Simulate.def. provide default information for Simulation Option.

Required DSSAT 4 files:
- DSSATPRO.FLE
- DETAIL.CDE
- DATA.CDE
- GRSTAGE.CDE
- Simulation.cde
- [Soil files]
- [weather files]
- [genotype files]

XBuild program is specially designed for the DSSAT4 software package and can be installed and used only is the database is available on the system. XBuild can work as stand-alone program and as part of the DSSAT4 Shell (see Shell Manual).

When the program started, the user may select an option to create a new FILEX or edit an existing file.

Although the program is designed to protect the user from some errors, knowledge of the structure of FILEX is necessary. The user will find many help tips on the program screens; these are pop up messages, messages, look up lists. The related entries are painted with same color. For example, **Weather Station** on the **Fields** screen and **Year** list on all other screens; **Soils** on the **Fields** screen and **Soils** on the **Initial Condition** screen.

We hope, that XBuild will be a useful tool for creating or editing the files.

1.4.2 New Simulation

A file, referred to as FILEX, documents the inputs to the models for each "experiment" to be simulated. The file contains a heading of the experiment code and name, the treatment combinations, and details of the experimental conditions. The experiment code uses the same conventions as the file naming system to provide information on institute, site, planting year, experiment number, and crop.(e.g. UFGA8201.MZX is the name of an experiment at University of Florida (UF) in Gainesville (GA) conducted in 1982 (82) on maize (MZ). The "01" indicates that this is experiment #1). The file contains details of the experimental (field characteristics, soil analysis data, initial soil water and inorganic nitrogen conditions, seedbed preparation and planting geometries, irrigation and water management, fertilizer management, organic residue applications, chemical applications, tillage operations, environmental modifications, harvest management), simulation controls, and treatment combinations. Most experiments have more then one treatment. Many treatments are conducted on only one site with treatments confined to such factors as fertilizer rates, varieties or irrigation treatments. Alternatively, an experiment may span several sites where the sites and varieties are treatments. To accommodate these different possibilities, FILEX has been designed with specific sections dedicated to particular categories of inputs. It should be noted that for any particular simulation, only a few of these sections would be needed. However, the minimum required information for the simulation are the **Experiment Name**, **Cultivar**, **Field,** **Planting Details**, and **Simulation Controls** sections.
XBuild is a developer tool for creating a new FILEX. The program leads the user through steps for creating the basic structure of FILEX. The users simply fills the required fields on the screen, and then saves the file. XBuild will prompt for necessary data and to alert users of incorrect entries.

To create a new simulation**:**

1. From the **File** menu, choose **New**.
2. Select **File Type** and fill in the text boxes for **Experimental Identifier** on the **General Information** screen. Fill in other information on the screen if desired. Click **Next** button. (Figure 2)
3. On the **Cultivar** screen, select **Cultivar** from the drop down list. Click **Next** button.

(Figure 3)

4. On the **Fields** screen, fill in the text boxes for **Field ID**, **Weather Station Name**, and **Soil Name**. Fill other information if necessary. Click the **Next** button (Figure 4).
5. On the **Planting Screen**, fill in the text boxes for **Planting Date**, **Row Spacing**, **Plant Population**, and **Planting Depth**. Click **OK** to save the entry and close the screen.
6. The **Simulation Control** section will be added automatically.
7. The **Treatment** combination will be set up automatically using default values from the files described earlier.
8. From the **File** menu, choose **Save**.

The new experimental file is created and saved in the directory under DSSAT4 for the crop in the experiment. The name of the file is automatically created using the required information shown in the screen. You may edit or close the file.

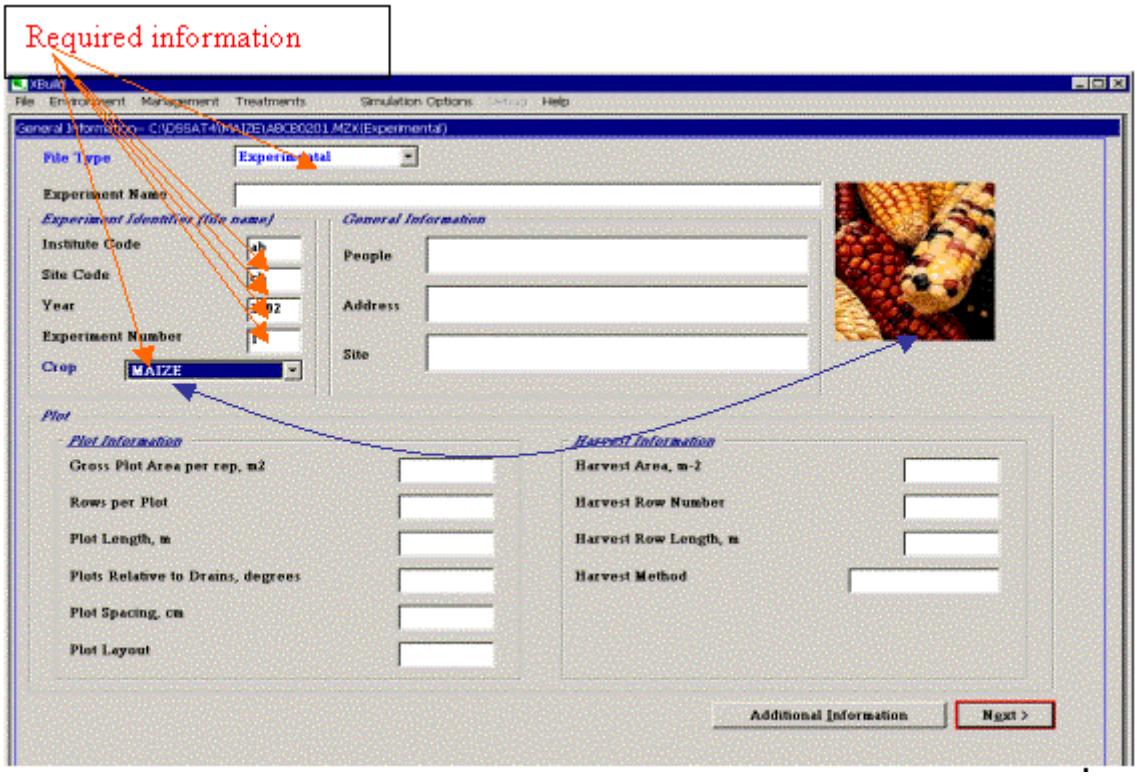

Figure 2. The first screen of XBuild that allows users to define general information, including the experimental file name.

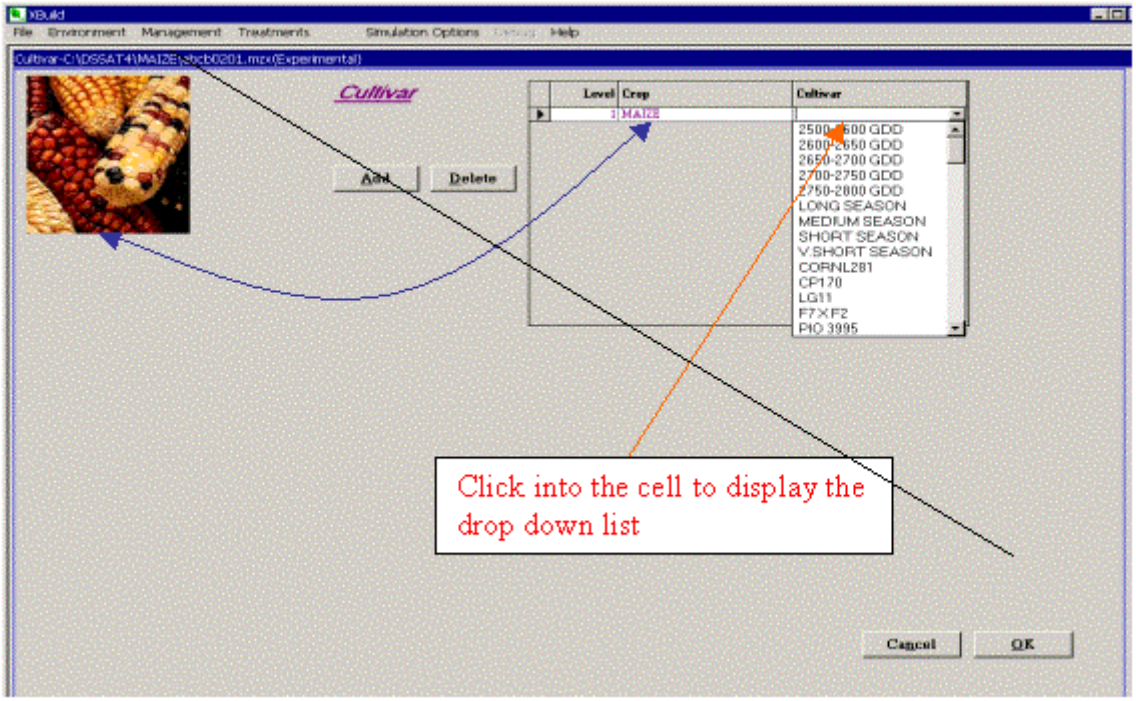

Figure 3. The second screen of XBuild that allows users to define cultivars information.

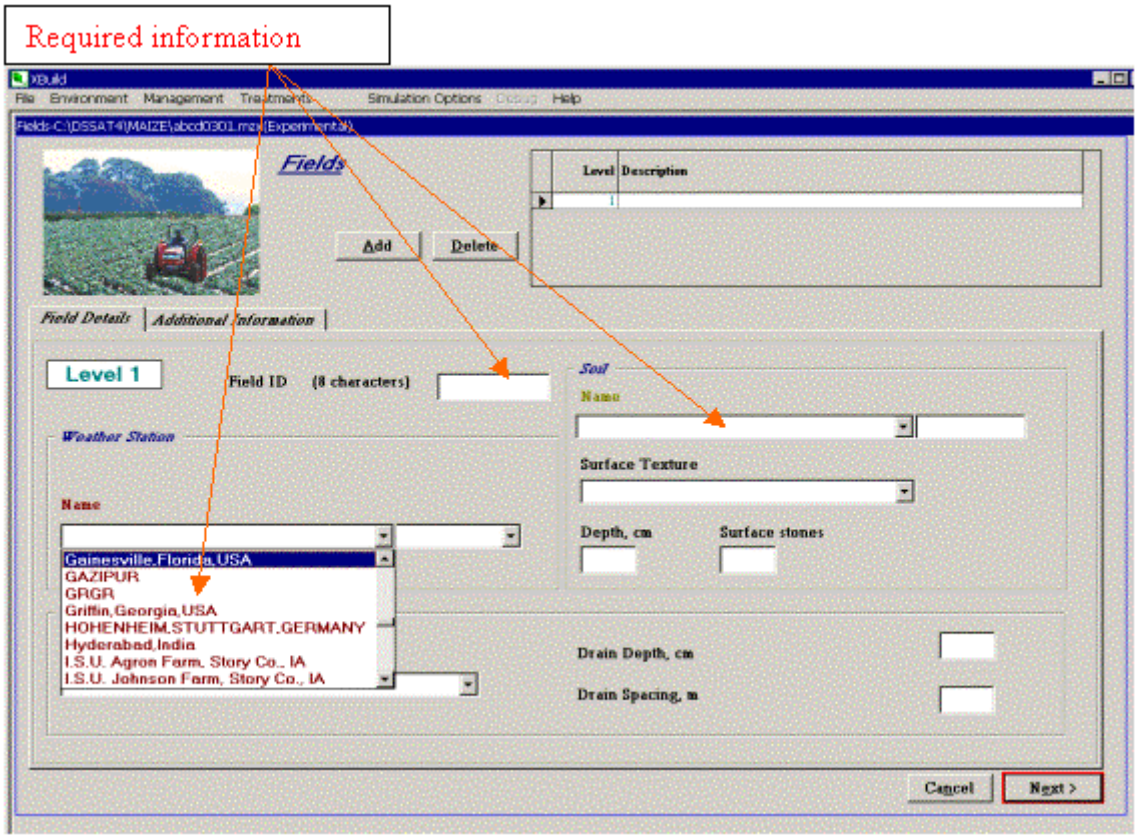

Figure 4. The third screen of XBuild that allows users to define field information (including weather and soil).

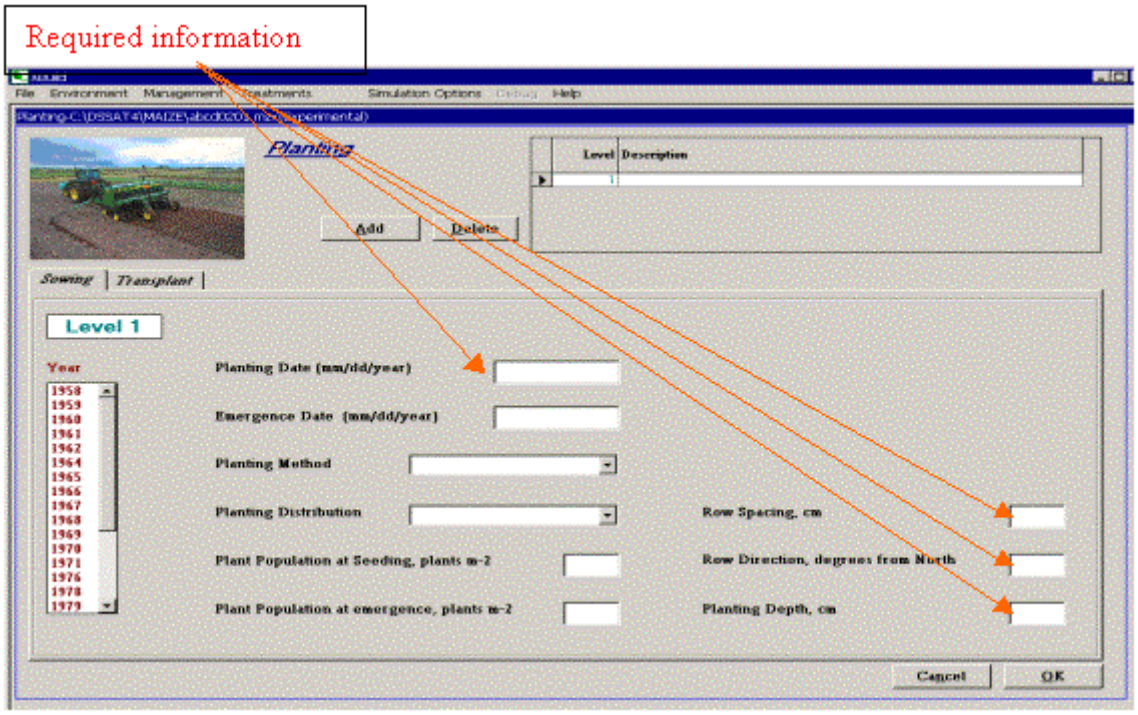

Figure 5. The fourth screen of XBuild that allows users to define planting information. On the left site, years are identified that have weather data.

1.4.3 Edit a file

The newly created or an existing FILEX can be modified with XBuild.
If the file has not been opened yet, go to the **File** menu, click the **Open** command, and select a file.
Modifications of FILEX will be started with modifications of the specific sections or factors dedicated to particular input categories.

- To change the data: type a number in a corresponding cell, or select information from a pull down list.
- To add a new level/ layer or date: Select the level/layer or date you want to use as a template. Press the **Add** button.
- To remove an existing level/ layer or date: Select the row you want to remove in the corresponding table. Press the **Delete** button.
- To cancel all changes to the section: Press the **Cancel** button.
- To save the changes to the section: Press **OK** button.
- To save the changes to a file: Select **File/Save** or **Save As**.
- To close the file: Select **File/Close**.

After all changes to the indicated sections are finished, the treatment combinations can be selected.
XBuild is much like many other Windows applications; it has a menu bar at the top of its main window. The corresponding menu option will open the section screens.

Menu Items

- **File**
- **Environment**

- **Management**
- **Treatments**
- **Simulation Options**
- **Help**

The **File** menu option allows users to: (1)create a **New** scenario for simulation, (2)**Open** an existing file for simulating a scenario previously defined, displays the **General Information** screen, (3)display a simulation scenario while it is being edited (**Print Preview**), (4)**Print**, and (5)**Save** the current scenario.

The **Environment** menu option allows users to make changes to (1)**Field** information, which includes daily weather variables, soil data, etc., (2)Soil **Initial Condition** which defines the initial soil water and nitrogen conditions at the start of simulation, (3)**Soil Analysis**, (4)**Environmental Modification** which allows one to make changes to weather variables such as daylength, daily total radiation, maximum temperature, minimum temperature, precipitation, CO_2, humidity, and wind.

In the **Management** menu option, the user can (1)select the crop and **Cultivar** that will be simulated, (2)enter management inputs of **Planting** details which defines the planting date, plant density, row spacing and planting depth, (3)**Irrigation** and water management which defines the dates and amounts of irrigation applications, (4)**Fertilizer** which defines the dates, amount, and types of fertilizer applications, (5)residues and other **Organic Amendments** which defines initial residue from the previous crop present at the start of simulation, (6)**Tillage**, (7)**Harvest** which defines final harvest date and other harvest parameters, and (8)**Chemical Applications.**
The importance of the above sections depends on the treatment factor levels that one defines for an experiment. The **Treatments** section allows one to select combination of the factors on section entries for each treatment.

The **Simulation Options** menu button defines the various options available for simulation, such as water balance and nitrogen balance simulation, crop management options, also it defines the output files and output frequency.

1.4.3.1 General Information

The **Experiment Identifier** or **File Name** can be modified by changing the data in the corresponding text boxes. While changing the data, you will see the changed file name on the upper panel of the screen(Figure 6).

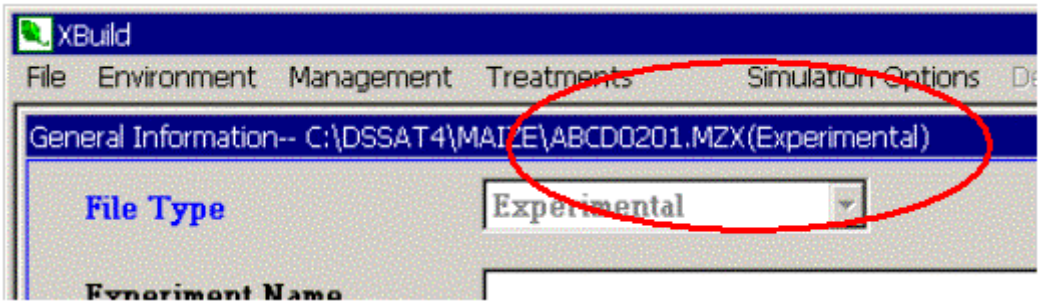

Figure 6. The name of the file as it is shown on the top of the screen.

Note: *You may not modify* ***File Type*** *or* ***Crop****.*

The user can enter an **Experiment Name**, **General, Plot**, and other information.

1.4.3.2 Environment

There are four options under the **Environment** menu button: **Fields**, **Initial Conditions**, **Soil Analysis**, and **Environmental Modifications**.

1.4.3.2.1 Field

The **Field** menu button opens the main **field** window (Figure 4). These data include description, Field ID, weather station, soil, location, drainage, and other field information. Some data have to be entered manually, some are chosen from drop down menus. The **Add** and **Delete** buttons will add or delete a level in the field sections. The **OK** button will save the data and close the window.

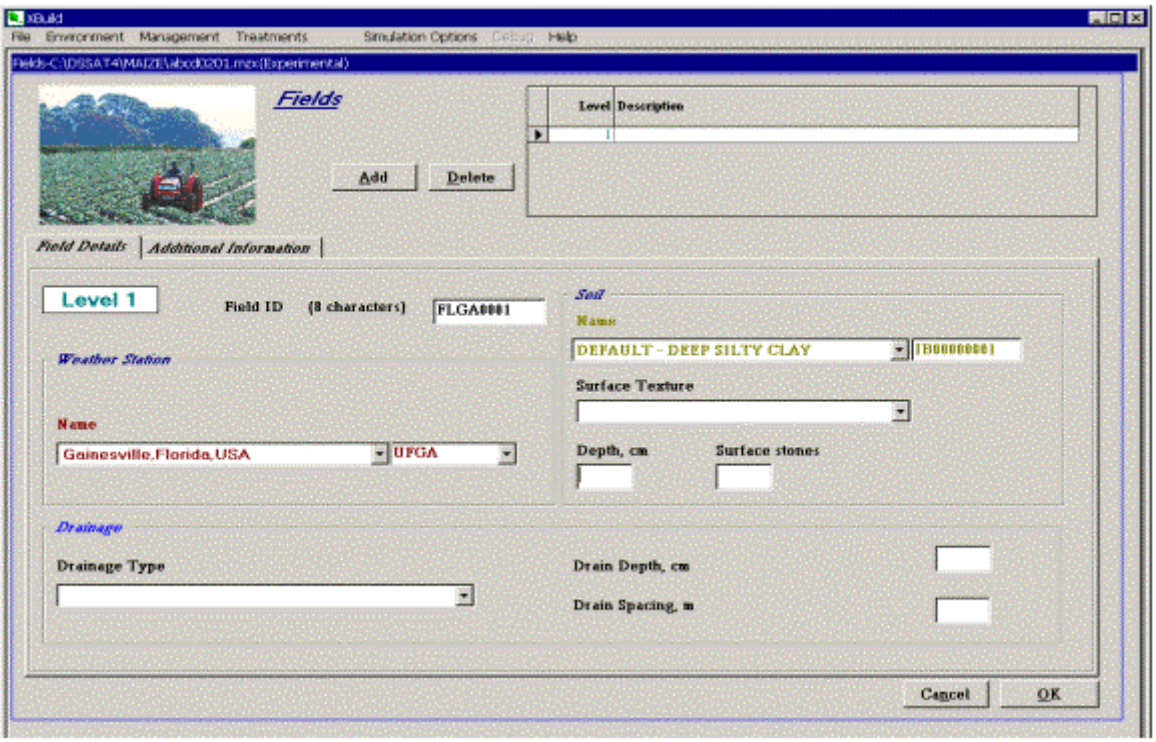

Figure 7. The Field screen.

Note: *When a new field id added (the* ***Add*** *button)* ***Field ID*** *will be incremented by one number. The* ***Field ID*** *can be changed in the cell, but be it must be unique in the field section.*

1.4.3.2.2 Initial Conditions

The **Initial Conditions** menu allows the user to modify the input variables used to initialize the crop model when a simulation is started. The screen (Figures 8,9) has a detail initial

condition information, including: measurement date, previous crop, rhizobia, residue, and initial condition layer data. While entering the date, the user may use as reference the list of available years. The years are identified that have weather data. This information is obtained from the weather site(s) selected in **Fields** **Weather Station**.

Soil layers initial conditions can be modified either by editing the values in the table or calculating the values accordingly to the selected Soil profile and **Water** and **Nitrogen** . The list of Soil Profiles contains all **Soil Name**s that were selected in **Fields** section.
Once a **Soil** is selected and **Soil Layers** are **Recalculated** for a certain **Initial Conditions** level, the program will remember the **Soil** name, **Water (%)**, and **Nitrogen (kg/ha)** for this **Initial Conditions** level. If the file is closed, the information about the **Soil** name, **Water (%)**, and **Nitrogen (kg/ha)** will be erased. If the user selects a **Soil**, and/or **Water (%)**, and **Nitrogen (kg/ha)** but does not **Recalculated** the **Initial Layers** - this information will not be saved.

***Note**: When **Treatments** are set, be sure that the **Soils**, which were selected in **Initial Condition** section, are consistent with the soils on **Field** section.*

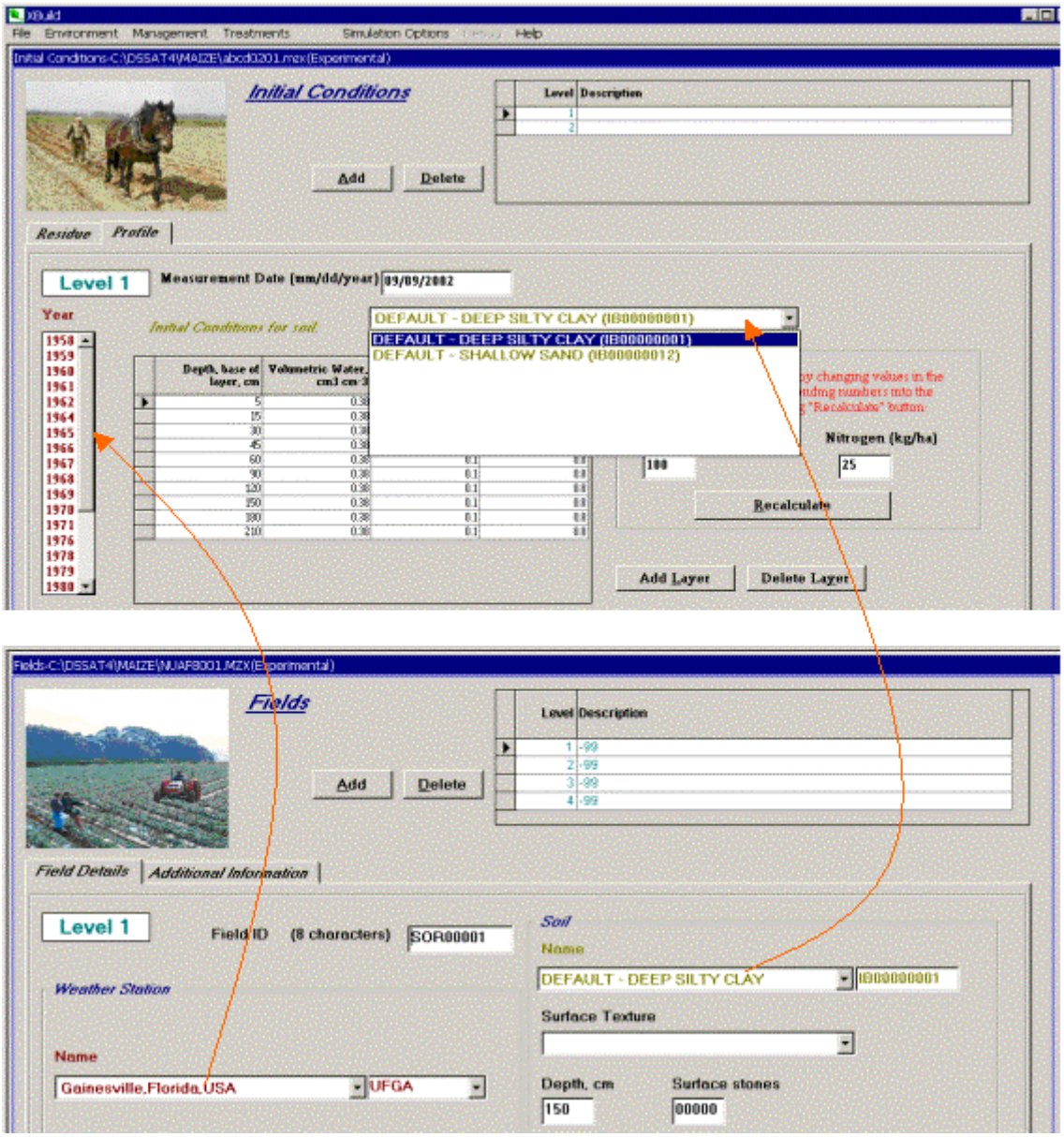

Figure 8,9.The Initial Condition screen/Profile.Figure .The Field screen.

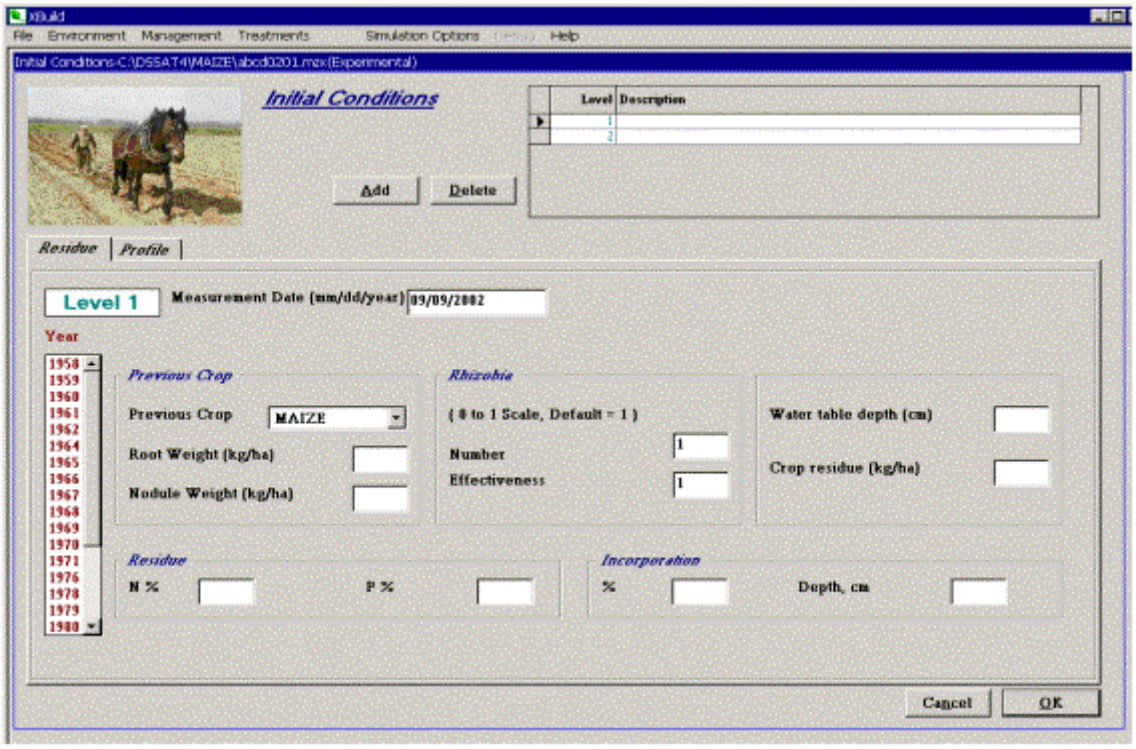

Figure 10.The Initial Condition screen/Residue.

1.4.3.2.3 Soil Analysis

The command **Soil Analysis** from menu, will open the **Soil Analysis** screen (Figure 11). This allows adding information related to soil analysis for the experiment, such as: analysis date, determination methods, and information about soil analysis layers, that are: depth, water content, organic carbon, nitrogen, phosphorus, and others.

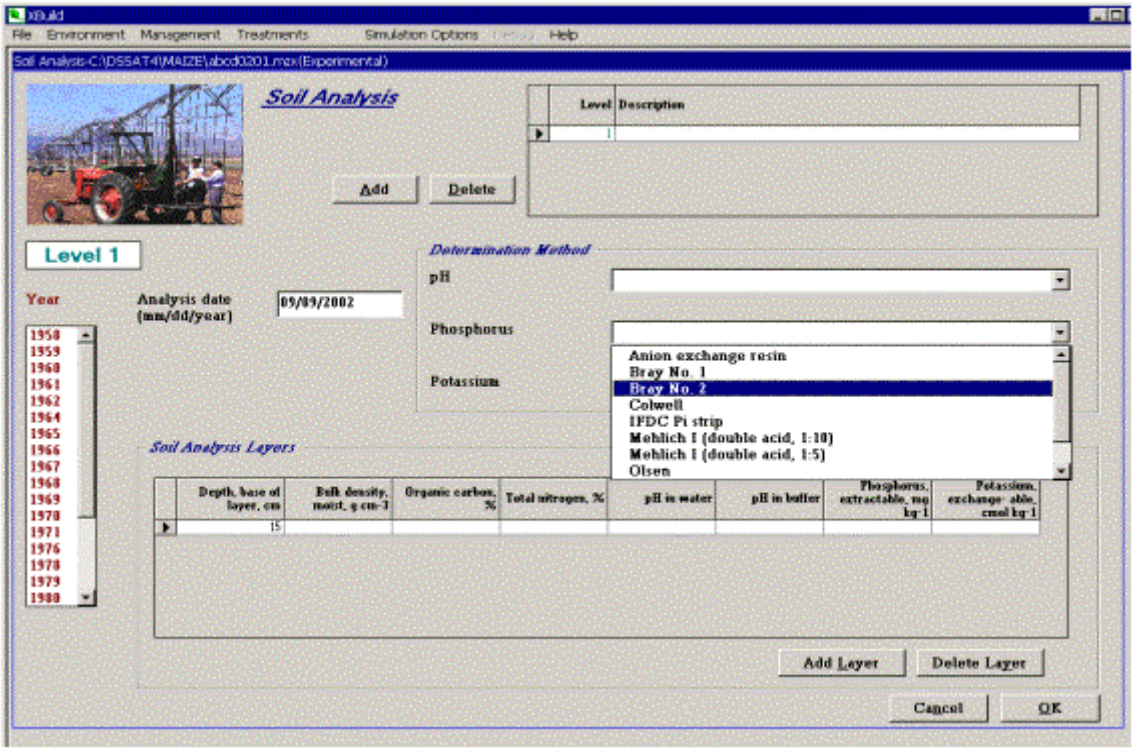

Figure 11. Soil Analysis screen.

The data can be modified. Soil analysis levels can be added or deleted. **OK** button will save the data and close the screen.

1.4.3.2.4 Environmental Modifications

The **Environmental Modifications** menu option allows users to set or change weather conditions for the crop simulation (Figure 12). This screen allows users to modify up to 8 different environmental variables for simulation. These environmental variables and their units are: Daylength (hour); Solar radiation (MJ m^{-2} day^{-1}); Maximum daily temperature (^{o}C); Minimum daily temperature (^{o}C); Precipitation (mm); (6) CO_2 (vpm); (7) Humidity (%); and (8) Wind speed (km d^{-1}).

Each environmental variable includes the **Adjustment** box and the **Factor** pull-down list. The **Adjustment** box allows users to enter a value for adjusting daily values of that variable. The **Factor** pull-down list provides 3 menu options: **Add**, **Multiple** or **Replace**. For an environmental variable (i.e. Radiation), users can enter a value in **Adjustment** cell and specify the type of adjustment using menu items in the **Factor** pull-down list.

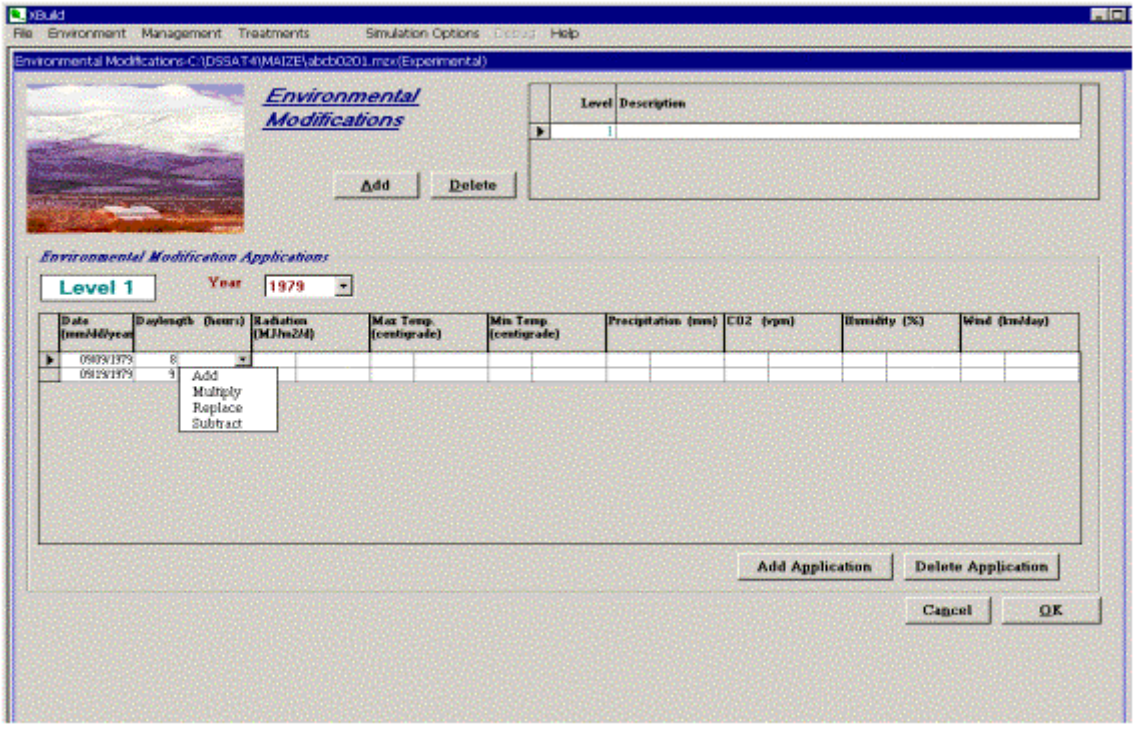

Figure 12. Edit the Environmental Modification Screen.

After all necessary modifications, the **OK** button returns to the main menu screen.

1.4.3.3 Management

There are eight options under the **Management** menu button: **Cultivars**, **Planting**, **Irrigation**, **Fertilizer**, **Organic Amendments**, **Tillage**, **Harvest**, and **Chemical Applications**.

1.4.3.3.1 Cultivars

The **Cultivars** option allows selection of one or more cultivars for the experiment. Data can be added or removed by using the corresponding buttons.
Button **OK** saves the information and close the screen. (Figure 13).

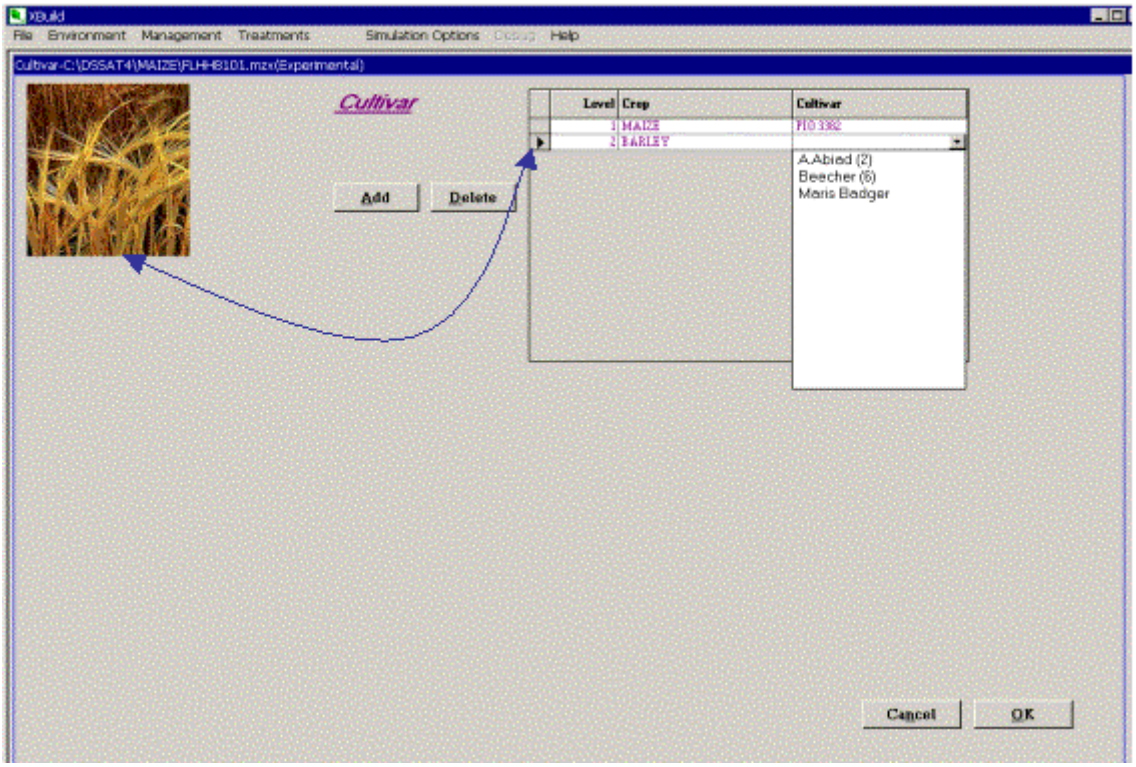

Figure 13.The Cultivar Screen.

1.4.3.3.2 Planting

The **Planting** option allows modifying **planting** and **emergence dates**, **plant populations**, **planting methods**, **planting distributions**, **row spacing** and other information.

For references, a list of years with daily weather data is displayed on the screen(Figure 14). The information is deriven from the weather stations selected on the **Field** screen(Figure 7).

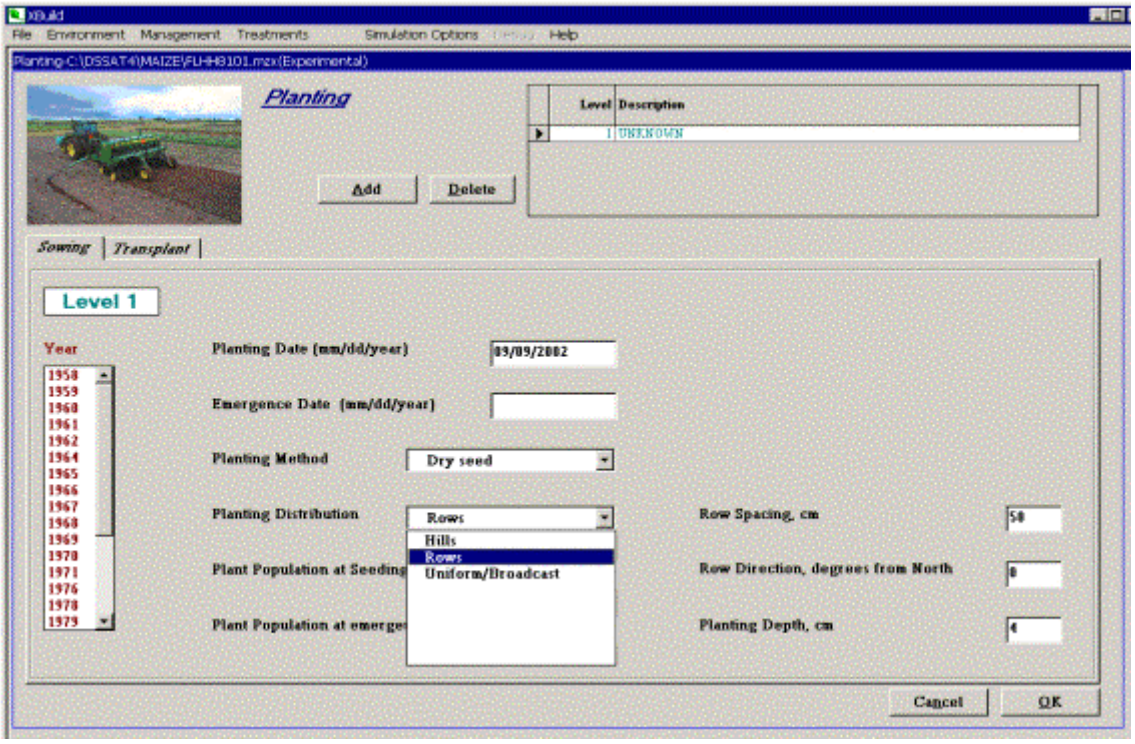

Figure 14.The Planting screen.
Note: *Be sure that planting date is* ***before*** *emergence date.*

After all necessary information is entered, the button **OK** saves the data and closes the screen.

Tip*: Data are saved only in the program but not to a file at this point. To save data to the file, you must select* ***File/Save*** *or* ***Save As*** *option from the bar menu. It is recommended, to periodically save the data to a file*.

1.4.3.3.3 Irrigation

Irrigation option allows users to modify the **irrigation dates**, and various options and variables associated with the water balance simulation and application depth (Figures 15,16). The user may select a **Management** option **On reported dates** (Figure 15) or **Days after planting** (Figure 16). In the first case, the table has the first column **Dates (mm/dd/year)** and in the second case, the column will have the header **Days.**

Note*: Be sure that the selected* ***Management*** *option is consistent with the option in the* ***Simulation Option*** *section .*

For experimental files that are located in DSSAT4/**RICE** folder, **Irrigation type** column is added to the **Irrigation Application** table. (Figure 17)

The list of available **Year**s is given for references.

You may edit, add or remove irrigation data on the screen. After all necessary modifications the screen data can be saved with the **OK** button. To save the information to the file, select

File/Save menu option.

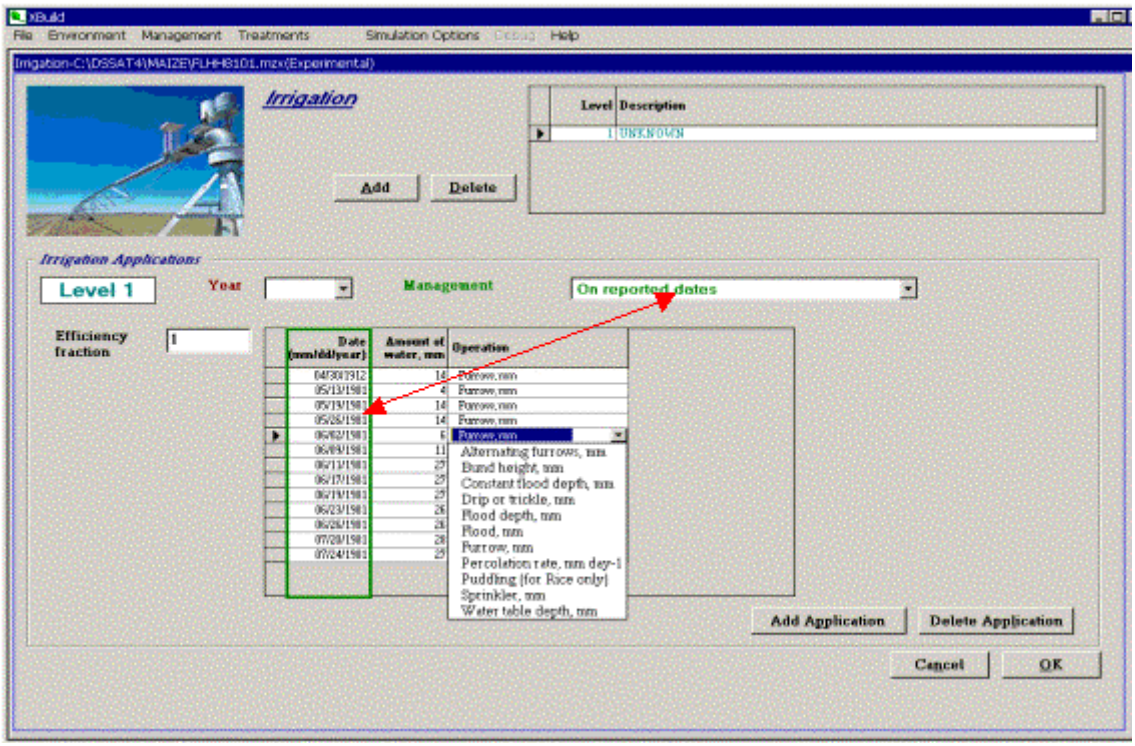

Figure 15. Edit Irrigation Applications **On reported dates**.

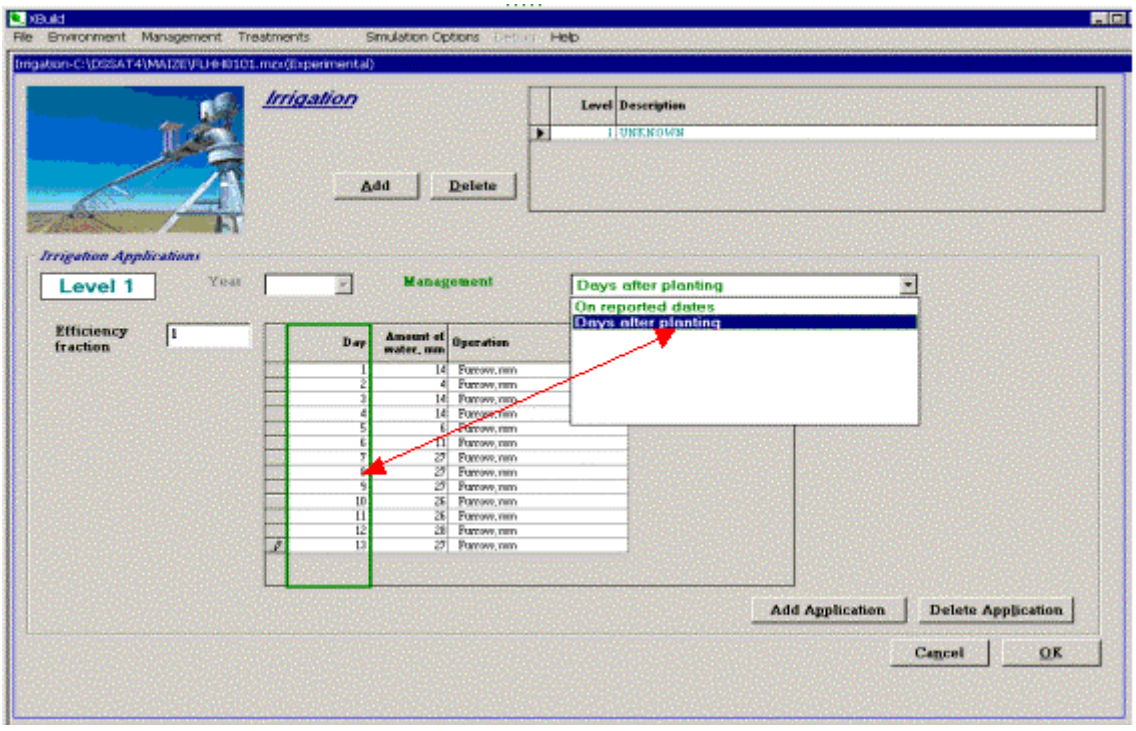

Figure 16. Edit Irrigation Applications on **Days after planting**.

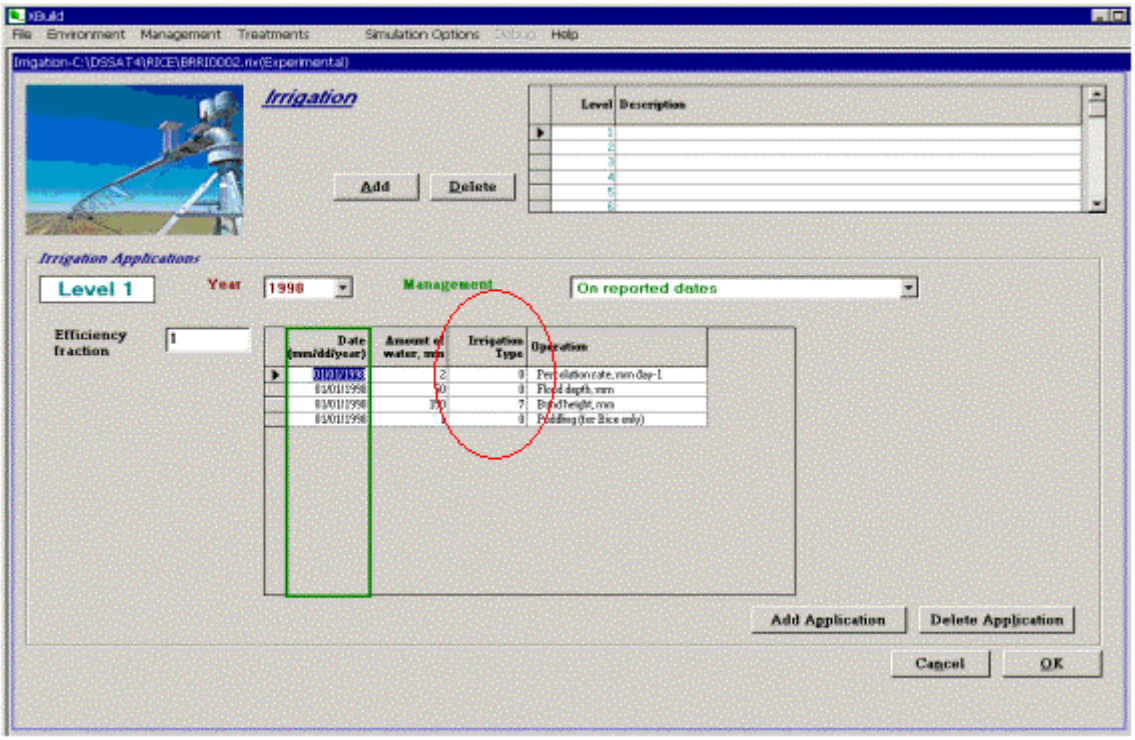

Figure 17. Edit Irrigation Applications for **Rice**.

1.4.3.3.4 Fertilizer

The **Fertilizer** option allows the user to modify variables and options associated with fertilizing, which includes fertilizer date, fertilizer material, fertilizer application/placement, application depth, amount of N, P, K, Ca, and other elements in applied fertilizer.

The user may select a **Management** option **On reported dates** (Figure 18) or **Days after planting** (Figure 19). In the first case, the table has a the first column **Dates (mm/dd/year)** and in the second case, the column will have the header **Days.** The selection of **Management** option has to be consistent with **Simulation options** .

The list of **Year**s is given for references.

You may edit, add or remove fertilizer data on the screen. After all necessary modifications the screen data can be saved with the **OK** button. To save the information to the file, select **File/Save** menu option.

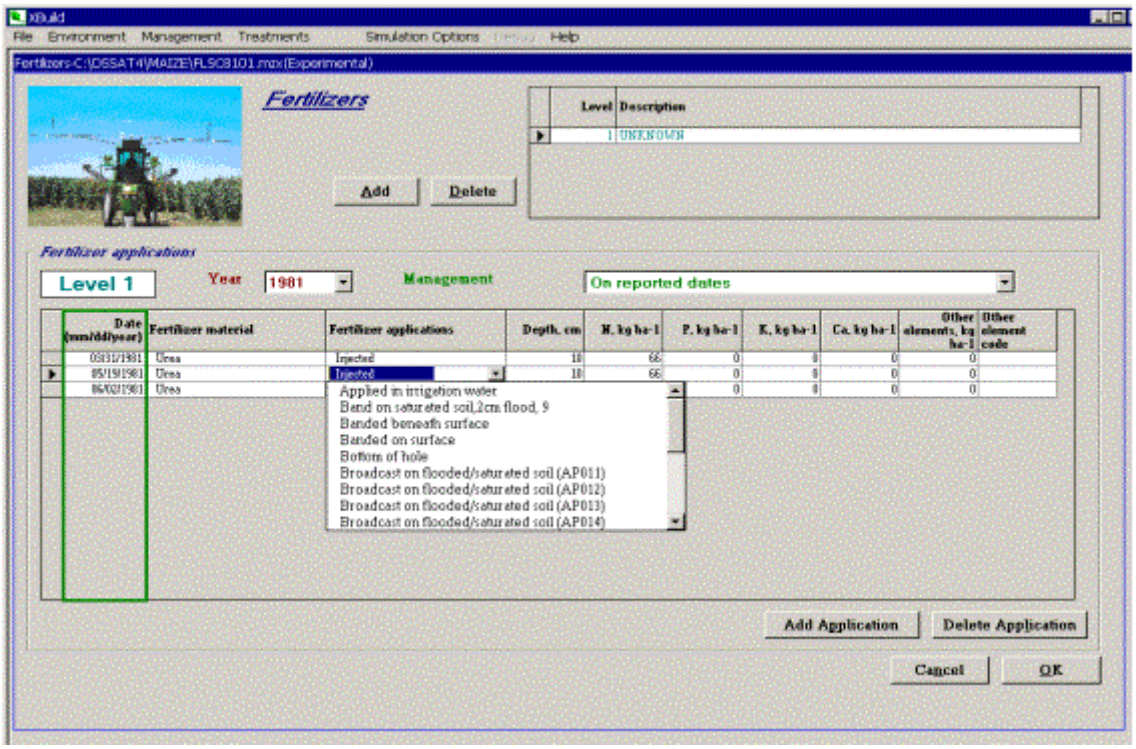

Figure 18. Edit Fertilizer Applications **On reported dates**.

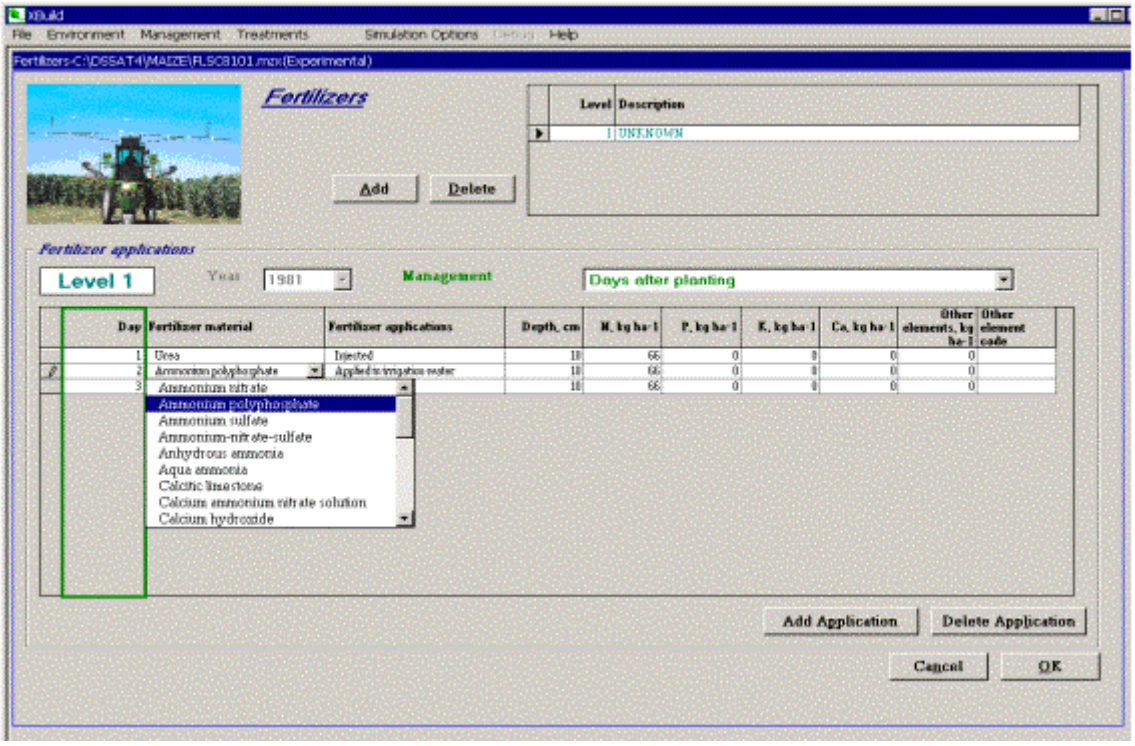

Figure 19. Edit Fertilizer Applications on **Days after planting**.

1.4.3.3.5 Organic Amendments

The **Organic Amendments** option allows the user to modify/enter data related to crop organic amendments at the start of simulation. This includes incorporation date, residue material, residue Nitrogen concentration, residue Potassium concentration, residue incorporation percentage, and residue incorporation depth.

The user may select a **Management** option **On reported dates** (Figure 20) or **Days after planting** (Figure 21). In the first case, the table have the first column **Dates (mm/dd/year)** and in the second case, the column will have the header **Days.** The selection of the **Management** option has to be consistent with **Simulation options** .

The list of **Year**s is given for references.

You may edit, add or remove organic amendment data on the screen. After all necessary modifications the screen data can be saved with the **OK** button. To save the information to the file, select the **File/Save** menu option.

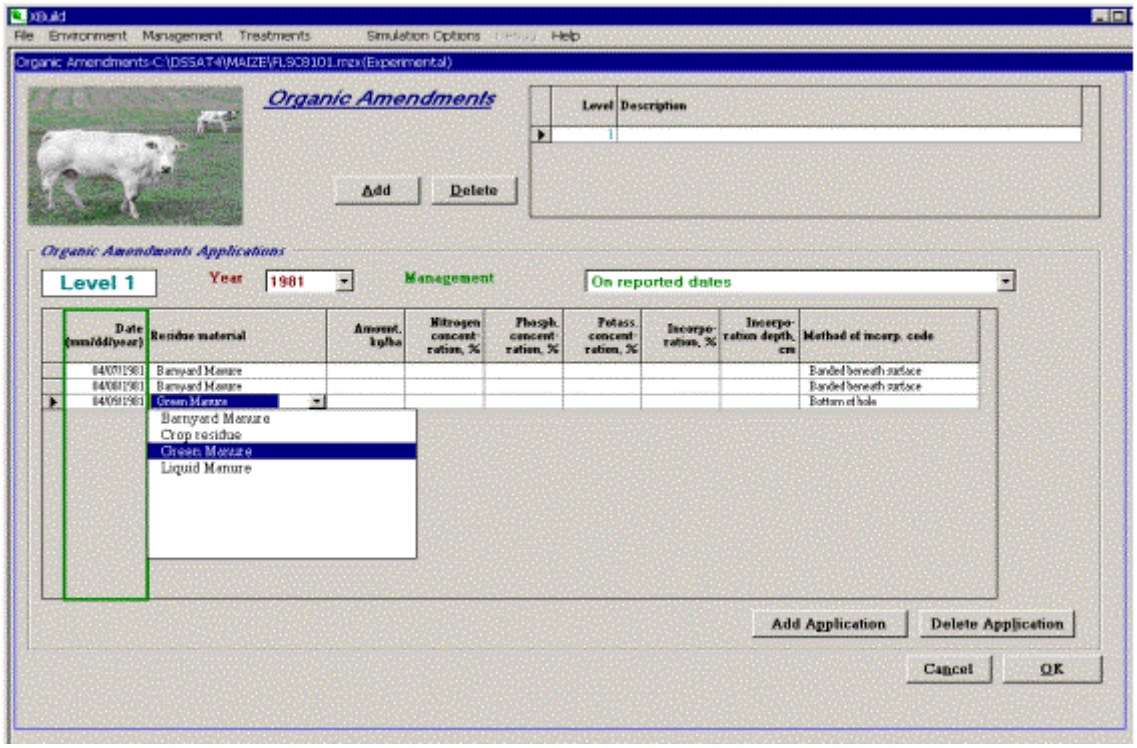

Figure 20. Edit Organic Amendments Applications on **On reported dates.**

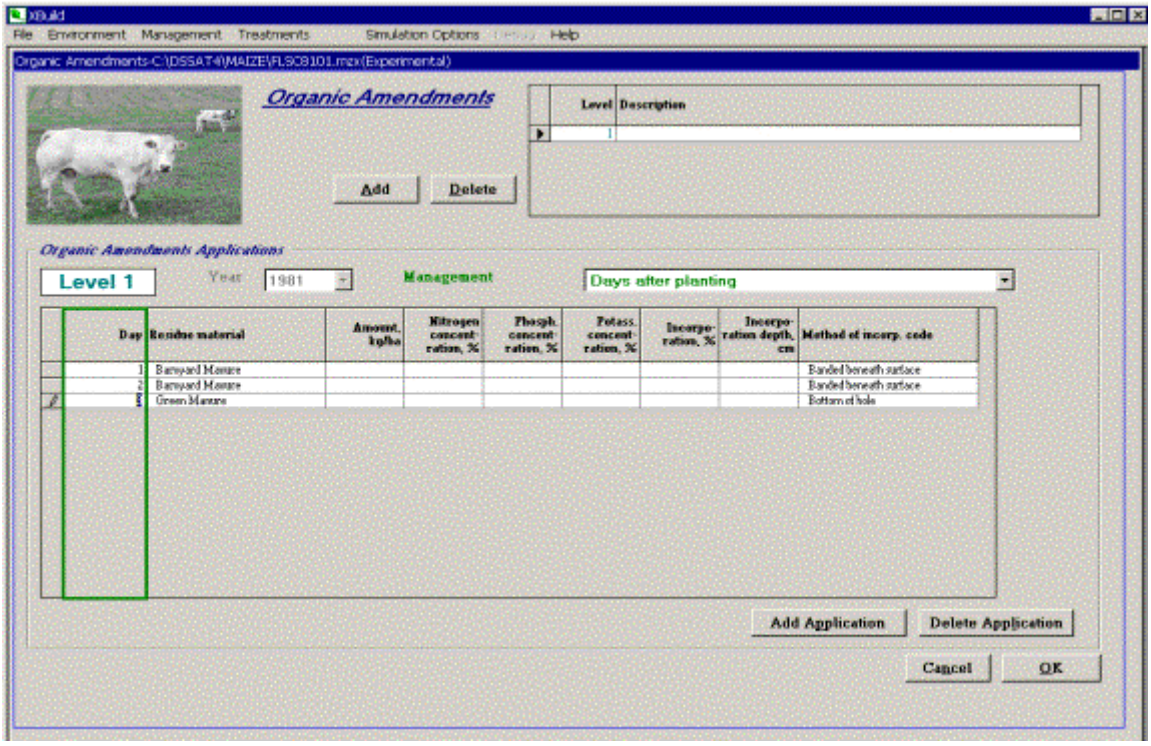

Figure 21. Edit Organic Amendments Applications on **Days after planting.**

1.4.3.3.6 Tillage

The **Tillage** option allows entering detail information about the first tillage application, which includes tillage application date, tillage implement, and tillage depth. Users may change any values in the corresponding boxes on the screen, and select a description from the pull-down list.

The list of **Year**s is given for references.

After all necessary modifications on the screen, data can be saved with the **OK** button. To save the information to the file, select the **File/Save** menu option.

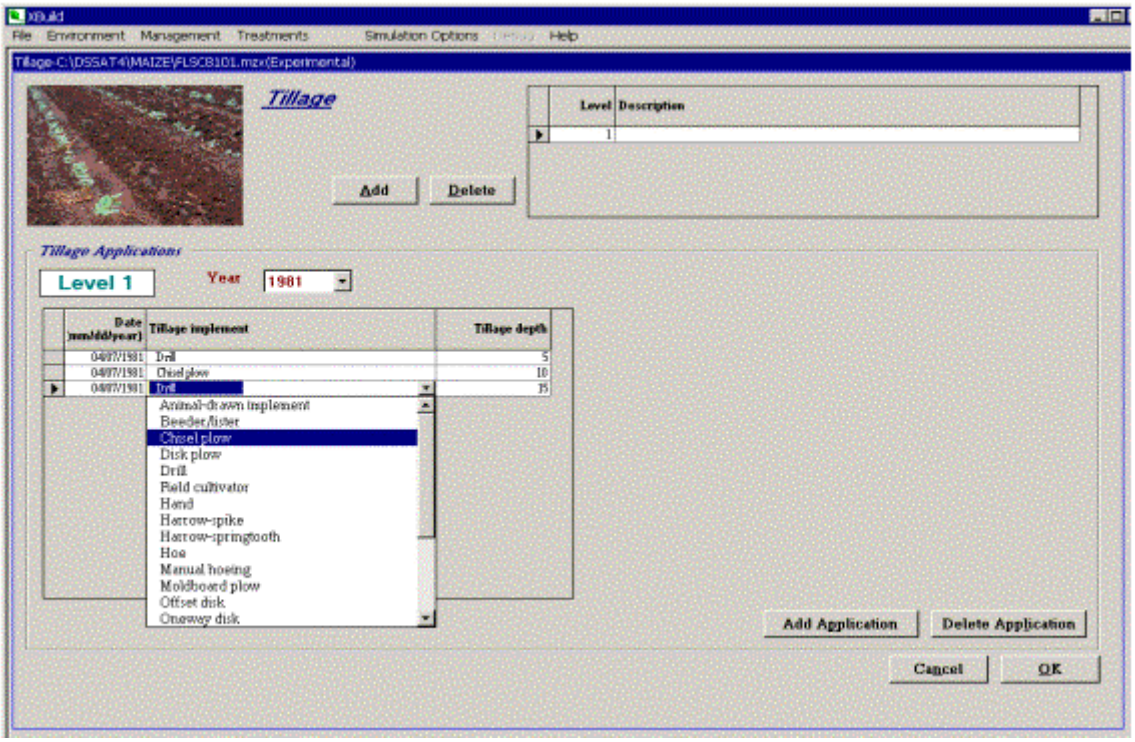

Figure 22. Edit Tillage Applications.

1.4.3.3.7 Harvest

The **Harvest** option allows one to optionally define the conditions for crop harvesting. If this section is omitted, the DSSATv4 model will assume that harvest occurs at the crop stage simulated as **Harvest Maturity**, that is indicated in the **Simulation options**. These are harvest date/days after planting, harvest stage, harvest component, harvest size group, harvest percentage. (Figure 24). Users may change any values in the corresponding boxes on the screen and select a description from the pull-down list.

The **Management** option on the Harvest screen allows selecting **On reported date(s)** or **Days after planting**. (The selection of **Management** option has to be consistent with **Simulation options**.) The first column of the **Harvest Number** table will reflect the selection.
The second column of the table is harvest **Stage**. The code can be selected from the dropdown list that will appear when the cell is selected. The list of harvest stages depends on the selected from **Crop** list crop. If the new Harvest level is added, the **Crop** list will have all crops from **Cultivar** section (Figure 23). If no description is specified in the **Harvest** table **Level/Description**, as default, the name of the crop will be entered.

The list of **Year**s is given for reference.

Harvest **Component** and harvest **Size group** are to be selected from dropdown lists other variables should be entered.

After all necessary modifications the screen data can be saved with the **OK** button. To save

the information to the file, select **File/Save** menu option.

Figure 23. Fragment of Cultivar screen.

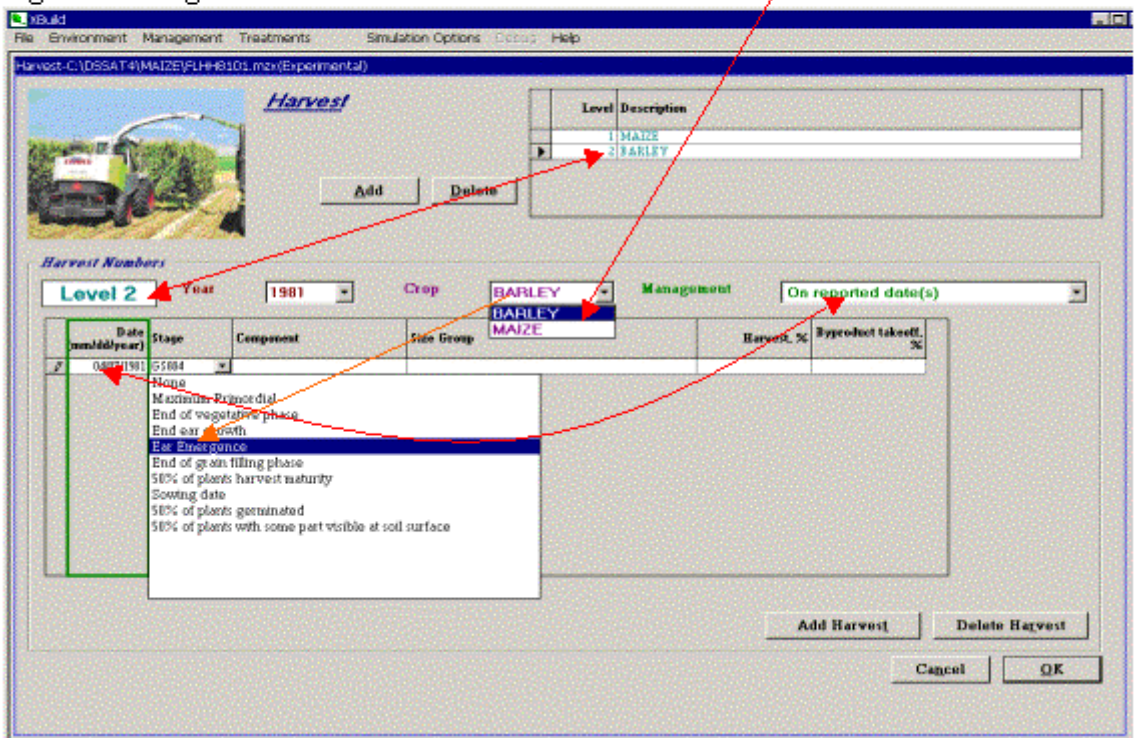

Figure 24. Harvest Screen.

1.4.3.3.8 Chemicals

The **Chemical Applications** option allows editing of detailed and information about a chemical application. This includes the chemical application date, chemical application material, chemical applications amount, the chemical application method, chemical application depth, and chemical application target. Users may change any values in the corresponding boxes on the screen and select a description from the pull-down list (Figure 25).

The list of **Year**s is given for reference.

After all necessary modifications the screen, data can be saved with the **OK** button. To save the information to the file, select the **File/Save** menu option.

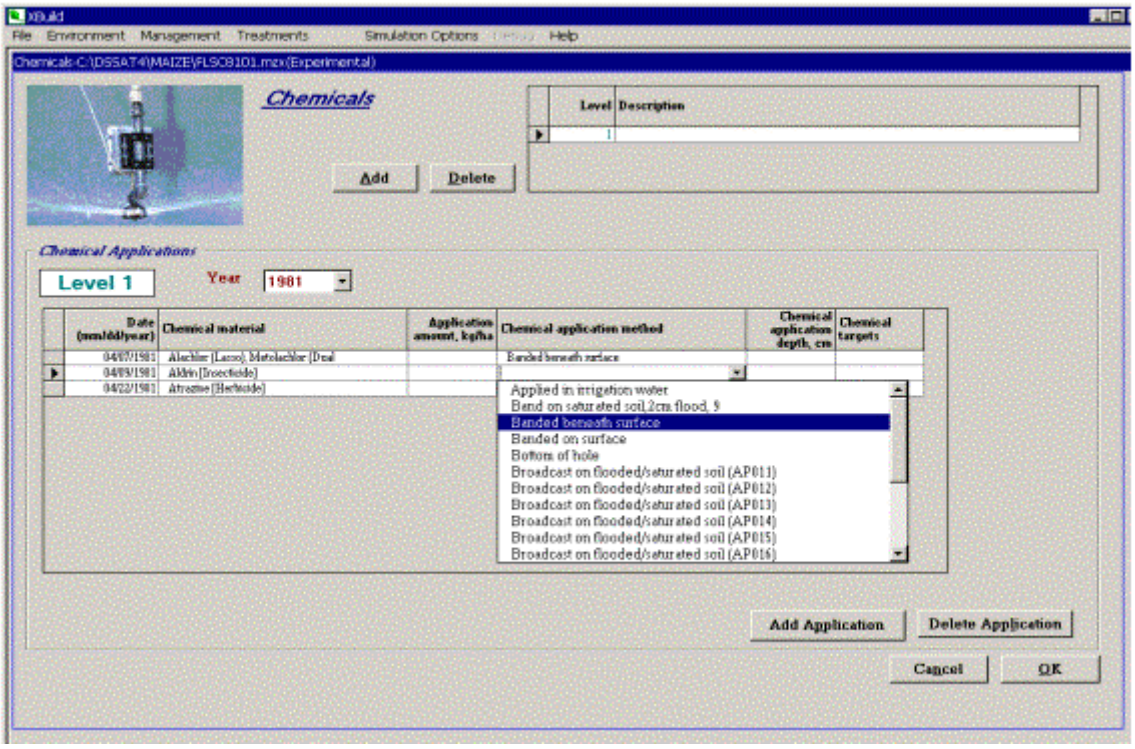

Figure 25. Chemicals screen.

1.4.3.4 Treatments

FILEX can have one or more treatments. Every treatment is a combination of different factors that corresponds to the specific section defined for this particular experiment.
The program allows creating new treatments and modifying existing treatments. The Treatment screen will display a table for creating/editing the treatments (Figure 26). The program design does not allow entering manually the factor level; instead it allows selecting the factor level from drop down lists.

Important: *The user must first add information to* ***Fields*****,** ***Planting*****,** ***Initial Conditions****, and* ***Cultivars****, and THEN open* ***Treatment*** *page to select the combination of those section for each desired treatment.*

Note: *If data are incorrect or no data are in* ***Simulation*** *section, the program has already added default Simulation control data to the scenario. The default data depends on the type of file is being designed (experimental, seasonal, sequence, or spatial). The data are been read from one of the files: Simulate.txt, Seasonal.txt, Sequence.txt, or Spatial.txt. The files come together with the installation of the program and can be found in the same directory, where the XBuild program has been installed.*

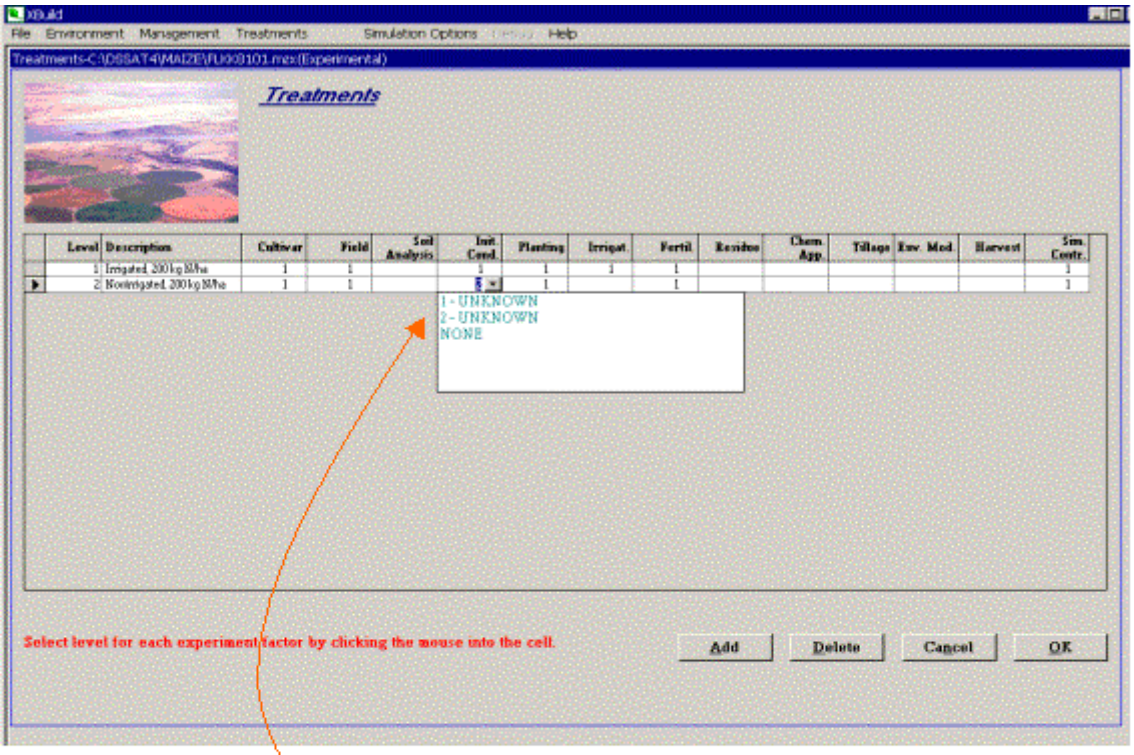

Figure 26. Treatment Screen.

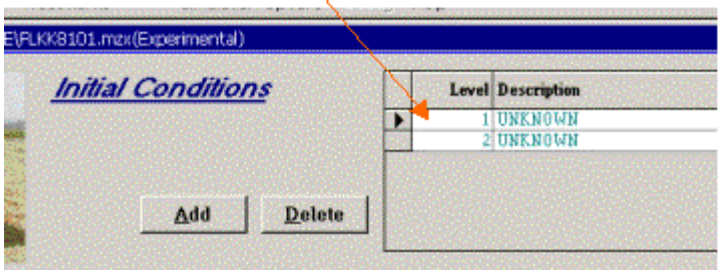

Figure 27. Initial Conditions Screen.

After all necessary modifications the screen data can be saved with the **OK** button. To save the information to the file, select **File/Save** menu option.

1.4.3.5 Simulation Options

The **Simulation Options** section in FILEX has two basic functions. It specifies the options to be used in a particular simulation run and controls the types and frequencies of outputs to be obtained. The **Options** specifies whether the water and nitrogen and other will be used. The **Methods** specifies the methods for computing processes such as evapotranspiration and photosynthesis. The **Management** section specifies whether different management operations, such as planting and irrigation, are to be based on recorded data as input in the FILEX or are to be simulated internally based on automatic management options specified in this section. The **Output** line specifies the frequency of daily outputs and the types of outputs to write. The second function of the Simulation Control section is to specify the parameters for controlling **Automatic Management** in the simulation (if any are used) for **Planting**,

Irrigating, applying **Nitrogen** and **Organic Amendments**, and **Harvest**ing. While changing options in the **Automatic Management** section you need to be consistent with the experimental data in the file. As an example, take **Irrigation applications** section. First, check treatment combinations, and for each treatment make the correspondence between Irrigation factor and Simulation factor levels (the arrows ↔ and ↔ on Figures 31 and 32) Second, check the management options (the arrow ↔ on Figures 31 and 32). Check the dates.

One Simulation Control section is required for each FILEX, and more than one could be used to control simulation for different treatments if needed.
If XBuild is creating a new FILEX, or if it of reads a file with an incorrect Simulation Control section,, default data are added.

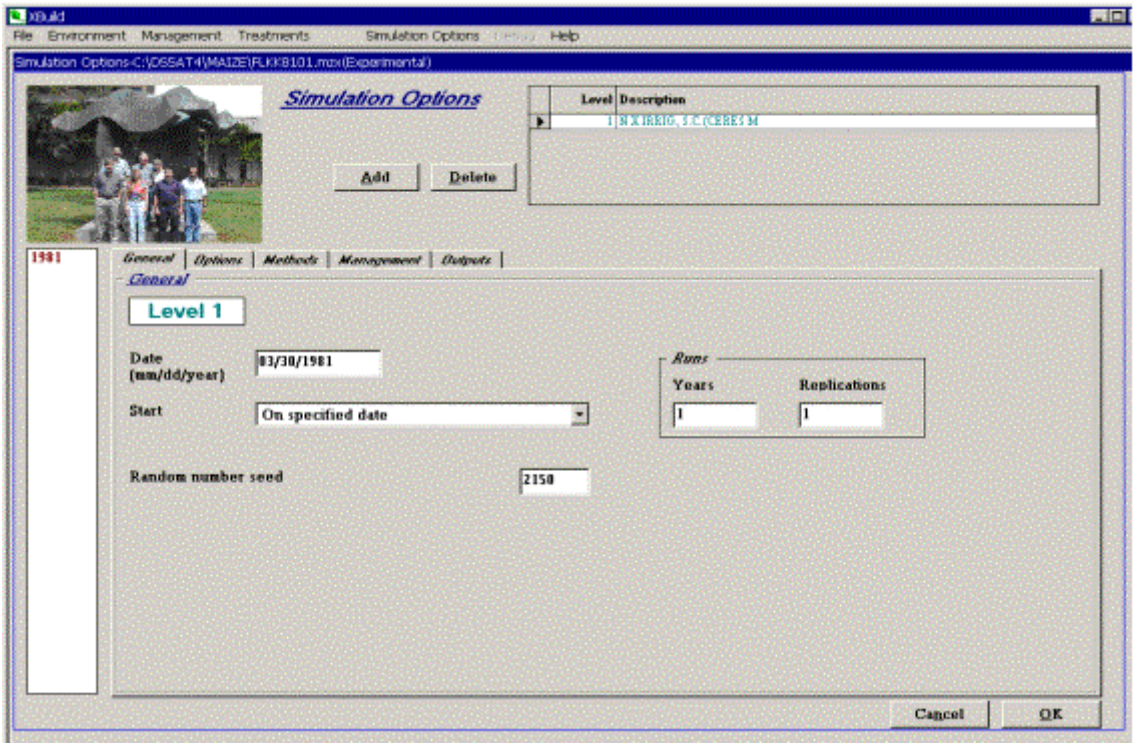

Figure 28. Simulation Options screen/General.

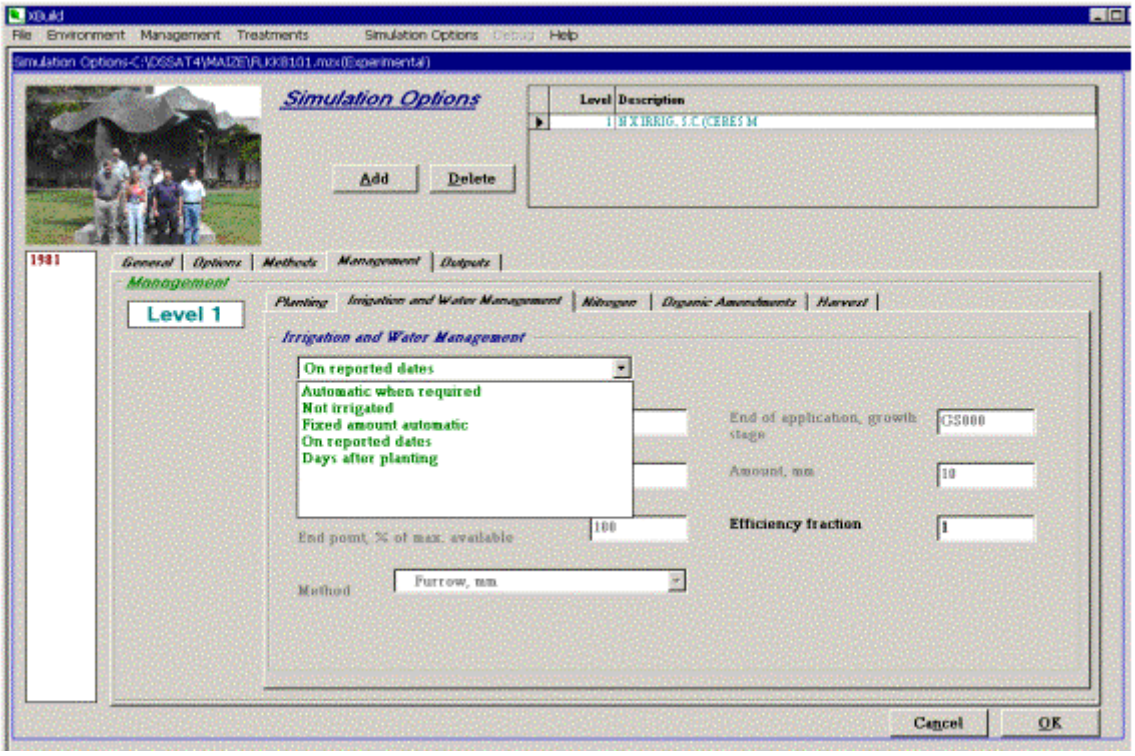

Figure 29. Simulation Options screen/Methods.

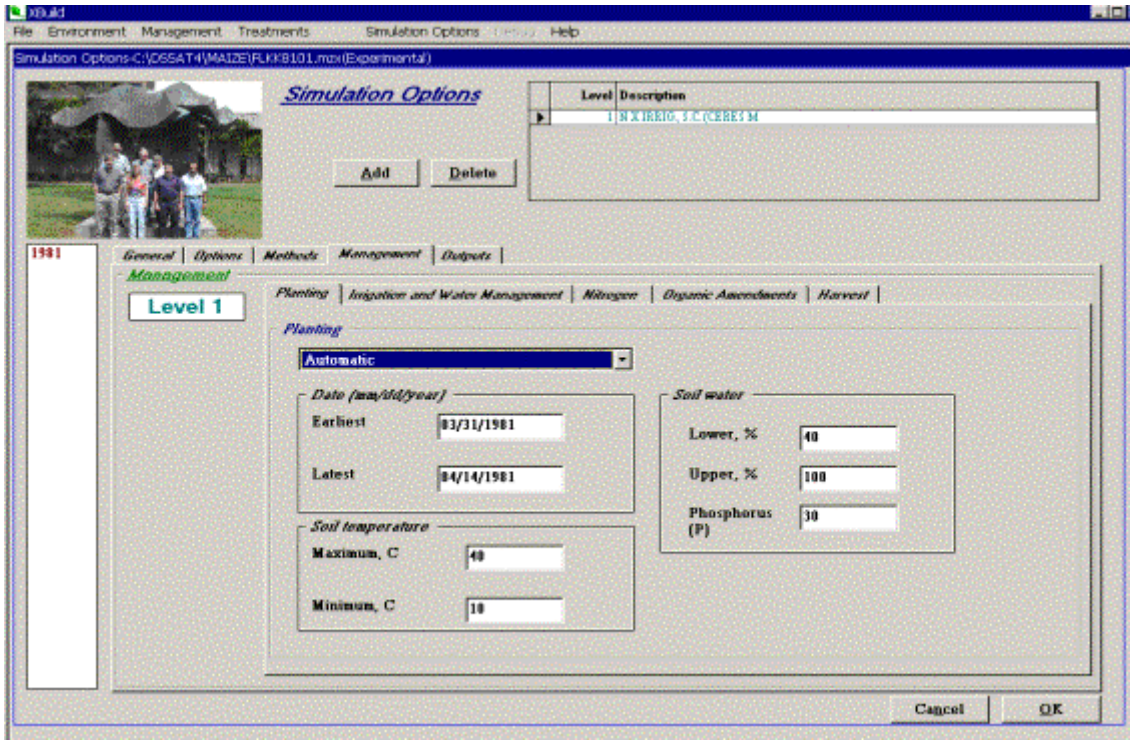

Figure 30. Simulation Options screen/Management.

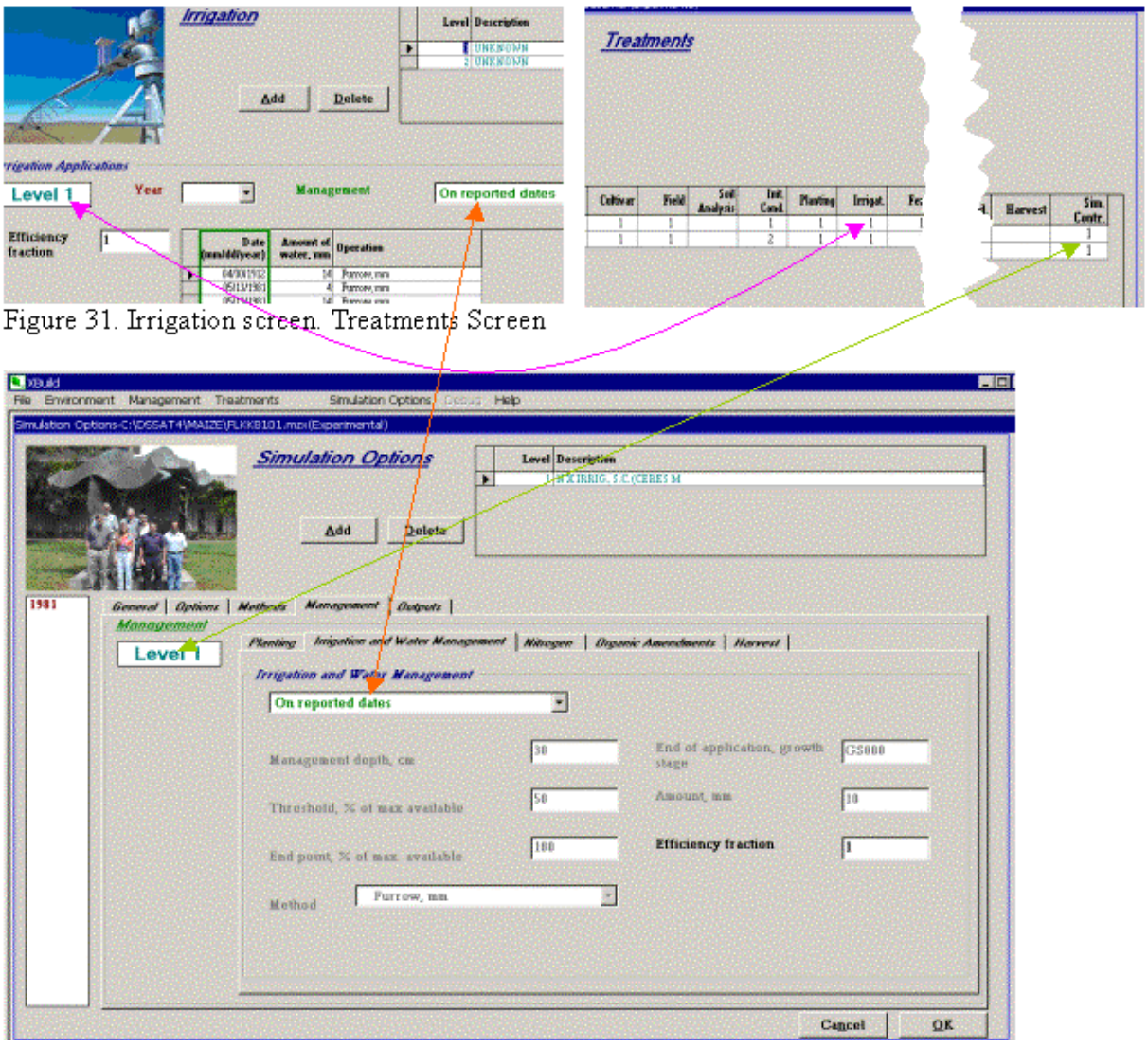

Figure 31. Irrigation screen. Treatments Screen

Figure 32. Simulation Options/Management/Irrigation. (the arrows ↔ and ↔ show the level factors for Irrigation and simulation control option for a selected treatment The arrow ↔ show the correspondence between Management options in Simulation options Sections and Irrigation section.

1.4.4 Print Preview

The print preview option is available under the **File** menu in XBuild. When users click on the **Print Preview** option, the **File preview** window will appear. Print preview allows users to display an experiment file while they are being created or edited. Using the scroll bar on the right corner in the window, users can go to the bottom of the file. Users have to click on the **Refresh** button to see current changes. To close print preview, click on the **OK** button. An example is shown in Figure 34.

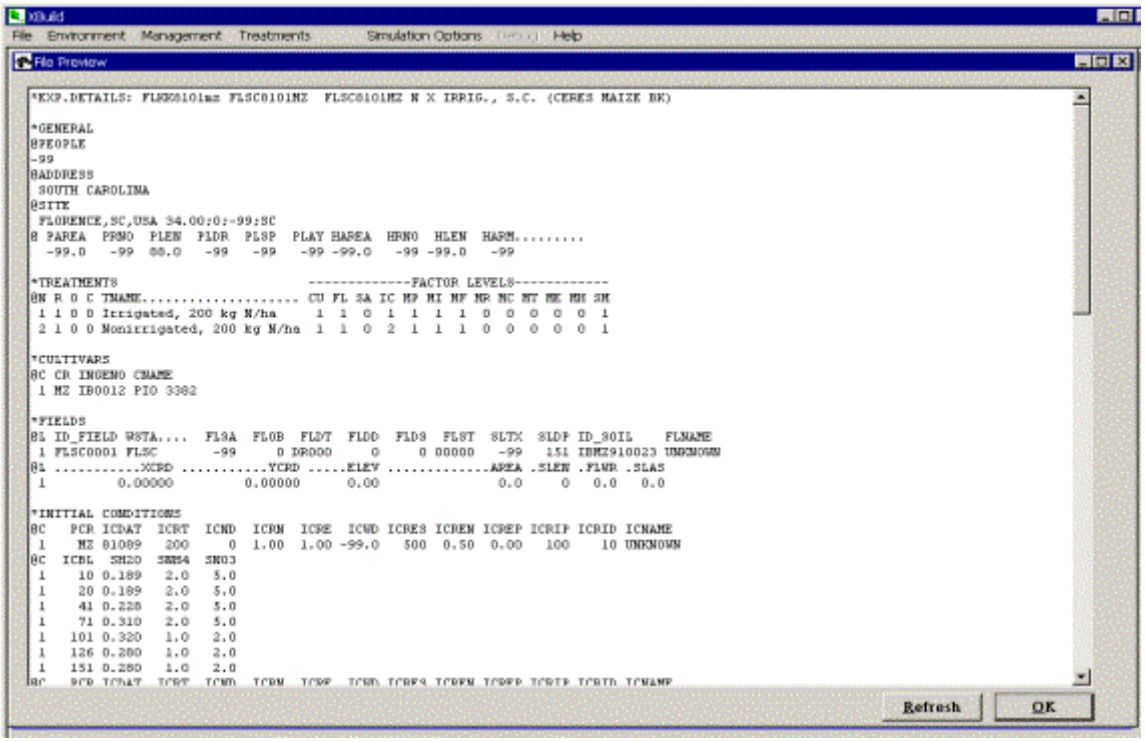

Figure 34. An example of a FILEX opened/edited with the XBuild program.

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Jones, J. W., L. A. Hunt, G. Hoogenboom, D. C. Godwin, U. Singh, G. Y. Tsuji, N. B. Pickering, P. K. Thornton, W. T. Bowen, K. J. Boote, and J. T. Ritchie. 1994. Input and Output Files. In DSSAT version 3. A Decision Support System for Agrotechnology Transfer. Volume 2. G. Y. Tsuji, G. Uehara, and S. Balas (eds.). University of Hawaii. Honolulu, HI. pp. 1-94.

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Chapter 3

DSSAT v4 Soil Data Editing Program (Sbuild)

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SBuild

Create/edit soil input files for evaluation and application on crop simulation models for DSSATv4

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Table of Contents

1 SBuild

1.1 Purpose

The soil file (Soil.sol) contains data on the soil profile properties. These data are used in the soil water, nitrogen, phosphorus and root sections of the crop models. The purpose of SBuild is to provide an effective tool for creating and modifying the soil files.

SBuild is a key-mouse driven windows program that allows the user to enter data into tables, freeing the user from possible formatting errors associated with entering data directly into an ASCII file. The program will also calculate missing data before saving.

1.2 System Requirements

- PC with at least 35 MB of free disk space
- Windows 95/98/NT/2000/XP Operating System
- DSSAT v4
- A display with at least 800x600 resolution recommended

1.3 Installation

Insert the installation CD and run the setup program. Windows will execute the setup program and display two preliminary dialog boxes. Then the program will display the dialog box (Fig.1). Although the setup program lets the user select the directory to install the program, it is recommended that the default directory be used. The default directory for installing SBuild is C:\DSSAT4\Tools\SBuild\. After clicking on the button shown in Figure 1, the installation begins.

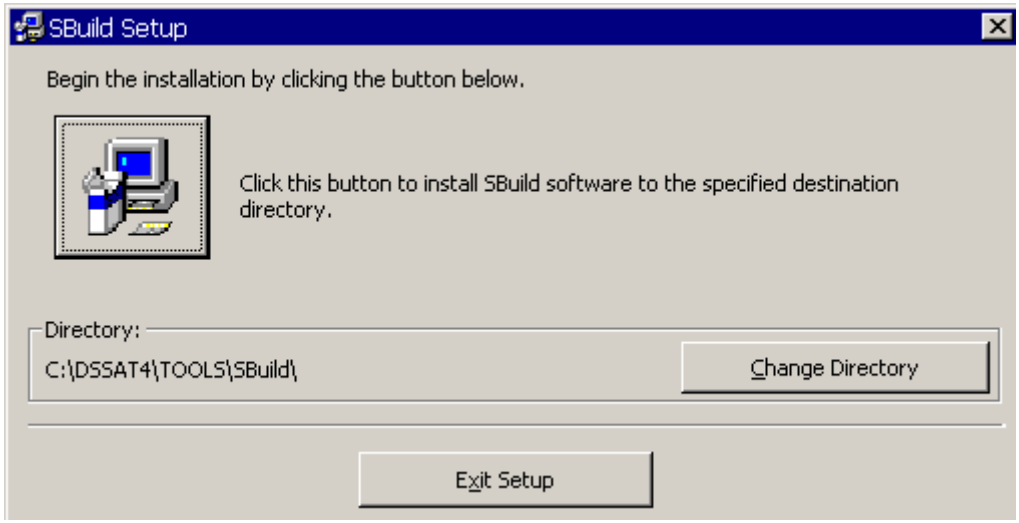

Figure 1. Window displayed by Setup.exe, prompting the user to click the button to begin installation, and offering an opportunity to change installation directory.

During installation, the program registers all OCXs (ActiveX controls) and copies all necessary files. If some of the files already exist on your system, warning messages will be displayed. It is recommended that you keep the newest version of the files when you are prompted.
If during the installations some problems occur, see **DSSATv4 Help, Troubleshooting**

After the installation is completed, SBuild is ready to use without rebooting the computer.

1.4 Tutorial User's Guide

SBuild was designed to help the users create or edit soil files easily to avoid major errors like typos, format errors, errors with calculated values, etc

1.4.1 Soil file

The file contains information that is available for the soil at a particular experimental site, and supplementary information extracted from a soil survey database for a soil of the same taxonomic classification as the soil at a the experimental site (Fig.2).

```
*IB00000002  IBSNAT      SIC      150 DEFAULT - MEDIUM SILTY CLAY
@SITE        COUNTRY          LAT     LONG SCS FAMILY
 Generic     Generic           -99     -99  Generic
@ SCOM  SALB  SLU1  SLDR  SLRO  SLNF  SLPF  SNHB  SNPX  SNKE
   -99  0.11   6.0  0.20  87.0  1.00  1.00 IB001 IB001 IB001
@  SLB  SLMH  SLLL  SDUL  SSAT  SRGF  SSKS  SBDM  SLOC  SLCL  SLSI  SLCF  SLNI  SLHW  SLHB  SCEC  SADC
     5   -99 0.280 0.380 0.490 1.000   -99  1.35  1.74  50.0  45.0   0.0  0.17   6.5   -99   -99
    15   -99 0.280 0.380 0.490 1.000   -99  1.35  1.74  50.0  45.0   0.0  0.17   6.5   -99   -99
    30   -99 0.280 0.380 0.490 0.819   -99  1.36  1.66  50.0  45.0   0.0  0.17   6.5   -99   -99
    45   -99 0.280 0.380 0.490 0.607   -99  1.36  1.45  50.0  45.0   0.0  0.15   6.5   -99   -99
    60   -99 0.280 0.380 0.490 0.607   -99  1.36  1.45  50.0  45.0   0.0  0.15   6.5   -99   -99
    90   -99 0.280 0.380 0.490 0.368   -99  1.37  1.09  50.0  45.0   0.0  0.11   6.5   -99   -99
   120   -99 0.280 0.380 0.490 0.202   -99  1.38  0.65  50.0  45.0   0.0  0.07   6.5   -99   -99
   150   -99 0.280 0.380 0.490 0.111   -99  1.38  0.29  50.0  45.0   0.0  0.03   6.5   -99   -99

*IB00000003  IBSNAT      SIC       60 DEFAULT - SHALLOW SILTY CLAY
@SITE        COUNTRY          LAT     LONG SCS FAMILY
 Generic     Generic           -99     -99  Generic
@ SCOM  SALB  SLU1  SLDR  SLRO  SLNF  SLPF  SNHB  SNPX  SNKE
   -99  0.11   6.0  0.10  89.0  1.00  1.00 IB001 IB001 IB001
@  SLB  SLMH  SLLL  SDUL  SSAT  SRGF  SSKS  SBDM  SLOC  SLCL  SLSI  SLCF  SLNI  SLHW  SLHB  SCEC  SADC
     5   -99 0.280 0.380 0.490 1.000   -99  1.35  1.74  50.0  45.0   0.0  0.17   6.5   -99   -99
    15   -99 0.280 0.380 0.490 1.000   -99  1.35  1.74  50.0  45.0   0.0  0.17   6.5   -99   -99
    30   -99 0.280 0.380 0.490 0.819   -99  1.36  1.66  50.0  45.0   0.0  0.17   6.5   -99   -99
    45   -99 0.280 0.380 0.490 0.607   -99  1.36  1.45  50.0  45.0   0.0  0.15   6.5   -99   -99
    60   -99 0.280 0.380 0.490 0.607   -99  1.36  1.45  50.0  45.0   0.0  0.15   6.5   -99   -99

*IB00000004  IBSNAT      SIL      210 DEFAULT - DEEP SILTY LOAM
@SITE        COUNTRY          LAT     LONG SCS FAMILY
 Generic     Generic           -99     -99  Generic
@ SCOM  SALB  SLU1  SLDR  SLRO  SLNF  SLPF  SNHB  SNPX  SNKE
   -99  0.12   6.0  0.40  77.0  1.00  1.00 IB001 IB001 IB001
@  SLB  SLMH  SLLL  SDUL  SSAT  SRGF  SSKS  SBDM  SLOC  SLCL  SLSI  SLCF  SLNI  SLHW  SLHB  SCEC  SADC
     5   -99 0.106 0.262 0.462 1.000   -99  1.37  1.16  10.0  60.0   0.0  0.12   6.5   -99   -99
    15   -99 0.106 0.262 0.462 1.000   -99  1.37  1.16  10.0  60.0   0.0  0.12   6.5   -99   -99
    30   -99 0.106 0.262 0.462 0.819   -99  1.37  1.10  10.0  60.0   0.0  0.11   6.5   -99   -99
    45   -99 0.107 0.262 0.462 0.607   -99  1.37  0.97  10.0  60.0   0.0  0.10   6.5   -99   -99
    60   -99 0.107 0.262 0.462 0.607   -99  1.37  0.97  10.0  60.0   0.0  0.10   6.5   -99   -99
```

Figure 2. Soil.sol file (fragment)

The first line of data contains the soil identifiers, information on soil texture (Ref.1) and depth, that derives from the soil layer information, a description that could relate to the soil classification according to a specified, locally used system and a country. The third line contains geographic data together with taxonomic information. The third line contains information on soil properties that do not vary with depth, such as surface albedo, and on

measurement techniques. The forth line contains data on the first layer; the fifth line on the second layer, and so on for each succeeding layer in the soil profile. The second tier of the information for the soil layers is optional and contains variables related to the soil phosphorus balance and the nutrients. Soil organic carbon is included in this file because it is frequently used to compare other soil properties. The percentage of sand is assumed to be 100 minus the percentage of clay and silt, and thus is not included as an input. The number of layers, and the thickness of each layer should be the same as those in the soil analysis and initial condition sections of the experiment file whenever possible. The file may contain properties for several soils. The data for each new that is created soil are simply appended to the file.

1.4.2 Program menu

SBuild is like many other Windows applications. It has a menu bar at the top of its main screen with the following menu options:

- **File**
- **Profile**
- **Help**

1.4.2.1 File

The **File** menu options allows users to

- **New**: Create a new soil file.

Soil files may contain properties of one or more soils. The soil file normally used is SOIL.SOL. However, users may create other files soils with names **.SOL, where the ** refers to the 2-character institute code used in DDSAT (such as CO.SOL, EB.SOL, and RO.SOL shown in the dialog box Fig.3). A new soil file will be started with a new soil profile. When a **New** file option is selected, the program will prompt with screens for creating a new soil profile. Entering the data in the corresponding boxes and tables and following Next buttons allow the user to create the profile. Menu **Save File** will finish creating the new soil file.

- **Open:** Opens an existing soil file.

The common dialog box allows the user to select any Soil file (Fig.3).

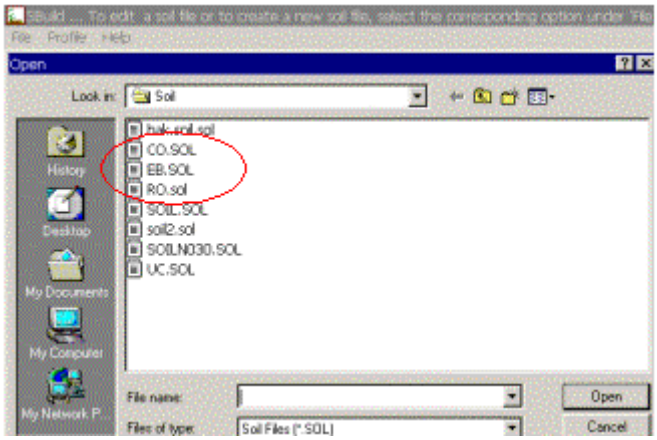

Figure 3. Common dialog box for selection a soil file.

- **Close:** Closes the opened Soil file.

Before opening a soil file, the user must close an open file. If the file was not saved warning message will prompt

to save the file.

- **Save As :** Saves the opened file with a selected name.

- **Save:** Saves the opened file. The file will be saved with the name indicated on the upper panel (Fig.4).

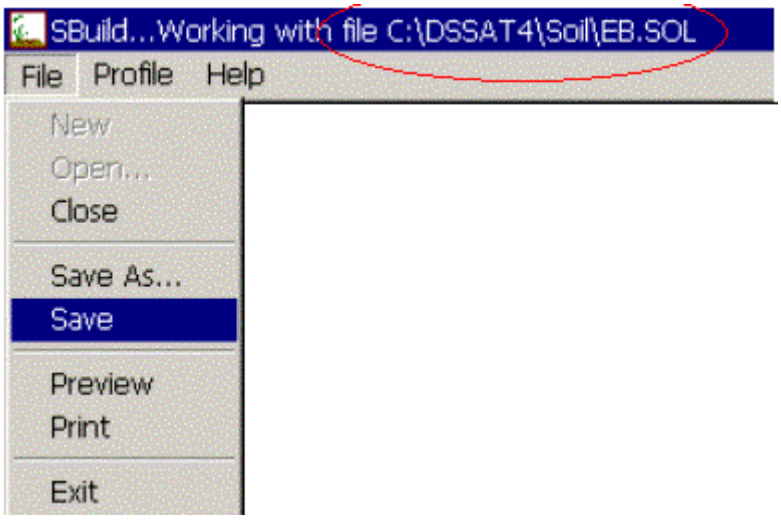

Figure 4. The file "C:\DSSAT4\SOIL\EB.SOL"will be saved if **File/Save** is selected.

- **Preview:** Previews the opened soil file. Before saving or printing the user can view the soil file that is indicated on the upper panel.
- **Print:** Prints the opened soil file.

1.4.2.2 Profile

Since each soil file may contain properties for a number of soil profiles, this **Profile** button allows users to create a **New** soil within a file that is open, **Edit** soil properties (one soil profile at a time), etc.

- **New**: Create a new soil profile in the currently opened soil file. To create a new profile the user must enter the data in the corresponding boxes and tables, follow the **Next** buttons and then **Save** the profile. To save to profile in the file the user must also **Save** the file. The new profile will be added to the end of the file.
- **Edit:** Displays the list of all available soil profiles for selection.
- **Delete:** Deletes a profile from the opened soil file. This profile will be selected from the list of all available soils in the file.
- **Close:** Closes an opened profile. After all necessary modifications the profile must be closed.
- **Save As:** Saves the opened profile with a selected name. The name of the profile has predefined format of 10 characters (Fig. 5). This is "aabbyynnnn", where:

"aa" - the Institute ID (for example "IB" (Fig. 6));
"bb" - Site ID;
"yy" – Year (for example "91" (Fig. 6));
"nnnn" – the profile number (for example "0001" (Fig. 6));

***Note**: If the **Institute ID or the Year of a soil profile is changed** , the **Save** menu option will activate the **Save As** option.*
*If the changes to the profile to be saved, then the **Save** or **Save As** option must be selected before closing the profile.*

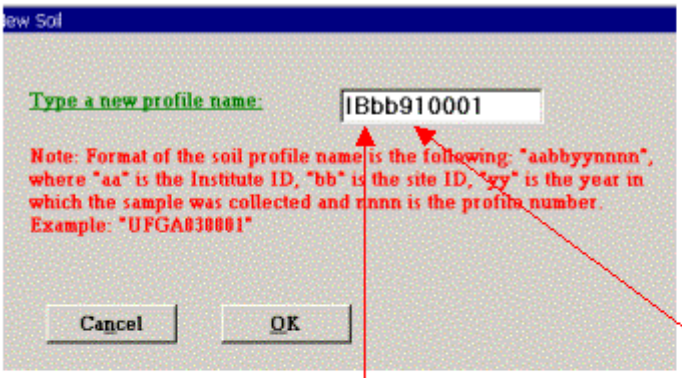

Figure 5. A soil profile **Save As** screen.

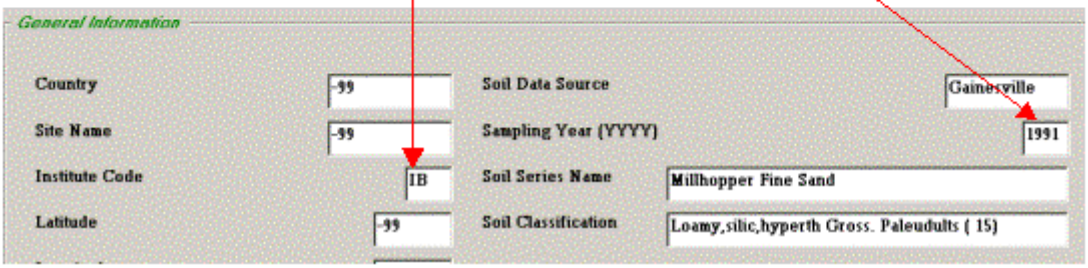

Figure 6. General information screen.

- **Save:** Saves the changes to the profile.
- **Preview:** Previews the selected profile.
- **Print:** Prints the opened profile.

***Note:** No changes to the opened file will be saved unless File/Save or File/Save As is applied.*

1.4.2.3 Help

Opens help file

1.4.3 Getting Started

SBuild is designed for users who need to create or modify soil information needed to run DSSAT crop modules. First the program starts with opening the SOIL.SOL file located in the

indicated in the DSSAT4 registry folder (DSSATPRO.FLE, Fig 7).

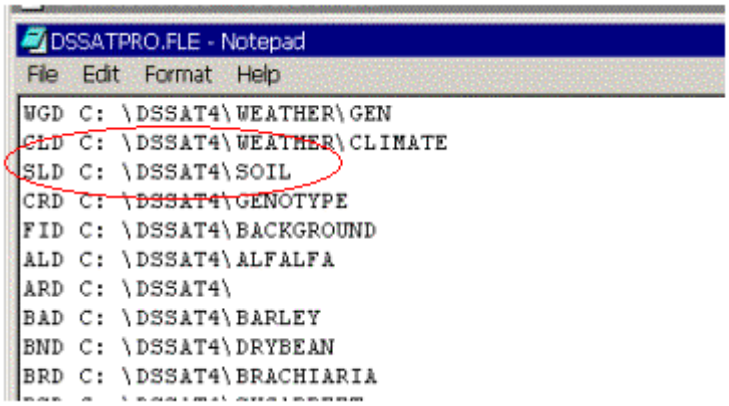

Figure 7. The file DSSATPRO.FLE.

1.4.3.1 Open soil

The program starts with opening SOIL.SOL file. If the user wants to work with other than SOIL.SOL file, it can be closed with the **File/Close** menu option and another file can be opened with the **File/Open** menu option.
After the desired soil file is opened, the user can select the option to edit, create a new, or delete a selected profile. When **New** is selected, the program will open screens with empty boxes and tables. When a selected profile is **Open**ed, the boxes and tables will be filled with the corresponding data. The data can be modified/entered on the screen, and then saved into the file. The program will prompt when incorrect entries are made, and guides the user in creating a new profile using the **Next**, and **Finish** buttons.

Start the program and consider an example of editing the profile "DEFAULT - MEDIUM SILTY CLAY (IB00000002)". in the SOIL.SOL file.

(1) Start the program and close the Help pop up message.
(2) Go to menu options and select **Profile/Edit** (Fig. 8).

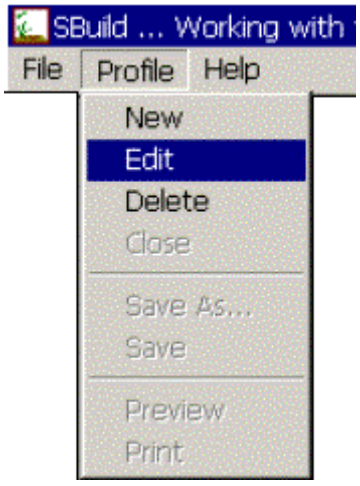

Figure 8 The **Profile/Edit** option is selected(3)

(3) Select the profile "DEFAULT - MEDIUM SILTY CLAY (IB00000002)" (Fig 9).

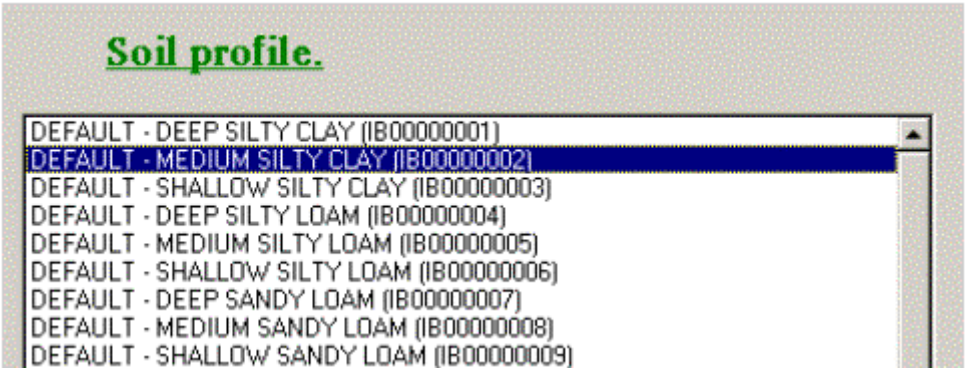

Figure 9. Selected the "DEFAULT - MEDIUM SILTY CLAY (IB00000002)" profile.

After the profile is selected and the button **OK** pushed**,** the screen with **General and Surface Information** of the soil will be shown.

1.4.3.2 General and Surface Information

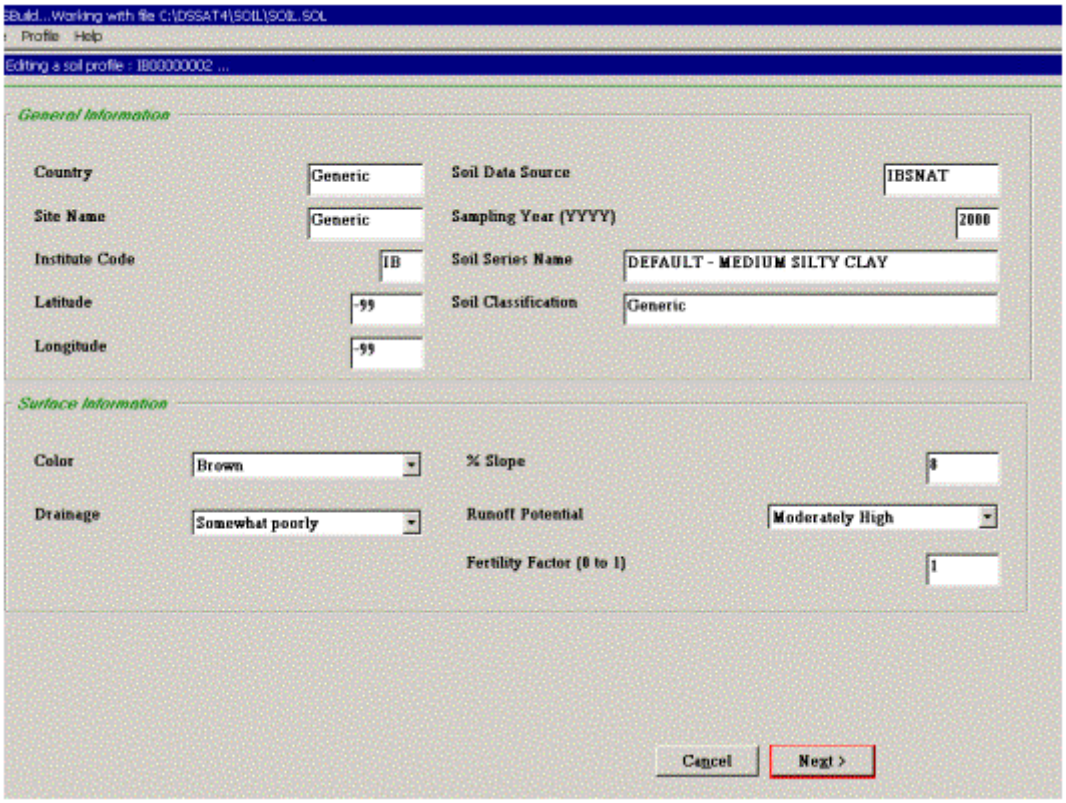

Figure 10. The first screen of the program.

The **General Information** section corresponds to the first two lines on the soil profile . The **Surface Information** section includes (Ref.2):

- The **Color** of the upper horizon is used to approximate the Albedo (**SALB**) as shown in the Table 1:

Table 1. Color Modifiers

Color	**Albedo (SALB)**
Brown	0.13
Red	0.14
Black	0.09
Gray	0.13
Yellow	0.17

- The **Drainage** coefficient (**SLDR**) can be approximated from soil description based on classification given in Table 2:

Table 2. Drainage Classifications.

Drainage	**Drainage coefficient (SLDR)**
Excessive	0.85
Somewhat excessive	0.75
Well	0.60
Moderately well	0.40
Somewhat poorly	0.25
Poorly	0.50
Very Poorly	0.01

- To determine the runoff curve number for cropland soils, it is necessary to decide which of four hydrologic soil groups best describes the soil. Description of the **Runoff Potential** groups is given in Table 3. The curve number (**SLRO**) is determined from the **Slope** of the site using information in Table 4.

Table 3. The soil hydrologic groups needed for selection of a runoff curve number for croplands.

Hydrologic group	Description
A - Lowest Runoff Potential.	Includes deep sands with very little silt and clay, also deep, rapidly permeable loess
B - Moderately Low Runoff Potential.	Mostly sandy soils less deep then A, and loess less deep or less aggregated then A, but the group as a whole has above-average infiltration after thorough wetting.
C - Moderately High Runoff Potential.	Comprises shallow soils and soils containing considerable clay and colloids, though less then that of group D. The group has bellow-average infiltration after thorough wetting.
D - Highest Runoff Potential.	Included mostly clays of high swelling percent, but the group also includes some shallow soils with nearly impermeable subhorizons near the surface.

Table 4. Runoff curve numbers (CN2) for various hydrologic conditions, slops, and conservation practices.

	Hydrologic Condition			
% Slope	**A**	**B**	**C**	**D**
0-2	61	73	81	84
2-5	64	76	84	87
5-10	68	80	88	91
>10	71	83	91	94

When all necessary **General information** and **Surface information** is entered, the **Next** button will lead to the next screen,

1.4.3.3 Input Table

The second screen is called **Input Table**. It contains the table for soil layers data (Fig.11).

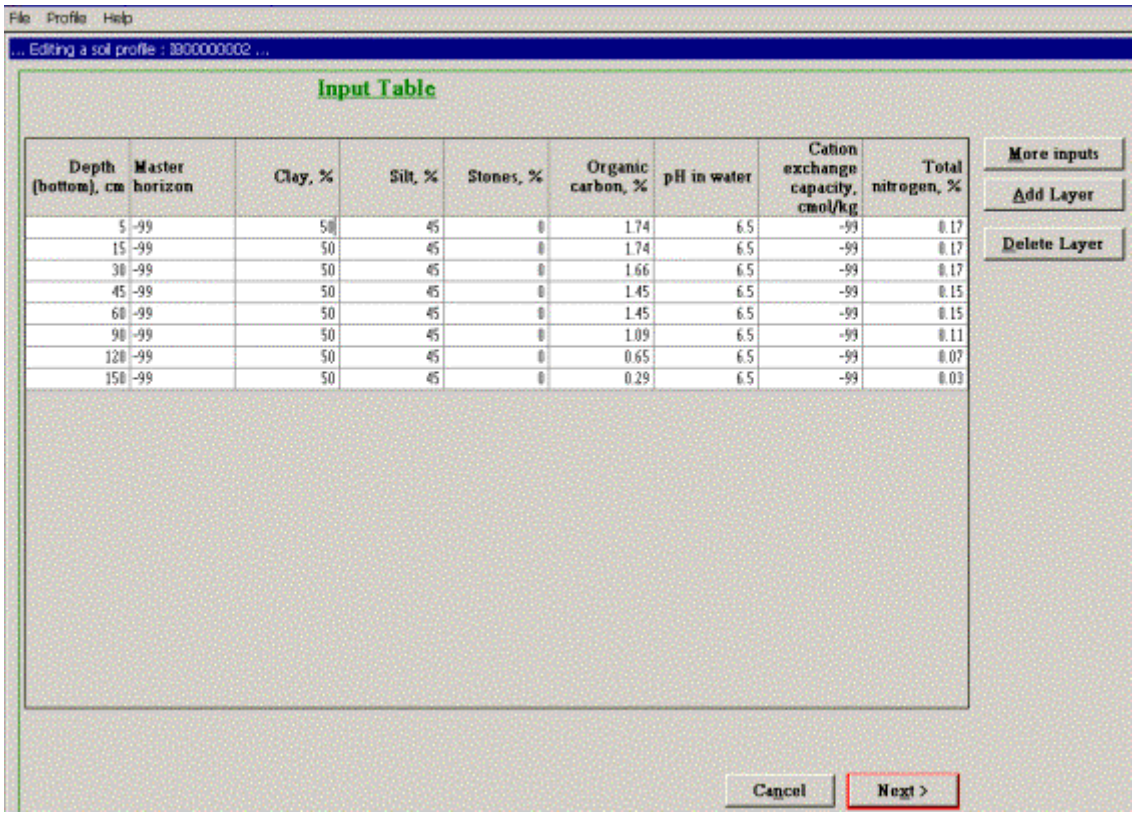

Figure 11. The screen for entering/editing data for the soil layers

The data can be modified in the table. The **Add Layer** button will add a soil layer, the **Delete Layer** button will delete a selected layer.
The button **More Inputs** will open a table with other properties then displayed (Fig.12).

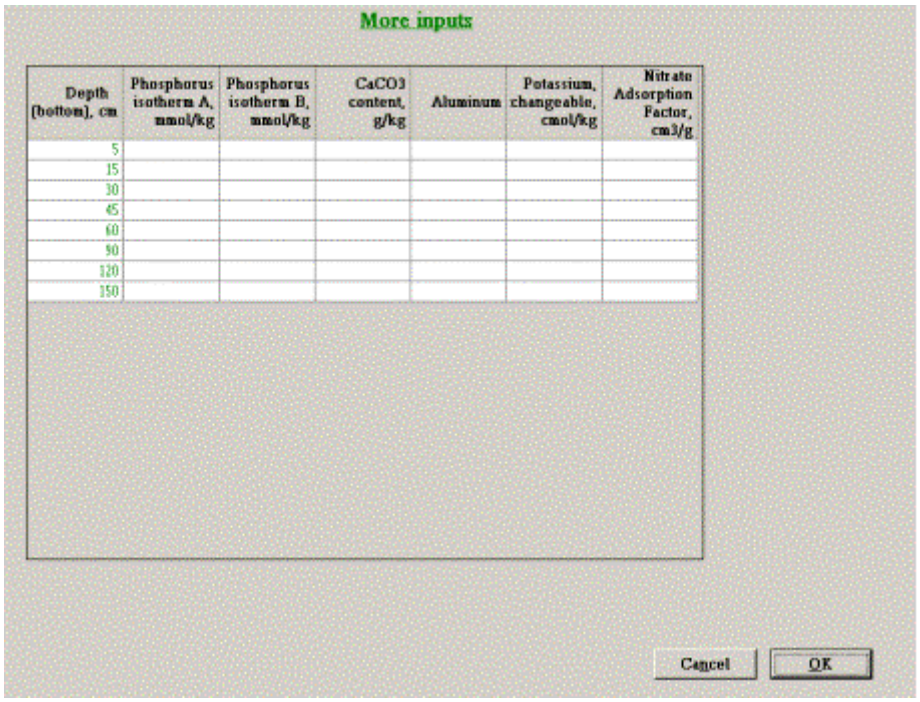

Figure 12. The screen with additional entry for the soil layers.

***Note**: The **More Inputs** table does not have an option to add or delete soil layers. It does not allow making changes to **Depth** values. These changes can be done only on the **Input Table** screen.*

The **OK** button will save the data and return to the **Input Table** screen;
the **Cancel** data will cancel any changes and return to the **Input Table** screen.
If the **More Inputs** table does not have any data, these variables will not be shown in the soil profile.

When all necessary modifications to the **Input Table** are finished, the **Next** button will save the data and open the second soil layers entry screen.

1.4.3.4 Calculate/Edit Soil parameters

Calculate/Edit Soil parameters is the last screen in SBuild. The user can edit or calculate some values using the screen utilities.
The table (Fig.13) on the screen is divided into two parts. One is a snapshot from the previous screen table and displayed only for reference. The other part of the table can be edited by typing the values into the table or calculated by using the **Calculate Missing Values** button.

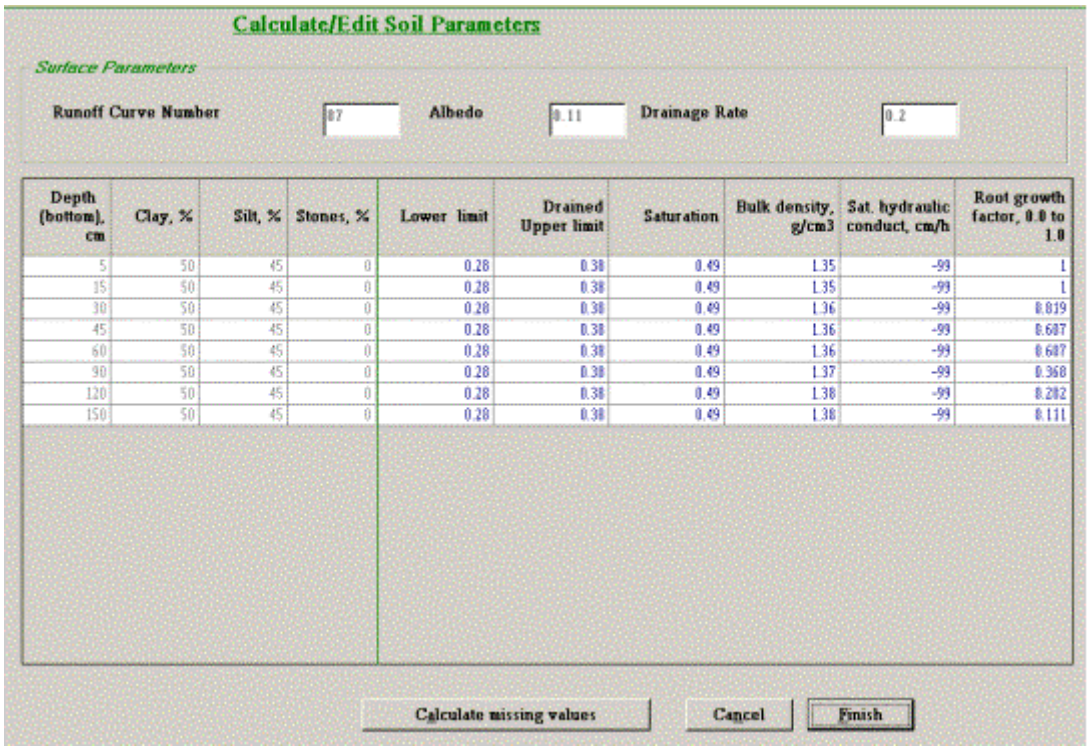

Figure 13. The table for calculating or editing data for soil layers.

There are four columns in the table that cannot be edited: **Depth(SLDP)**, **Clay(SLCL)**, **Silt(SLSI)**, and **Stones(SLCF)**.
There are six columns in the table that can be edited/calculated.: **Lower limit(SLLL)**, **Drained Upper limit(SDUL)**, **Saturation(SSAT)**, **Bulk density(SBDM)**, **Saturated hydraulic conduct(SSKS)**, and **Root growth factor(SRGF)**.
The values can be typed into the cells or can be calculated with the button **Calculate Missing values**.

Calculations are based on:
- Soil **Bulk density** (minerals + SOM + pores) is calculated according to equation in Rawls & Brakensiek 1985 .
- **Saturated hydraulic conduct, Saturation, Drained Upper limit or Lower limit** is calculated with Saxton or Rawls method: If **Organic Carbon(SLOC)** values are missing for any of the layers, then Saxton method)(Ref.4) is used, if **Organic Carbon(SLOC**) values are known for all layers of the soil, then Rawls method (Ref.5) is used.
- For calculating **Root growth factor** , the formula bellow is used:

If [Center Of Layers] > 20
then [Root growth factor**]** = EXP(-0.02 * [Center Of Layers]
Else [Root growth factor**]** = 1

1.4.4 Finish modifying the soil profile

When all calculation and other modifications are complete, the soil can be **save**d with the original name or **Save As** with a new name. Then the soil profile will be **close**d and program is ready for modifying, creating or deleting another profile. If all no more changes for the soil file is needed, the soil file has to be **save**d or **Saved As** and **close**d**.** Now the program can **open** another soil file or create a **new** one**, or the** program can be closed(**Exit**). The saved soil profile can then be used in DSSAT v4 to simulate any cropping system.

1.5 References

Baumer, O.W., and Rice, J.W. 1988. Methods to predict soil input data for DRAINMOD. ASAE Paper No. 88-2564.

Ritchie,.J.T., Godwin, D.C., Singh, U.. 1989. Soil and Water inputs for IBSNAT crop models. In DSSAT. IBSNAT Symposium. Part I. Las Vegas, Nevada. Pp.31-47

Rawls, W.J., and Brakensiek, D.L. 1985. Prediction of soil water properties for hydrologic modeling. In: Jones, E.B. and Ward, T.J. (Eds.), Proc. Symp. Watershed Management in the Eighties. April 30-May 1, 1985, Denver, CO. Am. Soc. Civil Eng., New York, NY. pp.293-299.

Rawls, W.J., Brakensiek, D.L., and Saxton, K.E. 1982. Estimation of soil water properties. Transactions of the ASAE 25, 1316-1328.

Saxton, K.E., Rawls, W.J., Romberger, J.S., and Papendick, R.I. 1986. Estimating generalized soil-water characteristics from texture. Soil Sci. Soc. Am. J. 50, 1031-1036.

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Chapter 4

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Content

1. Welcome to WeatherMan

WeatherMan is an object-oriented tool for importing, analyzing, and exporting climate data for use in crop simulation modeling and other activities. The Windows version has elements similar to the original DOS version, although a key difference exists in that the new version uses Paradox databases to store climate data. The DOS version used a flat-file ASCII system for storing and manipulating data. This help file contains information on most of the key elements of the program, and context sensitive help is also available for most functions of the program.

Some of the topics covered in the help file are listed below, including a complete users guide with sections

- Introduction
- Getting Started
- Managing Weather Data
- Climate File Structure
- References

There are also help topics dealing with the functionality of WeatherMan. You can browse or search the help file for more information on related topics. The primary reference topics on the functionality of WeatherMan include

- Accessing WeatherMan Functions
- Setting Program Preferences
- Importing Exisiting Climate Stations
- Importing Raw Data and Creating New Stations
- Editing Station Information
- Editing Monthly Means
- Editing Weather Data
- Plotting Daily Weather
- Plotting Summary Statistics
- Save and Export Options
- Generating Weather Data
- Locating Weather Stations
- Accessing Web Resources
- About WeatherMan

2. User Guide

2.1. 1. Introduction

2.1.1. Intoduction to Weatherman

Daily weather data are commonly used as input to mathematical models used in water related projects and agriculture. While the models expect the data to be complete and reliable, raw data from a weather station, or even a reliable secondary supplier of weather data, are often flawed. Common data problems include format errors, missing data, unreasonable values, data recorded in different units than needed, and data in an inconvenient format. Often there are no data available for a specific site, or a particular variable is not in the available weather record.

ICASA has focused on the development of crop models and software tools such as the DSSAT to aid research and development in agriculture. Available and reliable weather data are essential for good predictions using these crop models.

ICASA has specified a minimum daily weather data set and format for use with the crop models. In DSSAT v2.1, (IBSNAT 1986), the required daily variables were solar radiation (MJ/m ^{2}/d), maximum temperature (° C) minimum temperature (° C), and rainfall (mm). An extended DSSAT v2.1 data set included photosynthetically active radiation (PAR, mol/m ^{2}/d). DSSAT v35 uses the same minimum weather data set and allows optional variables, such as PAR, dew point (° C) and wind speed (m/s).

The WeatherMan program is designed to simplify or automate many of the tasks associated with handling, analyzing, and preparing weather data for use with crop models or other simulation software. WeatherMan has the ability to translate both the format and units of daily weather data files, check for errors on import, and fill-in missing or suspicious values on export. WeatherMan can also generate complete sets of weather data comprising solar radiation, maximum and minimum temperature, rainfall, and photosynthetically active radiation. Summary statistics can be computed and reported in tables. The summary statistics or daily data can be viewed graphically.

WeatherMan checks for and flags format or range errors on import. On export, data flagged as missing or suspect can be replaced with estimates using several methods. The GENERATE menu permits generation of synthetic sequences of solar radiation, maximum and minimum temperature, rainfall, and photosynthetically active radiation for any duration. The ANALYZE menu includes the ability to display the results using tables or graphs.

2.2. 2. Getting Started

2.2.1. Getting Started

WeatherMan is installed via a CD. If your computer is configured to Auto-Start a compact disc, the installation should proceed automatically. If not, you will need to run the Setup.exe program in the WeatherMan directory of the CD. You can do this by clicking on Start|RUN and browsing the CD until you find the correct program (not sample dialog below). You drive letter may vary.

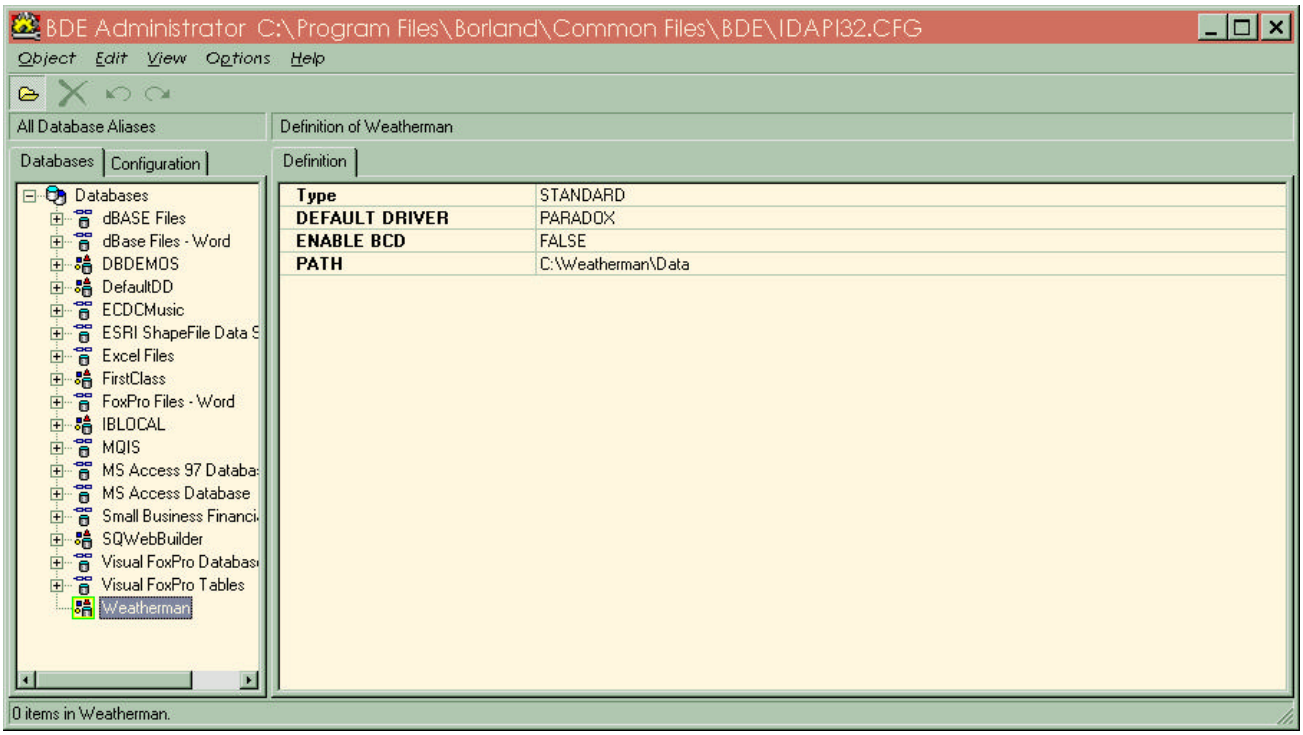
After starting the Setup program, WeatherMan will install itself. The default directory is C:\WeatherMan. It is advised that you choose the default directory. You can install WeatherMan in an alternative directory, however you may then need to run the Borland Database Engine (BDE) configuration utility, supplied by the WeatherMan Installation.

The Installation CD also contains other programs that may be needed to complete installation. An upgrade to the Microsoft© Common Control is supplied, along with a copy of the Adobe Acrobat Reader for reading the documentation file. Both reside in a separate directory on the CD and need only be installed if you experience operational difficulties.

2.2.2. Borland Database Engine

The Borland Database Engine (BDE) is the default database driver installed with WeatherMan. The Borland Database Engine (BDE) offers a rich and robust set of features used in client-server applications. The BDE database-driver architecture includes numerous shared services utilized by database drivers and other functions. The included set of database drivers enables consistent access to standard data sources: Paradox, dBASE, FoxPro, Access, and text databases. BDE is object-oriented in design. Runtime objects are created and then used to manipulate database entities, such as tables and queries. The core database engine files consist of a set of DLLs that are fully re-entrant and thread-safe. You configure the BDE system using the BDE Administrator (BDEADMIN.EXE). BDE provides flexible and powerful configuration management capabilities.

WeatherMan is installed as a Paradox database. You should not need to modify any settings after installation by WeatherMan. If you should, you can access the BDE administrator via the control panel.



Shown is the default settings for WeatherMan. If you need to change the Path (change **NOTHING** else) you can edit this entry.

2.3. 3. Managing Weather Data

2.3.1. Managing Data

WeatherMan is designed to work with the user to import weather data (in ICASA, DSSAT, or undefined weather format) into a WeatherMan database for export and use in applications that require daily climatic data, such as crop simulation models. The weather data, stored in Paradox databases, are associated with climate stations with a PRM extension. The default directories for searching for climate data and saving the data are defined in the Preferences dialog; the data is stored in the system registry.

2.4. 4. Climate file structure

2.4.1. File Structures

There are several climate file structures associated with WeatherMan.

- Summary data are stored in PRM files
- Data can be imported from and exported to DSSAT v35 files
- Data can be imported from and exported to ICASA 1.x files
- Weather can be generated from Monthly Target Files

2.4.2. PRM file

PRM climate files

```
$CLIMATE: ARPE

*GENERAL
@Latitude Longitud  Elev Zone    TAV  TAMP REFHT WNDHT SITE
  -33.930  -60.549    65        16.5   6.7   1.5   3.0 Pergamino, Argentina
@WYR  WFIRST   WLAST
  68 1931001 1998120
@PEOPLE
Guillermo Podesta

@ADDRESS

@METHODS

@INSTRUMENTS

@PROBLEMS

@PUBLICATIONS

@DISTRIBUTION

@NOTES
Created on day 2/20/01 at 12:13:03 PM

*AVERAGES
@ Mean    JAN    FEB    MAR    APR    MAY    JUN    JUL    AUG    SEP    OCT    NOV    DEC
  SRad  25.49  21.25  17.10  13.75  10.64   8.36   8.46  12.10  16.17  20.16  26.11  25.59
  TMax  30.39  29.32  26.77  22.77  19.62  15.73  15.51  17.54  19.80  22.47  25.87  29.01
  TMin  16.22  15.52  13.85  10.06   7.44   4.89   4.28   4.88   6.59   9.68  12.37  14.94
  Rain 112.17  97.23 128.14  89.14  52.47  44.93  36.62  39.70  55.53 108.70  95.19 101.74
  RNum   7.72   6.83   7.97   6.83   5.69   5.75   4.62   4.62   5.67   8.59   8.31   8.05
  SunH  68.01  68.52  63.01  60.64  54.37  48.13  52.06  57.06  57.93  57.45  64.58  63.68

*HIGH-FREQUENCY PARAMETERS
@Param    JAN    FEB    MAR    APR    MAY    JUN    JUL    AUG    SEP    OCT    NOV    DEC
 TxMND  30.51  29.44  27.00  22.88  19.68  15.81  15.55  17.79  19.93  22.52  25.99  29.12
 TxSDD  3.312  3.360  3.730  3.720  4.004  3.693  4.110  4.271  4.297  4.092  3.701  3.559
 TxMNW  30.01  28.94  26.10  22.40  19.35  15.41  15.29  16.04  19.21  22.33  25.56  28.70
 TxSDW  4.161  3.990  4.225  4.069  4.067  3.543  4.129  4.656  5.145  4.428  4.491  4.017
 TnMND  15.70  14.87  13.17   9.17   6.65   4.06   3.66   4.29   5.85   8.74  11.75  14.46
 TnSDD  3.278  3.317  3.808  4.084  4.500  4.512  4.620  4.350  4.079  3.828  3.550  3.500
 TnMNW  17.79  17.50  15.80  13.04  10.96   8.37   7.81   8.23   9.80  12.11  13.99  16.31
 TnSDW  2.719  2.583  3.154  3.416  3.943  3.969  4.016  3.664  3.692  3.329  3.064  2.587
    Ku  0.811  0.729  0.748  0.743  0.803  0.872  0.811  0.777  0.819  0.889  0.910  0.814
  XMND  1.419  1.566  1.310  1.535  1.114  0.638  0.602  1.178  1.131  0.977  1.275  1.288
  XSDD  0.995  1.070  1.016  1.110  1.026  1.210  1.320  1.071  1.070  1.230  1.080  0.976
  XMNW  0.181  0.172 -0.132  0.014 -0.209 -0.942 -1.102 -0.314 -0.385 -0.586 -0.051  0.207
  XSDW  1.217  1.195  1.167  0.961  0.753  0.891  1.047  0.762  1.016  1.208  1.283  1.148
 Alpha 0.2525 0.2036 0.2337 0.2962 0.3032 0.5498 0.3226 0.2948 0.3596 0.3586 0.2172 0.2891
 Beta1  1.401  0.814  0.904  1.242  0.473  1.055  0.402  0.710  1.481  1.489  0.723  1.733
 Beta2  18.82  17.54  20.58  17.87  12.89  15.85  11.37  11.76  14.31  18.74  14.31  16.94
  PDDW 0.2243 0.2163 0.2040 0.1698 0.1350 0.1347 0.1049 0.1035 0.1377 0.2282 0.2479 0.2292
  PWDW 0.2048 0.1967 0.1954 0.1801 0.1469 0.1806 0.1354 0.1294 0.1507 0.2310 0.2346 0.2331
   PWW 0.3387 0.3390 0.4180 0.4137 0.3966 0.4005 0.3770 0.4048 0.4000 0.4033 0.3611 0.3414
    PW 0.2489 0.2440 0.2571 0.2278 0.1835 0.1917 0.1490 0.1489 0.1890 0.2769 0.2769 0.2593

*LOW-FREQUENCY PARAMETERS
@Param    JAN    FEB    MAR    APR    MAY    JUN    JUL    AUG    SEP    OCT    NOV    DEC
 TxSDC  0.380  1.575  0.233  0.738  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.650
 TnSDC  0.836  0.509  0.492  1.137  1.499  1.147  1.564  0.443  0.000  1.103  0.642  1.030
  XSDC  0.160  0.113  0.070  0.284  0.237  0.316  0.208  0.170  0.245  0.271  0.270  0.242
 PWSDC 0.0702 0.1277 0.0000 0.0423 0.0391 0.0879 0.0535 0.0342 0.0907 0.0967 0.0556 0.1395
 TxPHI  0.342  0.474  0.393  0.170  0.146 -0.046  0.225 -0.098 -0.017  0.041  0.108  0.344
```

```
 TnPHI  0.527  0.451  0.321  0.241  0.260  0.209  0.197  0.000  0.143  0.226  0.348  0.536
  XPhi  0.396  0.296  0.162  0.271  0.163  0.262  0.396  0.337  0.449  0.397  0.390  0.458
 RaPhi  0.007  0.016 -0.014  0.037  0.263 -0.111  0.098 -0.048 -0.037  0.020  0.027  0.099
 RTxTn  0.276  0.316  0.490  0.587  0.591  0.595  0.708  0.583  0.376  0.484  0.443  0.474
 RTx_X  0.058  0.320 -0.032  0.330 -0.080  0.213 -0.104  0.226  0.203  0.229  0.124  0.215
 RTxRa -0.478 -0.282 -0.108 -0.105  0.124 -0.130  0.223 -0.044 -0.044 -0.035 -0.270 -0.452
 RTn_X -0.033 -0.038 -0.190 -0.086 -0.476 -0.214 -0.437 -0.098 -0.115 -0.321 -0.126 -0.038
 RTnRa  0.143  0.102  0.257  0.119  0.312  0.244  0.450  0.173  0.357  0.569  0.234  0.090
 R_XRa -0.030 -0.187  0.013 -0.118 -0.233 -0.224 -0.169  0.091 -0.068 -0.205 -0.137 -0.083
```

2.4.3. DSSATv35 Files

DSSAT v35 file structure

```
*WEATHER DATA : Plains,Georgia,USA

@ INSI      LAT     LONG  ELEV   TAV   AMP REFHT WNDHT
  GAPL   32.040  -84.370   172  17.7   9.2   2.0   3.0
@DATE  BRAD  MAX  MIN  RAIN
93001   9.2  22.4   7.9   0.0
93002   5.7  16.7   9.4   0.0
93003  10.7  18.0   8.5   0.0
93004   2.5  19.8   9.4   2.0
93005   4.9  20.5  14.3   1.0
93006   3.7  17.7  13.1   4.8
93007   1.6  16.9  11.8  53.3
93008   2.4  20.1  12.7  37.6
93009   2.8  13.8   8.6   0.0
93010   1.6   9.7   6.2   0.0
93011   2.0  10.6   6.1   0.5
93012   1.5  11.7   7.6  15.0
93013   9.6  17.8   6.9   0.3
93014   6.3  11.6   3.4   0.0
93015   2.9   9.7   2.8   0.0
93016  11.5  14.3   4.6   0.8
93017  12.8  16.0   1.4   0.0
93018  10.8  18.4   4.6   0.0
93019   2.3  12.9   9.3   0.5
93020   2.2  10.1   3.8   3.0
93021   5.5  19.8   4.4   4.8
93022  14.2  20.5   7.6   0.3
93023  14.6  19.7   0.9   0.0
93024   2.5  17.7   4.0   8.6
93025  11.4  10.5  -0.9   0.0
93026   6.1   8.6   0.9   0.0
93027  15.0  17.7  -0.5   0.0
93028  12.5  17.6   0.2   0.0
93029   8.1  17.2   6.3   0.0
93030  12.2  16.2   2.5   0.0
93031  15.7  17.3  -0.5   0.0
93032  15.1  18.8   5.7   0.0
93033  16.0  13.5   2.2   0.0
93034  16.0  14.4  -2.7   0.0
93035  10.8  16.6  -0.3   0.0
```

2.4.4. ICASA 1.1 Files

ICASA 1.x weather files

```
$WEATHER: GAPL1994

*GENERAL
@Latitude Longitud  Elev Zone    TAV  TAMP REFHT WNDHT SITE
   32.040  -84.370   172       -99.0 -99.0   2.0   3.0 Plains,Georgia,USA
@WYR  WFIRST   WLAST
   6 1992010 1997364
@PEOPLE

@ADDRESS

@METHODS

@INSTRUMENTS

@PROBLEMS

@PUBLICATIONS

@DISTRIBUTION

@NOTES
Created on day 3/5/01 at 10:02:59 AM

*DAILY DATA
@  DATE  RAIN  TMAX  TMIN  SRAD
1994001   1.5  10.1   0.4   2.3
1994002   0.0  15.1   1.1   6.6
1994003   5.8  16.2   5.4   3.7
1994004   0.0   6.2   1.7   2.8
1994005   0.0  11.0  -2.2  13.1
1994006   0.0  15.4  -2.8   6.3
1994007   0.3  21.3   8.8   7.8
1994008   0.3   9.7  -2.3  11.3
1994009   0.0   8.8  -5.1  13.3
1994010   0.0   9.9  -2.5  11.0
1994011   7.6  11.0   4.4   4.5
1994012   0.8  12.5   8.4   3.5
1994013   1.5   9.7   4.0   2.8
1994014   0.0  11.8   1.3  11.0
1994015   0.0   4.7  -3.8  13.7
1994016   0.0   3.0  -7.6  10.3
1994017  15.0  14.9   0.5   1.8
1994018   0.3   5.9  -6.9  14.1
1994019   0.0   1.7 -11.7  14.3
1994020   0.0   8.8  -5.4  13.4
1994021   0.0  10.1  -3.8  14.6
1994022   0.0  15.2  -7.4  15.3
1994023   0.0  13.2  -3.2   7.3
1994024   0.0  19.7   0.3  13.8
1994025   0.0  21.6   2.1  12.4
```

```
1994026   0.0  22.2   7.6  10.1
1994027   0.3  15.9  10.6   1.6
1994028  37.1  19.6  13.1   3.7
1994029  11.2  14.5   5.5   2.9
1994030   3.6   9.8   3.5   4.6
1994031   0.0  11.1  -2.0  15.3
1994032   0.0   6.1  -3.7  13.5
1994033   0.0   7.4  -3.9  16.2
```

2.4.5. Monthly Target Files

Sample Monthly Target file used in climate file generation.

```
@ StYr  StMn  SpYr  SpMn
  1931     1  1998     4
@ yr mo  srmn  srsd  txmn  txsd  tnmn  tnsd  ramn  rasd
1931  1 25.44 -99.0 30.47 -99.0 16.82 -99.0  4.10 -99.0
1931  2 23.43 -99.0 29.51 -99.0 15.96 -99.0  1.92 -99.0
1931  3 17.35 -99.0 27.45 -99.0 16.16 -99.0  2.79 -99.0
1931  4 15.04 -99.0 24.62 -99.0 11.58 -99.0  7.52 -99.0
1931  5 10.63 -99.0 20.59 -99.0  8.46 -99.0  7.07 -99.0
1931  6  7.65 -99.0 16.99 -99.0  7.42 -99.0  1.72 -99.0
1931  7  8.51 -99.0 15.88 -99.0  1.45 -99.0  0.22 -99.0
1931  8 10.91 -99.0 16.05 -99.0  4.24 -99.0  3.51 -99.0
1931  9 15.28 -99.0 18.43 -99.0  4.19 -99.0  0.77 -99.0
1931 10 21.43 -99.0 23.48 -99.0 10.21 -99.0  2.77 -99.0
1931 11 26.66 -99.0 24.16 -99.0 10.55 -99.0  5.71 -99.0
1932 12 27.92 -99.0 29.42 -99.0 14.22 -99.0  2.58 -99.0
1932  1 28.15 -99.0 33.33 -99.0 16.21 -99.0  3.42 -99.0
1932  2 19.63 -99.0 30.18 -99.0 15.26 -99.0  3.74 -99.0
1932  3 16.81 -99.0 27.79 -99.0 13.86 -99.0  4.64 -99.0
1932  4 11.89 -99.0 23.65 -99.0 11.77 -99.0  2.32 -99.0
1932  5  9.53 -99.0 17.93 -99.0  4.17 -99.0  0.83 -99.0
1932  6  7.15 -99.0 15.63 -99.0  3.26 -99.0  4.44 -99.0
1932  7  6.16 -99.0 17.81 -99.0  7.76 -99.0  3.54 -99.0
1932  8 11.53 -99.0 15.19 -99.0  4.07 -99.0  1.91 -99.0
1932  9 15.90 -99.0 21.18 -99.0  6.30 -99.0  0.76 -99.0
1932 10 16.83 -99.0 22.49 -99.0 11.03 -99.0  2.69 -99.0
1932 11 25.57 -99.0 28.11 -99.0 12.89 -99.0  2.69 -99.0
1933 12 23.81 -99.0 28.36 -99.0 14.65 -99.0  3.70 -99.0
1933  1 22.42 -99.0 30.28 -99.0 15.00 -99.0  3.51 -99.0
```

2.5. 5. References

2.5.1. Literature Cited

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Jones, J.W., L.A. Hunt, G. Hoogenboom, D.C. Godwin, U. Singh, G.Y. Tsuji, N. Pickering, P.K. Thornton, W.T. Bowen, K.J. Boote and J.T. Ritchie. 1994. Input and output files. *In:* Tsuji, G.Y., G. Uehara and S. Balas (eds). DSSAT v3. Vol. 2-1. University of Hawaii, Honolulu, HI.

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2.5.2. Variables

Abbreviations Used In WeatherMan

DAILY WEATHER VARIABLES

```
SRAD Total daily solar radiation.
TMAX Maximum daily air temperature.
TMIN Minimum daily air temperature.
RAIN Total daily precipitation.
DEWP Dew point temperature or vapor pressure.
WIND Total daily wind run.
SUNH Total daily sunshine hours.
PAR  Total daily photosynthetic radiation.
TWET Wet bulb air temperature at 9 a.m.
EVAP Total daily pan evaporation.
```

Summary Files

TIME VARIABLES

```
DOC  Number of days since January 1, 1801.
MTH  Month (1 - January, 2 - February, etc.).
MNO  Month number, counting from the first month in the data set.
YR   Year of century (eg., 94 can represent 1994).
YRNO Year number, counting from the first year in the data set.
```

MOMENTS

The first character in moment variables represents the weather variable type.
The second represents wet state. The final two represent the type of statistic.

```
S___ Total daily solar radiation.
X___ Maximum daily air temperature.
N___ Minimum daily air temperature.
R___ Total daily precipitation.
P___ Total daily photosynthetic radiation.
_D__ Dry days (i.e., without precipitation).
_W__ Wet days (i.e., with precipitation).
_A__ All days
__MN Mean.
__SD Standard deviation.
__SK Skewness coefficient.
__KT Kurtosis coefficient.
```

PERCENTILES

```
P0   Minimum.
P25  25th percentile.
P50  Median.
P75  75th percentile.
P100 Maximum.
```

DISTRIBUTION

```
BINi The relative frequency of observations falling within the ith interval.
SDEV Standard deviation.
LAGi Lag i (i=0..5) autocorrelation coefficients.
PW   Probability of a wet day.
PWW  Probability of a wet day following a wet day.
PDW  Probability of a wet day following a dry day.
PWWW Probability of a wet-wet-wet sequence.
PDWW Probability of a dry-wet-wet sequence.
PWDW Probability of a wet-dry-wet sequence.
PDDW Probability of a dry-dry-wet sequence.
```

2.5.3. Climate File Format

CLIMATE FILE FORMAT

The climate file contains summary information on a site in five sections. The *CLIMATE section contains characteristics of the location. The *MONTHLY AVERAGES section contains monthly means and Angstrom coefficients used by the SIMMETEO weather generator. The *WGEN PARAMETERS section contains the monthly distribution parameters used by the WGEN weather generator. The *RANGE CHECK VALUES section contains the values used to check for outliers and suspect data during the Import process. The *FLAGGED DATA COUNT section contains counts of total, erroneous, and suspect data in the archive file.

*CLIMATE

```
LAT   Latitude, degrees north.
LONG  Longitude, degrees east.
ELEV  Elevation, m.
TAV   Mean annual temperature, ºC.
AMP   Half of the mean temperature difference between the warmest and coolest
month.
SRAY  Mean annual daily solar radiation, MJ/m 2 /day.
TMXY  Mean annual daily maximum temperature, ºC.
TMNY  Mean annual daily minimum temperature, ºC.
RAIY  Mean annual daily rainfall, mm.
START Mean day of year of the first frost-free day.
DURN  Mean number of days between the last and the first frost.
ANGA  Intercept A in the Angstrom equation (Prescott, 1940).
ANGB  Multiplier B in the Angstrom equation (Prescott, 1940).
REFHT Height of weather instruments above ground, m.
WNDHT Height of annemometer above ground, m.
GSST  First year of observed weather data.
GSDU  Number of years of observed weather data.
```

*MONTHLY AVERAGES

```
MONTH Month (1 - January, 2 - February, etc.).
SAMN  Mean daily solar radiation for month, MJ/m 2 /day.
XAMN  Mean daily maximum temperature for month, ºC.
NAMN  Mean daily minimum temperature for month, ºC.
RTOT  Mean total rainfall for month, mm.
RNUM  Mean number of days with rainfall for month.
SHMN  Mean daily hours of bright sunshine for month, percent of daylength.
AMTH  Intercept A in the Angstrom equation for month.
BMTH  Multiplier B in the Angstrom equation for month.
```

*WGEN PARAMETERS

```
MTH   Month (1 - January, 2 - February, etc.).
SDMN  Mean daily solar radiation on dry days, MJ/m 2 /day.
SDSD  Standard deviation of solar radiation on dry days.
SWMN  Mean daily solar radiation on wet days, MJ/m 2 /day.
SWSD  Standard deviation of solar radiation on wet days.
XDMN  Mean daily maximum temperature on dry days, ºC.
XDSD  Standard deviation of maximum temperature on dry days.
XWMN  Mean daily maximum temperature on wet days, ºC.
XWSD  Standard deviation of maximum temperature on wet days.
NAMN  Mean daily minimum temperature, ºC.
NASD  Standard deviation of minimum temperature.
ALPHA Alpha coefficient of gamma distribution for rainfall.
RTOT  Total rainfall, mm.
```

```
PDW   Probability of a wet day following a dry day.
RNUM  Mean number of days with rainfall.
```

*RANGE CHECK VALUES

```
MIN  Minimum value for range check.
MAX  Maximum value for range check.
RATE Maximum change between days for range check.
```

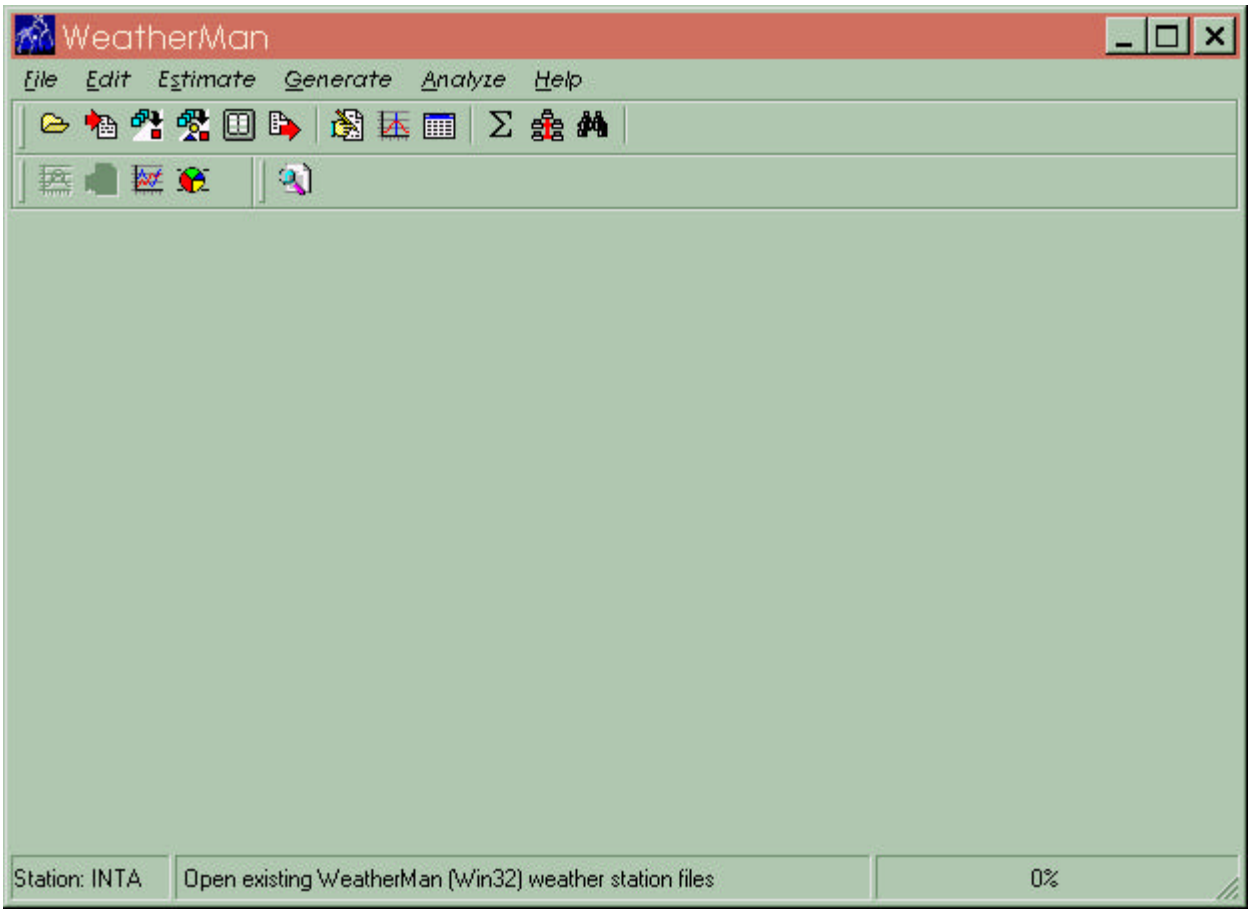
*FLAGGED DATA COUNT

```
BEGYR   Year of first daily weather record.
BEGDY   Day of year of first daily weather record.
ENDYR   Year of last daily weather record.
ENDDY   Day of year of last daily weather record.
TOTAL   Total number of observations.
VALID   Number of observations without error flags.
MISSING Number of missing values.
ERROR   Number of values with non-numeric strings encountered.
ABOVE   Number of values above the maximum.
BELOW   Number of values below the minimum.
RATE    Number of values with greater than maximum change from previous day.
```

3. WeatherMan

3.1. Accessing Weatherman Functions

This is the main form displayed on the initialization of WeatherMan. All functionality of the program can be accessed via the menu system or buttons. The buttons reside on tool bars, that themselves reside on resizable bars (rebars). These can be moved, expanded, or contracted to suit the users wishes. Hints are displayed whenever a mouse is held over a control; a longer hint is displayed in the status bar on the bottom of the screen.

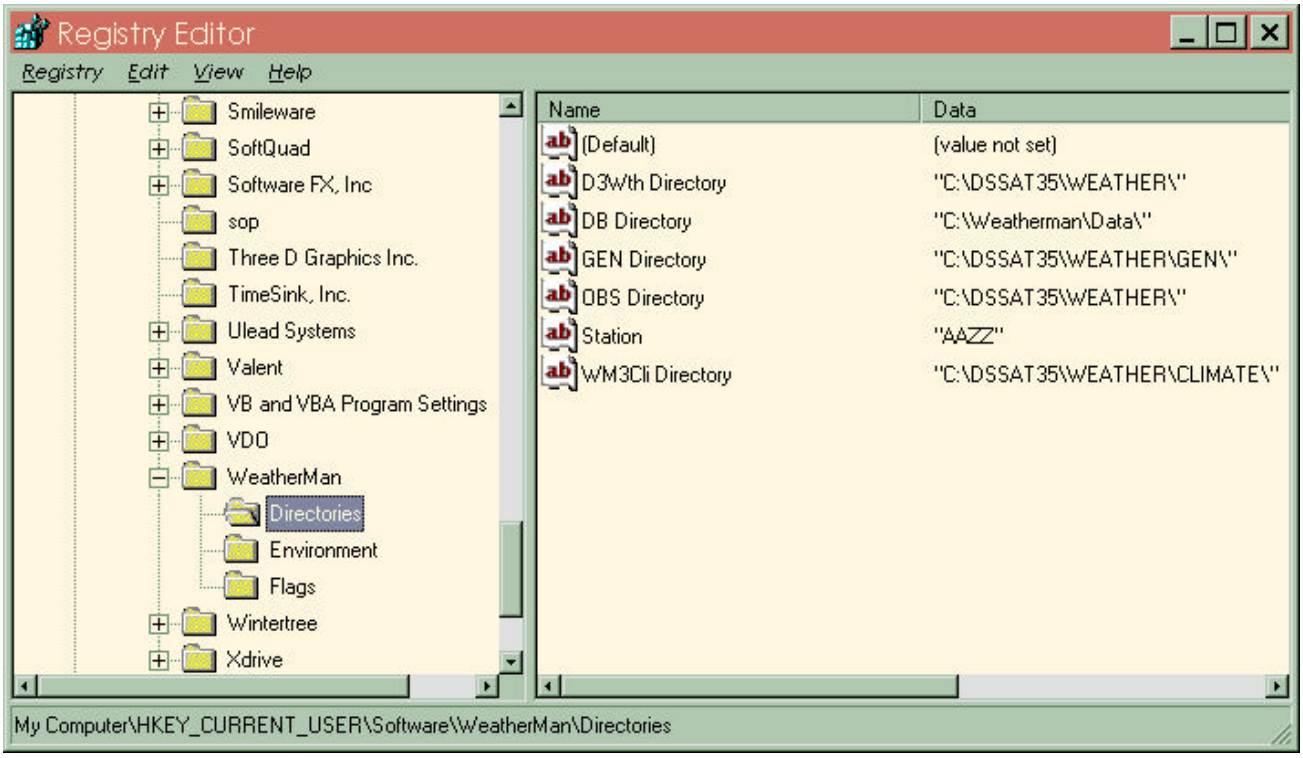


4. Preferences

4.1. Preferences

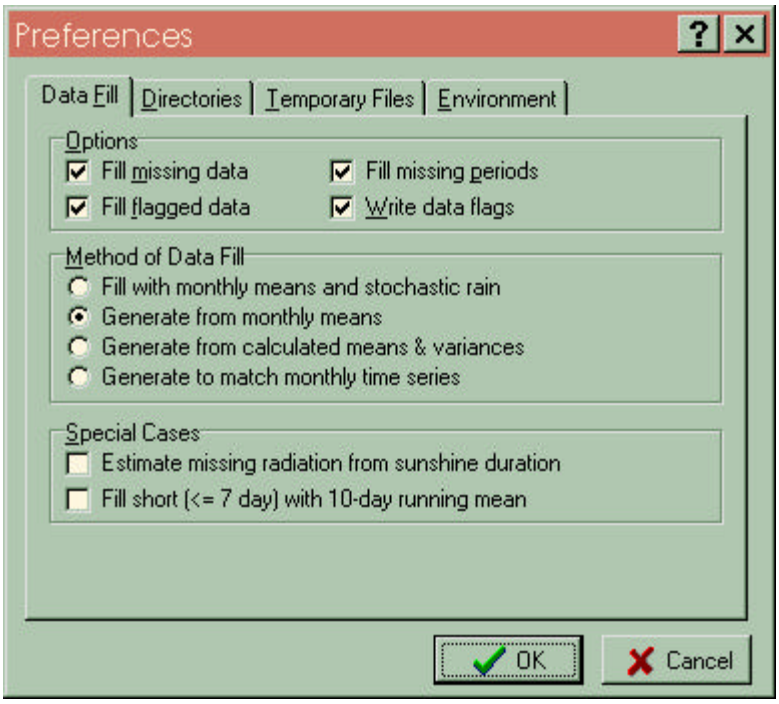
The WeatherMan preferences and default settings are accessed by the Preferences dialog. All setting are stored in the system registry. The data is stored in the Primary key of HKEY_CURRENT_USER in the \Software\WeatherMan directory. WeatherMan automatically reads and writes data to the Registry at startup and shutdown. Four pages are available in the preferences dialog;

- Data Fill Options
- Directories
- Temporary Files
- Environment



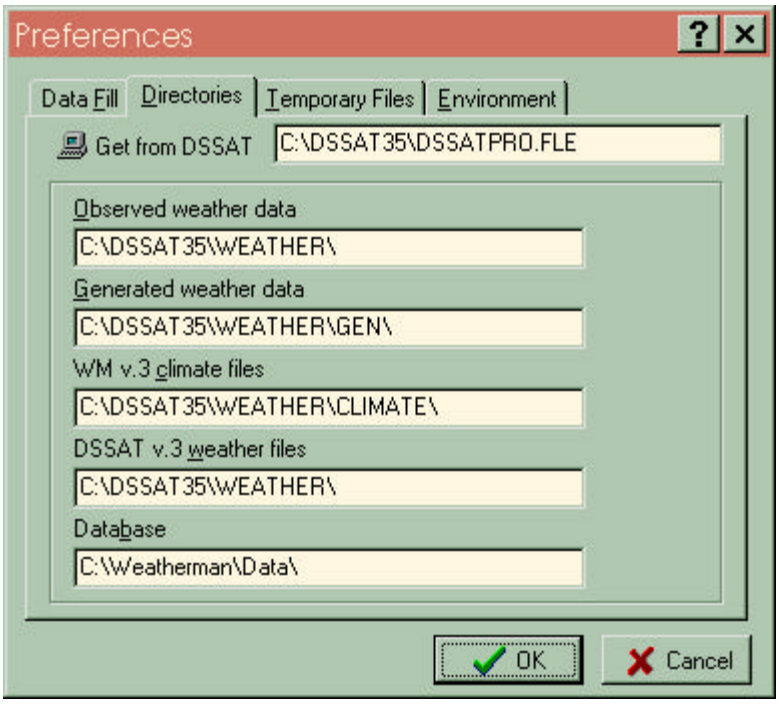
4.2. Data Fill Options

The data fill options for WeatherMan dictate how missing weather data is handled in WeatherMan. Using checkboxes, you can decide on default policies for filling missing data and flagging the data in the database files, the method to use for filling missing data, and how to calculate data in special cases, i.e. short periods of missing data or converting sunshine hours into solar radiation.



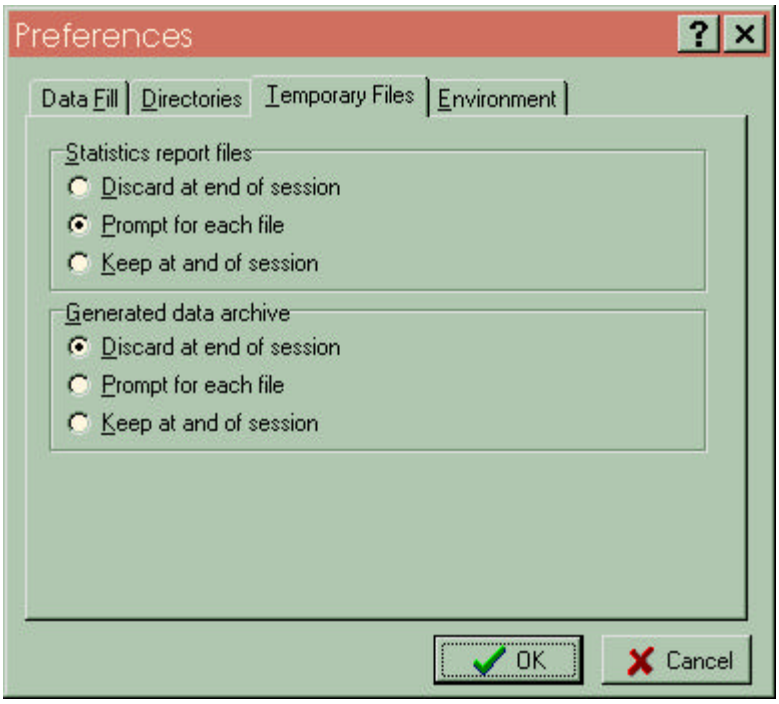
4.3. Directories

This sheet defines the default directories for WeatherMan. Click on the Get From DSSAT button to get path setting stored in DSSAT in the file DSSATPRO.FLE. Double-click on the displayed path for DSSAT to search for other DSSATPRO.FLE files on your computer to use, assuming you do not have DSSAT installed in the C:\DSSAT directory. Double-click on any of the directories listed (observed data, generated weather, DSSAT v35 wearther, and the WeatherMan database directory) to change the current setting. The SelectDirectory dialog will be displayed in that case.



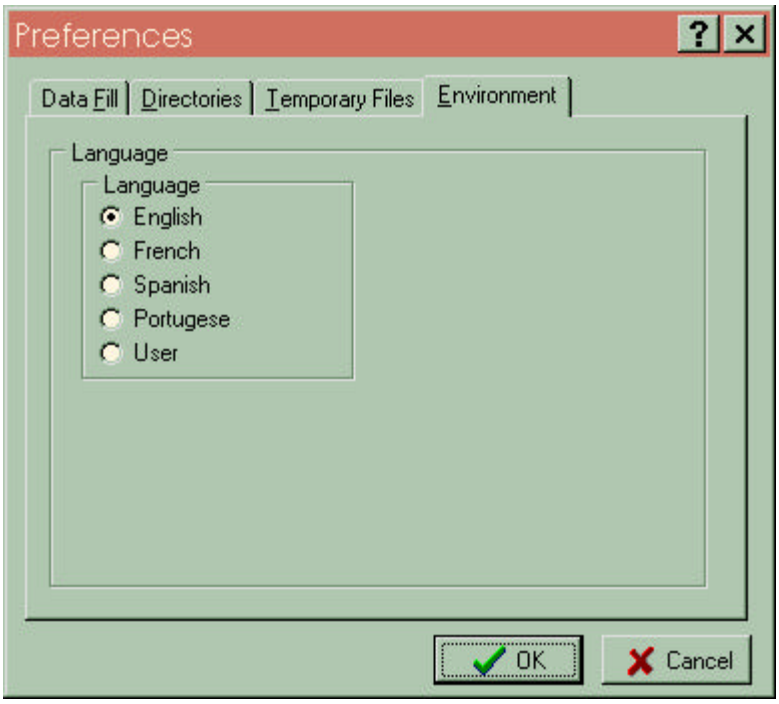
4.4. Temporary Files

The Temporary Files tab sheet displays the options for handling temporary files that may be created during normal functioning of WeatherMan.



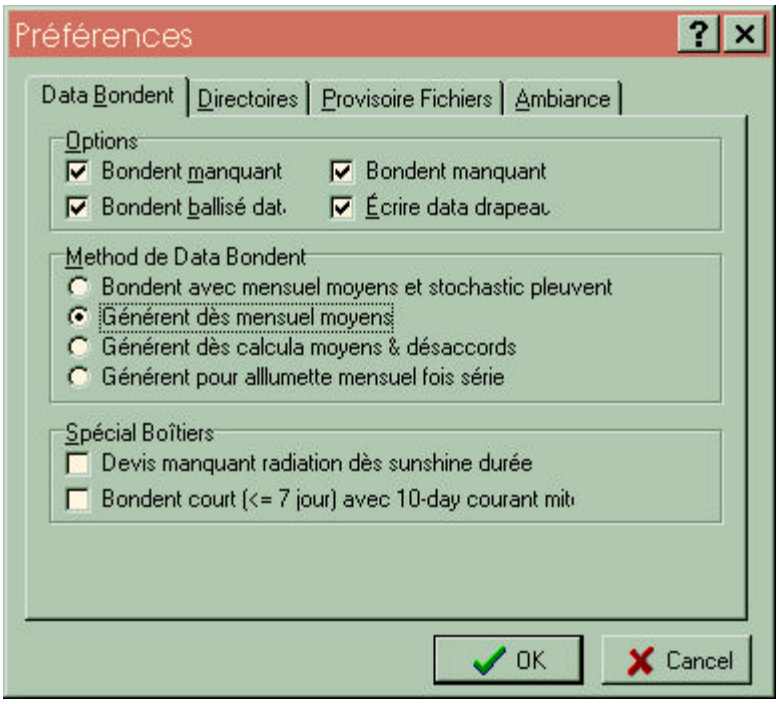
4.5. Environment

The environment options are displayed on this tabsheet. You can select any of 5 languages (4 defined) for use in WeatherMan.



The language file that holds the literal string translations is in a file called WeatherMan.sil. This file can be edited with an included utility program, SilEditor.exe. The last language included has been left blank; the user may in fact translate the program string to any language, save the SIL file, and use it in WeatherMan. ☞ It may be advisable to backup the SIL file before editing.

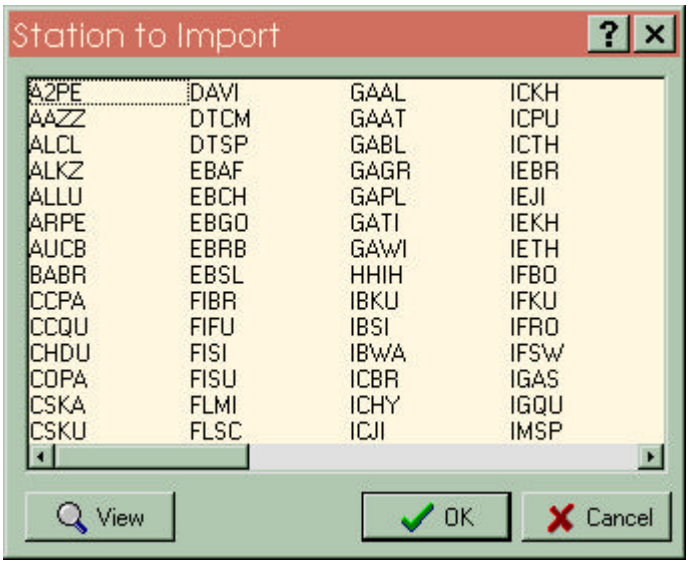
After selecting a new language, all strings in the program are immediately translated. An example of is displayed below. The English version of this same dialog is displayed here.


Préférences
Data Bondent
Directoires
Provisoire Fichiers
Ambiance
Options
Bondent manquant
Bondent manquant
Bondent ballisé dat
Écrire data drapeau
Method de Data Bondent
Bondent avec mensuel moyens et stochastic pleuvent
Générent dès mensuel moyens
Générent dès calcula moyens & désaccords
Générent pour alllumette mensuel fois série
Spécial Boîtiers
Devis manquant radiation dès sunshine durée
Bondent court (<= 7 jour) avec 10-day courant mit
OK
Cancel

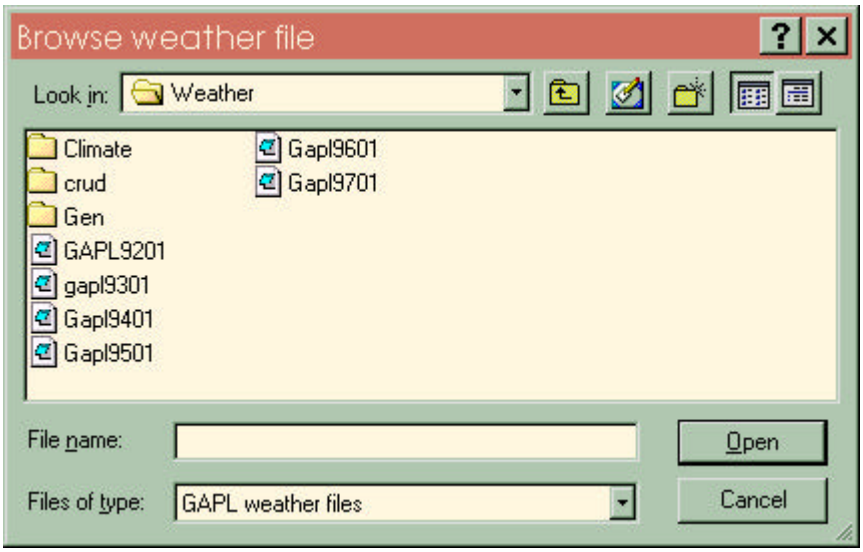
5. Importing Exisiting Stations

5.1. Importing Climate Data

WeatherMan allows the user to import DSSAT v35 and ICASA 1.x data files, along with DOS WeatherMan climate files into a WeatherMan database. From the File|Import Station menu or by clicking on the approriate tool bar button, choose to import DSSAT or ICASA weather data or DOS WeatherMan climate stations. A list of candidate files will be shown. Select the station to import by clicking on your choice. After importing, WeatherMan will calculate statistics and display the Edit Station dialog.



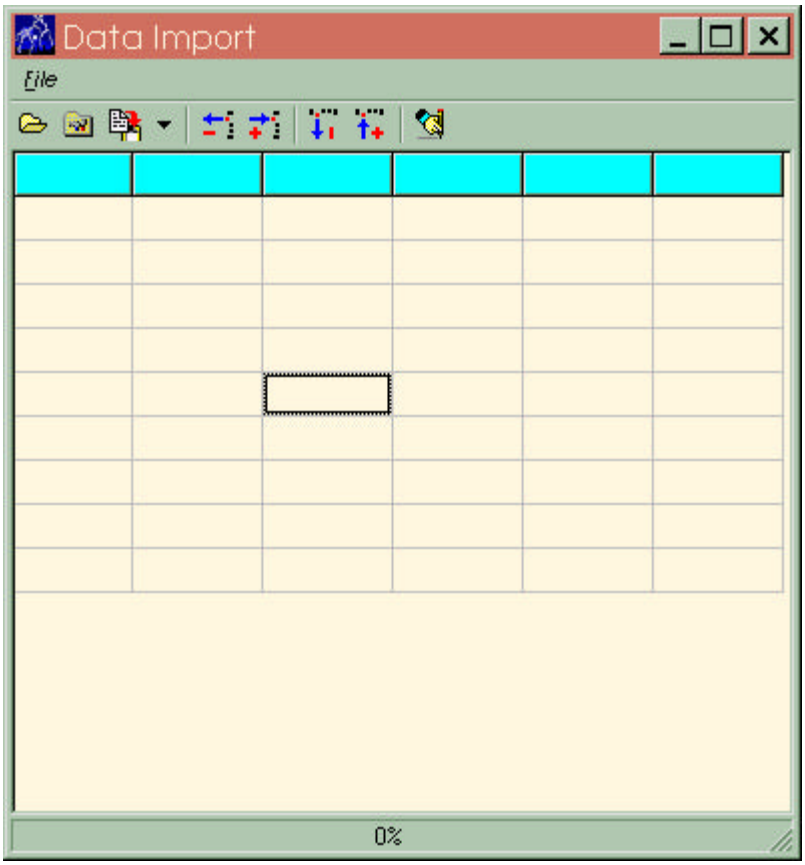
Selecting the View option after choosing a climate file(s) for input brings up a dialog box to view and/or edit any of the prospective files that will be imported as a WeatherMan data set.



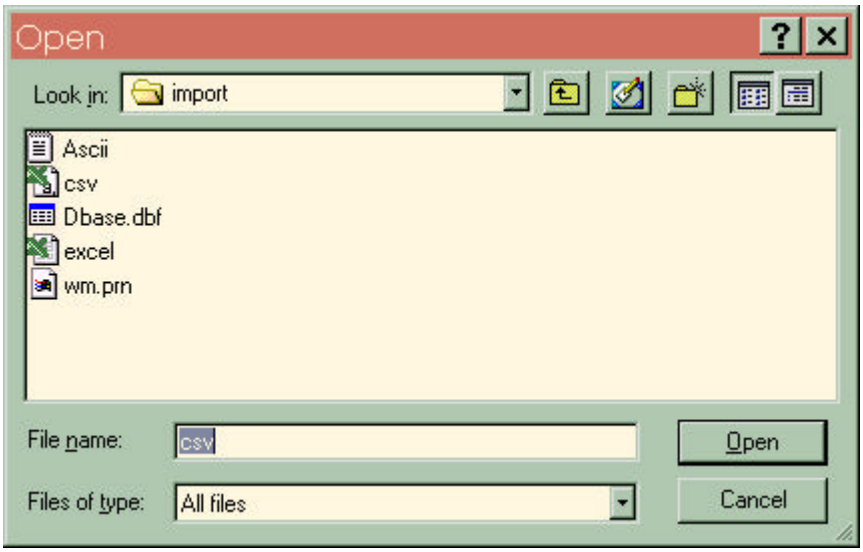
6. Importing and Creating Datasets

6.1. Import Raw Data

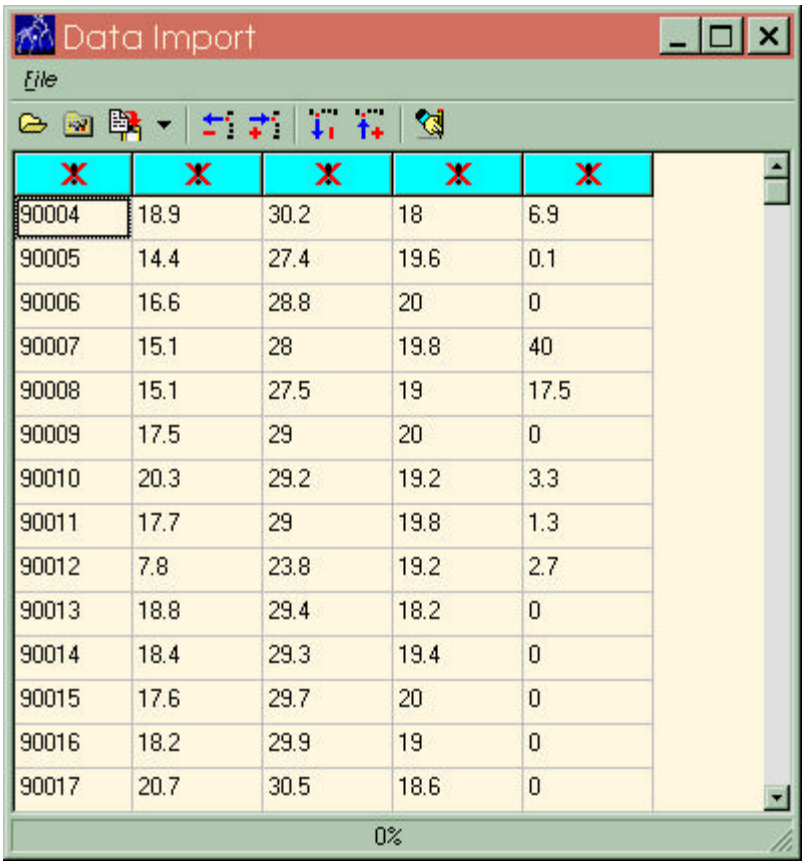
The Data Import dialog is used to import data from non-ICASA based weather file formats into WeatherMan, where they can be edited and exported as ICASA weather data. The default grid is displayed when the dialog box is created; you may enter data manually or import the data. To construct the data manually, use the Grid Wizard button (button 2 on the tool bar).



To selecting a file to import, click on the Open folder icon. A list of files is displayed; sample data for ASCII format, CSV format, and Excel XLS format is installed with WeatherMan. Select a file for import from the Import directory or browse the disk for data in other locations. Currently, WeatherMan supports space-delimited text (TXT) files, comma-delimited (CSV) files, and Excel work sheets (XLS files).

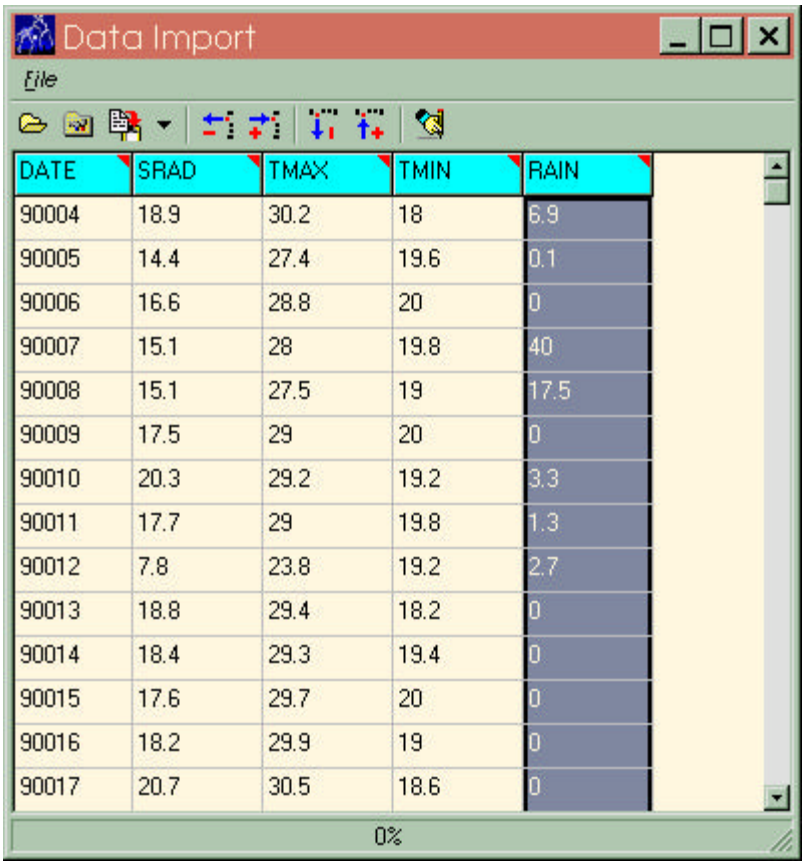


After importing a raw data file, the data is displayed in the grid. No columns are defined as yet as to content. This is noted by the X in the column header. Numerous functions are are defined for editing the grid data. Both rows and columns my be inserted or deleted using the buttons on the tool bar. You can manually edit any of the cells using the in place editor. You can navigate from cell to cell by clicking on a cell or to advance to the next cell, just hitting return. Hitting return on a cell with out making any changes returns the cell contents to the original value. Before you can save/export/import the data into a WeatherMan database, the columns need to be defined as to variable and units. Right-click on a column header and the Column Property Editor is invoked.



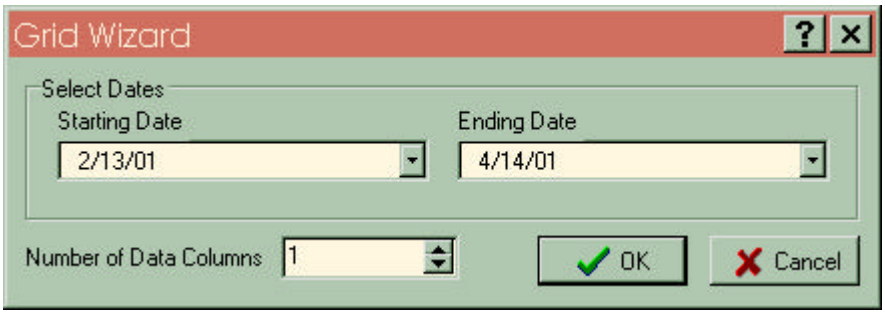
90004	18.9	30.2	18	6.9
90005	14.4	27.4	19.6	0.1
90006	16.6	28.8	20	0
90007	15.1	28	19.8	40
90008	15.1	27.5	19	17.5
90009	17.5	29	20	0
90010	20.3	29.2	19.2	3.3
90011	17.7	29	19.8	1.3
90012	7.8	23.8	19.2	2.7
90013	18.8	29.4	18.2	0
90014	18.4	29.3	19.4	0
90015	17.6	29.7	20	0
90016	18.2	29.9	19	0
90017	20.7	30.5	18.6	0

After you have defined all the columns and edited the data, you need to save the data by choosing the Write Data icon. Note that data columns that you have NOT defined will be ignored and not included when the data is imported into the WeatherMan database. You may simply wish to delete any unneeded columns to simplify the editing and assignment process.

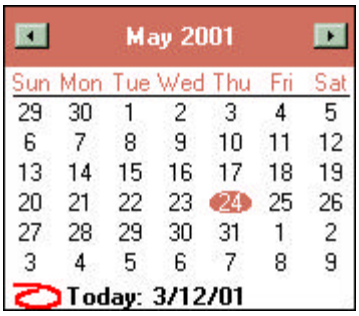


6.2. Using the Grid Wizard

The Grid wizard allows a user to set up a grid for entering raw data by hand by defining the start and end dates for the climate record and the number of data columns. A blank grid is created with the data column populated and defined; you need only fill in the met data for the station.



Selecting a combobox for either the Starting or Ending date will allow the user to select the exact starting and ending dates for his new file. Note that you can always add or delete columns and/or rows once you have begun editing the data grid.

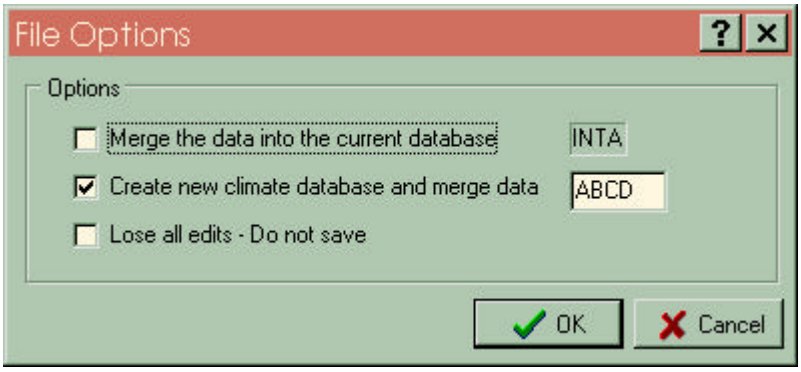


6.3. Save Raw Data Dialog

This dialog allows the user to save the data defined in the Import Data grid. You can either

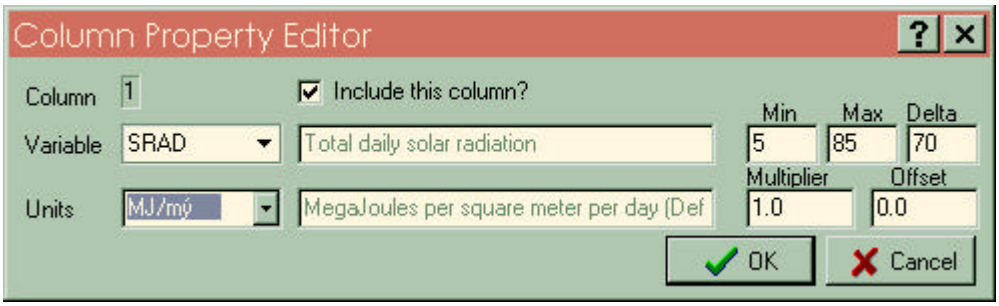
- Merge the data the currently selected database
- Change the current database by double clicking on the station name (INTA in this case), or
- Create a new climate station from scratch

If you create a new station from scratch, the station will use the 4-character name you have chosen (ABCD in this case). The imported data will be analyzed. put in the ABDC.db database, and the Edit Station dialog will be displayed. You will need to fill in all the correct parameters for the station at this time (latitude, longitude, etc.).



6.4. Column Property Editor

The column property editor is invoked by right-clicking on a column header in the Import Raw data grid. You must choose the variable that that column represents and then select the units for that variable. Note that a unit called undefined is available for each variable; this allows a unit of measure not included in the translation table to be used by setting the multiplier and offset properties for conveting the raw data into ICASA default units. The climate file variables and constants are defined in the file weather.var in the WeatherMan directory. Do **NOT** delete this file.



6.5. Climate Units

Climate units

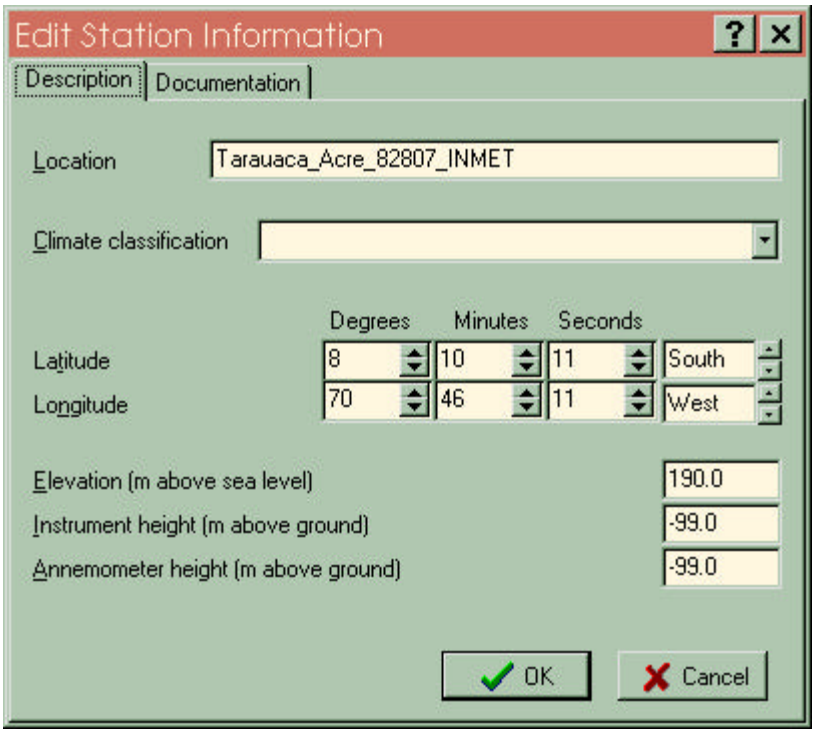
```
*DATE Date/Time Variables                                  1.0      1.0    1.0
Year         Year of weather (yyyy)                             1.0      0.0
Month        Month of the year                                  1.0      0.0
Day of Year  Julian day of year                                 1.0      0.0
Day of Mon   Day of associated month                            1.0      0.0
YRDOY        DSSAT Year Day-of-Year Format (yyddd)              1.0      0.0
LDate        ICASA Long Date Format (yyyyddd)                   1.0      0.0
Encoded      Windows encoded date-time                          1.0      0.0
*SRAD Total daily solar radiation                          5.0    85.0   70.0
MJ/mý        MegaJoules per square meter per day (Default)      1.0      0.0
kJ/mý        KiloJoules per square meter per day                0.001    0.0
cal/cmý      Calories per square centimeter per day             0.04184  0.0
W-h/mý       Watt-hour per square meter per day                 0.0036   0.0
BTU/ftý      British Thermal Units per square foot per day      0.011357 0.0
New          Undefined radiation unit                           1.0      0.0
*TMAX Maximum daily air temperature                        5.0    40.0   20.0
øC           Degrees Celsuis (Centrigrade) (Default)            1.0      0.0
10th øC      Tenths of a degree Celsuis                         0.1      0.0
øF           Degrees Fahrenheit                                 0.555556 -32.0
10th øF      Tenths of a degree Fahrenheit                      0.055556 -320.0
øK           Degrees Kelvin (Absolute)                          1.0      -273.15
New          Undefined temperature unit                         1.0      0.0
*TMIN Minimum daily air temperature                      -20.0  30.0   20.0
øC           Degrees Celsuis (Centrigrade) (Default)            1.0      0.0
10th øC      Tenths of a degree Celsuis                         0.1      0.0
øF           Degrees Fahrenheit                                 0.555556 -32.0
10th øF      Tenths of a degree Fahrenheit                      0.055556 -320.0
øK           Degrees Kelvin (Absolute)                          1.0      -273.15
New          Undefined temperature unit                         1.0      0.0
*RAIN Total daily precipitation                            0.0    600.0  500.0
mm           Millimeters per day (Default)                      1.0      0.0
10th mm      Tenths of a millimeter per day                     0.1      0.0
cm           Centimeters per day                                10.0     0.0
inch         Inches per day                                     25.4     0.0
10th in      Tenths of an inch per day                          2.54     0.0
100th in     Hundredths of an inch per day                      0.254    0.0
New          Undefined rainfall unit                            1.0      0.0
*DEWP Dew point temperature or vapor pressure              0.0    25.0   5.0
øC           Degrees Celsuis (Centrigrade) (Default)            1.0      0.0
øF           Degrees Fahrenheit                                 0.555556 -32.0
øK           Degrees Kelvin (Absolute)                          1.0      -273.15
Pa           Water vapor pressure (Pa)                          0.001    0.0
```

```
kPa          Water vapor pressure (kPa)                          1.0      0.0
MPa          Water vapor pressure (MPa)                          1000.0   0.0
mbar         Water vapor pressure (mbar)                         0.1      0.0
bar          Water vapor pressure (bar)                          100.0    0.0
New          Undefined dewpoint unit                             1.0      0.0
*WIND Total daily wind run                                 0.0    500.0  300.0
km           Kilometers per day (Default)                        1.0      0.0
Miles        Miles per day                                       1.609344 0.0
m/s          Meters per second (average daily speed)             86.4     0.0
Knots        Nautical miles per hour (average daily speed)       44.448   0.0
Miles/hr     Miles per hour (average daily speed)                38.624   0.0
New          Undefined wind unit                                 1.0      0.0
*SUNH Total daily sunshine hours                           0.0    100.0  90.0
%Hrs         Percent of day with bright sunshine (Default)       1.0      0.0
n/N          Fraction of daylength with bright sunshine          0.01     0.0
Hrs          Hours of bright sunshine                            1.0      0.0
10th Hrs     Tenths of an hour of bright sunshine                0.1      0.0
New          Undefined sunshine hours unit                       1.0      0.0
* PAR Total daily photosynthetic radiation                 5.0    85.0   70.0
Mol/mý       Moles PAR per square meter per day (Default)        1.0      0.0
New          Undefined PAR unit                                  1.0      0.0
*TDRY Dry bulb air temperature at 9 am                     0.0    35.0   20.0
øC           Degrees Celsuis (Centrigrade) (Default)             1.0      0.0
10th øC      Tenths of a degree Celsuis                          0.1      0.0
øF           Degrees Fahrenheit                                  0.555556 -32.0
10th øF      Tenths of a degree Fahrenheit                       0.055556 -320.0
øK           Degrees Kelvin (Absolute)                           1.0      -273.15
New          Undefined dry bulb unit                             1.0      0.0
*TWET Wet bulb air temperature at 9 am                     0.0    25.0   20.0
øC           Degrees Celsuis (Centrigrade) (Default)             1.0      0.0
10th øC      Tenths of a degree Celsuis                          0.1      0.0
øF           Degrees Fahrenheit                                  0.555556 -32.0
10th øF      Tenths of a degree Fahrenheit                       0.055556 -320.0
New          Undefined wet bulb unit                             1.0      0.0
øK           Degrees Kelvin (Absolute)                           1.0      -273.15
*EVAP Total daily pan evaporation                          0.0    15.0   15.0
mm           Millimeters per day (Default)                       1.0      0.0
10th mm      Tenths of a millimeter per day                      0.1      0.0
cm           Centimeters per day                                 10.0     0.0
inch         Inches per day                                      25.4     0.0
10th in      Tenths of an inch per day                           2.54     0.0
100th in     Hundredths of an inch per day                       0.254    0.0
New          Undefined evaporation unit                          1.0      0.0
*
```

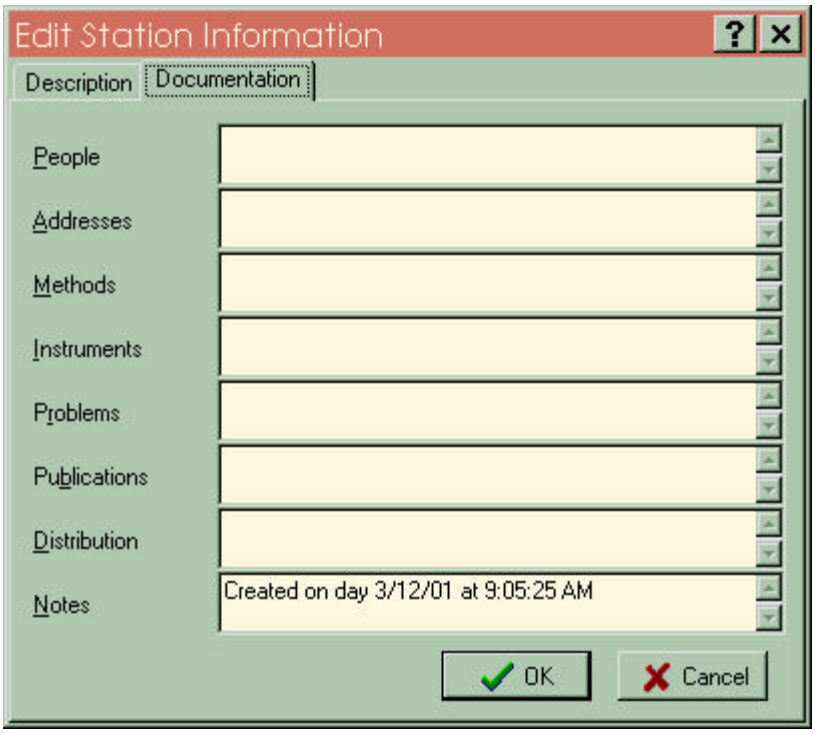
7. Edit Station Information

7.1. Editing Station Information

The Edit Station Information dialog allows the user to modify the existing information stored in the selected PRM file. The first page of data displays the location of the data set, latitude, longitude, elevation, instrument height, and anemometer height. This data is normally imported from DSSAT or ICASA weather files; when creating a station from scratch, you will need to edit this information manually.



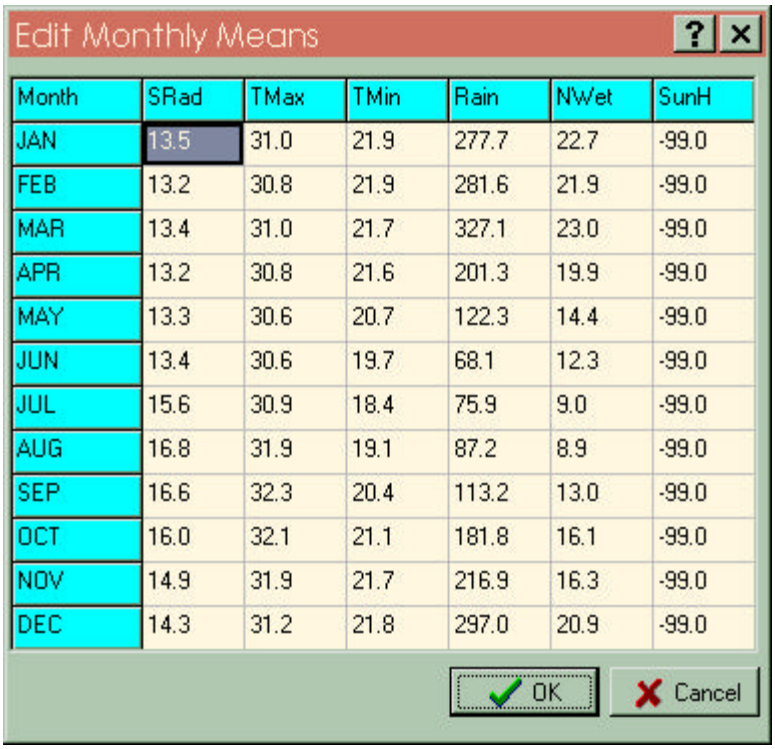
The second tab sheet in the dialog deals with documenting all facets of the climate data, from the people who collected it to where the data is published. WeatherMan by default always inserts the date and time that the file was created in the Notes section as a reference; Each section can contain as many lines that are needed to fully document the data set and all the data are stored in the PRM file.


Edit Station Information
Description
Documentation
People
Addresses
Methods
Instruments
Problems
Publications
Distribution
Notes
Created on day 3/12/01 at 9:05:25 AM
OK
Cancel

8. Edit Monthly Means

8.1. Edit Calculated Monthly Means

The calculated monthly means may be viewed and/or edited by choosing the Edit|Monthly Means menu option. The grid displays the calculated monthly means based on all data that has been imported for that station. you can edit and change these values, if you wish, by editing any cell. You may right-click on the grid to bring up a menu for printing, saving, or exporting the grid data.

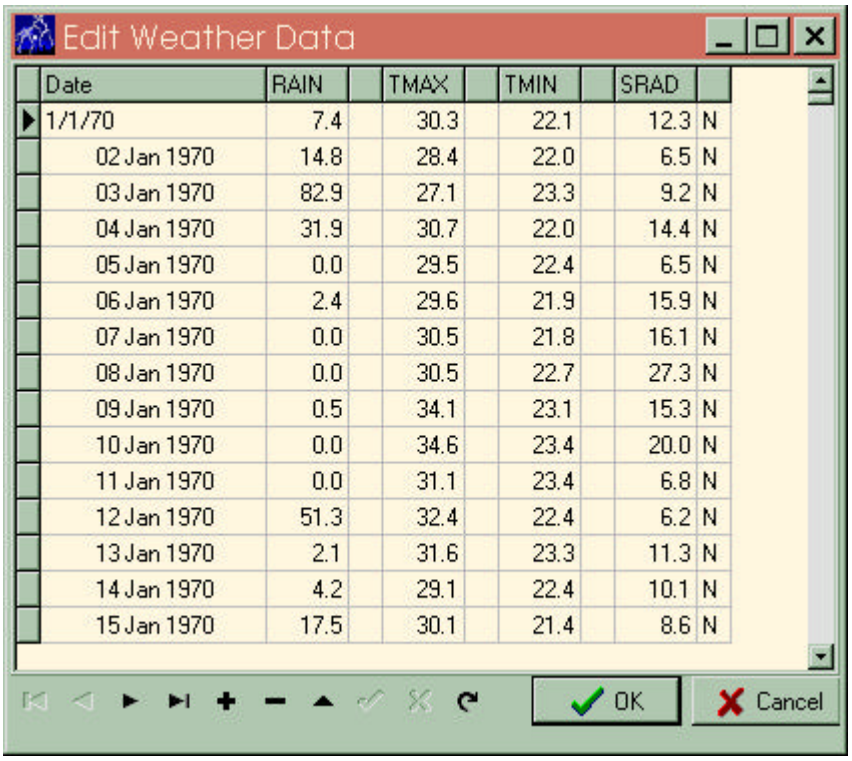


Month	SRad	TMax	TMin	Rain	NWet	SunH
JAN	13.5	31.0	21.9	277.7	22.7	-99.0
FEB	13.2	30.8	21.9	281.6	21.9	-99.0
MAR	13.4	31.0	21.7	327.1	23.0	-99.0
APR	13.2	30.8	21.6	201.3	19.9	-99.0
MAY	13.3	30.6	20.7	122.3	14.4	-99.0
JUN	13.4	30.6	19.7	68.1	12.3	-99.0
JUL	15.6	30.9	18.4	75.9	9.0	-99.0
AUG	16.8	31.9	19.1	87.2	8.9	-99.0
SEP	16.6	32.3	20.4	113.2	13.0	-99.0
OCT	16.0	32.1	21.1	181.8	16.1	-99.0
NOV	14.9	31.9	21.7	216.9	16.3	-99.0
DEC	14.3	31.2	21.8	297.0	20.9	-99.0

9. Editing Weather Data

9.1. Editing a climate database

The daily weather data may be edited by selecting the Edit|Daily Weather menu option. A database grid is diplayed that is linked to the Paradox databse containing all of the climate data for the station. You can edit any of the climate data at this time and changes are written to the database. If you make changes, you should recalculate the station PRM file.



Date	RAIN	TMAX	TMIN	SRAD	
1/1/70	7.4	30.3	22.1	12.3	N
02 Jan 1970	14.8	28.4	22.0	6.5	N
03 Jan 1970	82.9	27.1	23.3	9.2	N
04 Jan 1970	31.9	30.7	22.0	14.4	N
05 Jan 1970	0.0	29.5	22.4	6.5	N
06 Jan 1970	2.4	29.6	21.9	15.9	N
07 Jan 1970	0.0	30.5	21.8	16.1	N
08 Jan 1970	0.0	30.5	22.7	27.3	N
09 Jan 1970	0.5	34.1	23.1	15.3	N
10 Jan 1970	0.0	34.6	23.4	20.0	N
11 Jan 1970	0.0	31.1	23.4	6.8	N
12 Jan 1970	51.3	32.4	22.4	6.2	N
13 Jan 1970	2.1	31.6	23.3	11.3	N
14 Jan 1970	4.2	29.1	22.4	10.1	N
15 Jan 1970	17.5	30.1	21.4	8.6	N

For ease in navigating the database, a series of navigator buttons are placed on the dialog. The DBNavigator provides users a simple control for navigating through records in a dataset, and for manipulating records. The navigator consists of a series of buttons that enable a user to scroll forward or backward through records one at a time, go to the first record, go to the last record, insert a new record, update an existing record, post data changes, cancel data changes, delete a record, and refresh record display. The following table describes the buttons on the navigator.

Button **Purpose**

First Calls the dataset's First method to set the current record to the first record.
Prior Calls the dataset's Prior method to set the current record to the previous record.
Next Calls the dataset's Next method to set the current record to the next record.
Last Calls the dataset's Last method to set the current record to the last record.
Insert Calls the dataset's Insert method to insert a new record before the current record, and set the dataset in Insert state.
Delete Deletes the current record. If the ConfirmDelete property is True it prompts for confirmation before deleting.

Edit	Puts the dataset in Edit state so that the current record can be modified.
Post	Writes changes in the current record to the database.
Cancel	Cancels edits to the current record, and returns the dataset to Browse state.
Refresh	Clears data control display buffers, then refreshes its buffers from the physical table or query.

10. Plot Daily Data

10.1. Graph Data

Daily data can be graphed for the selected climate database by clicking on the Graph icon or choosing the Analyze|Graph menu item. The primary graph is then displayed.

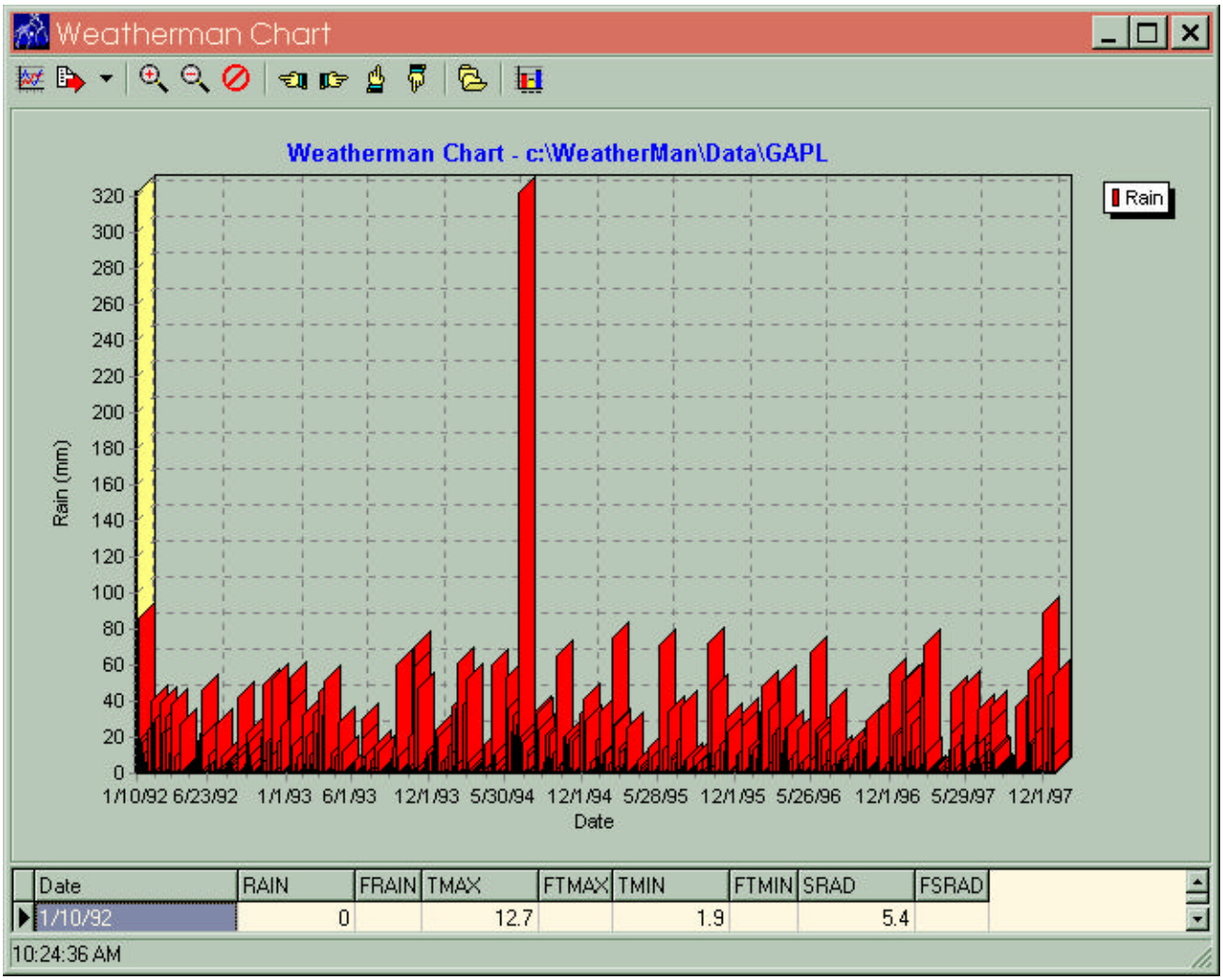
10.2. Weatherman Chart

10.2.1. Graph Data

This is the main screen for displaying daily data. The data table at the bottom is the data being displayed; this data is live. You can interactively edit and of the data points and the chart changes accordingly. The changes you make are written to the database so edit with caution. The tool bar at the top encapsulates much of the graph functionality. The buttons (from the left) ..

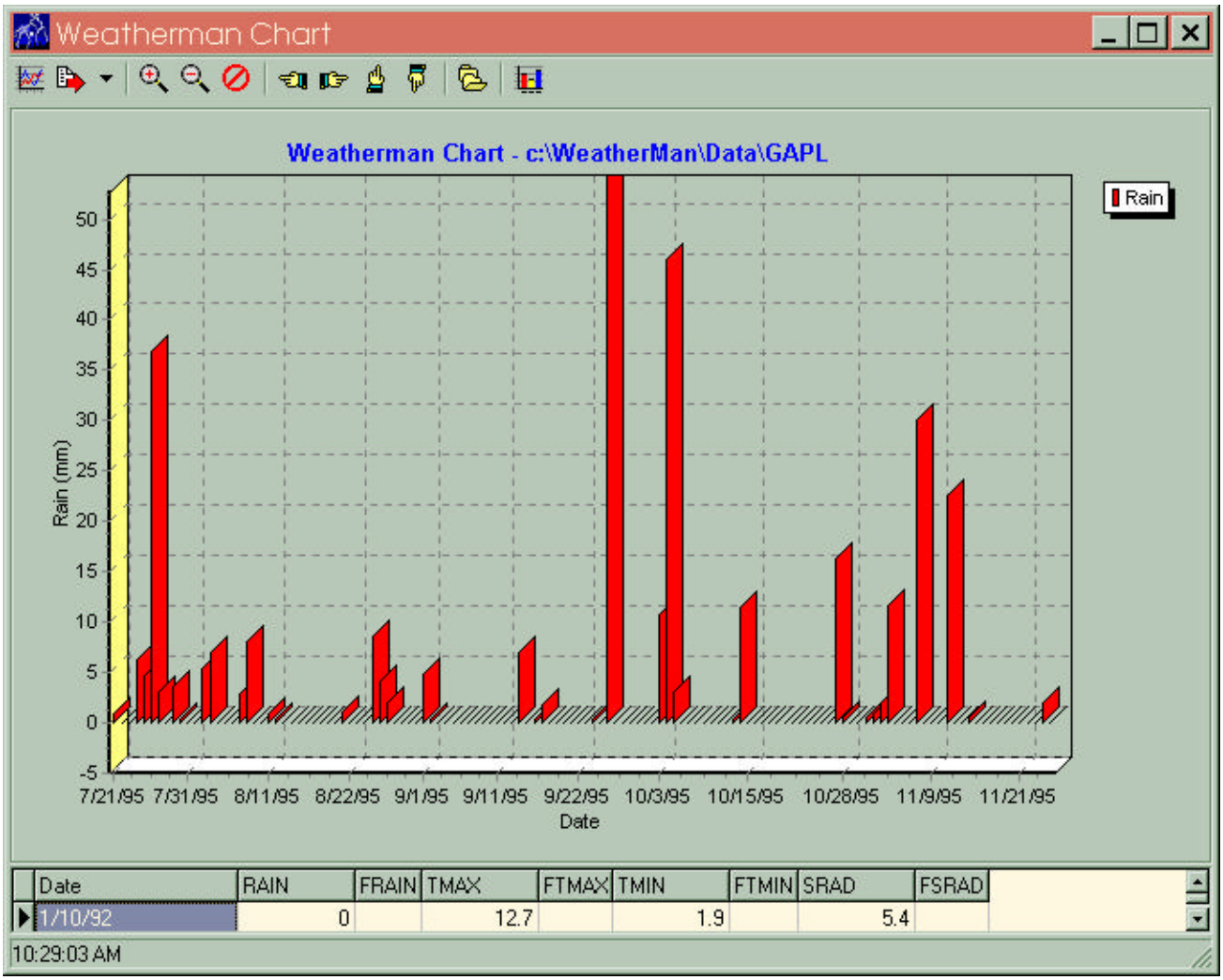
- Display the plot options dialog
- Access the print/export menu options
- Zoom In
- Zoom Out
- Reset Zoom
- Scroll Left
- Scroll Right
- Scroll Up
- Scroll Down
- Open an additional or new database
- Plot Summary data for this station (if it exists)

In addition, drawing a rectangle with the left mouse button zooms in on a particular subsection of the plot, and clicking on the Graph key show the statistics for that plotted series. Holding the right mouse button down allows you to drag the graph in all directions.



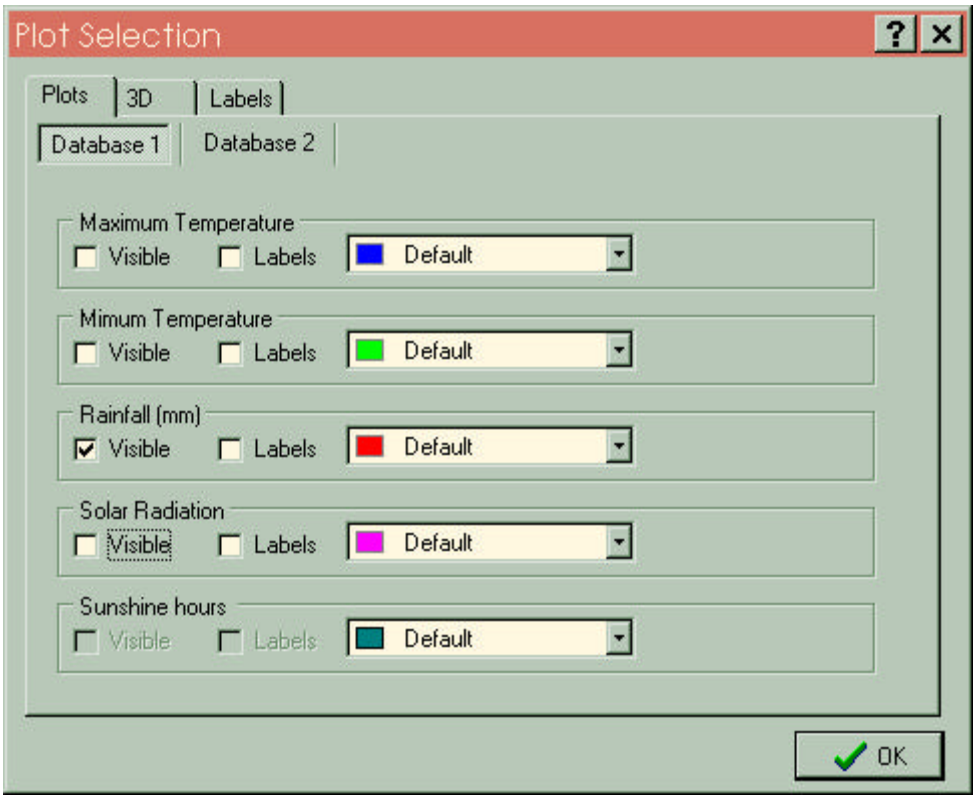
10.2.2. Select Data

Selecting a subset of data to view with the mouse allows you too zoom in an a particulat X-axis range. This particularly useful if you are plotting labels on the graph and have many data points to view.



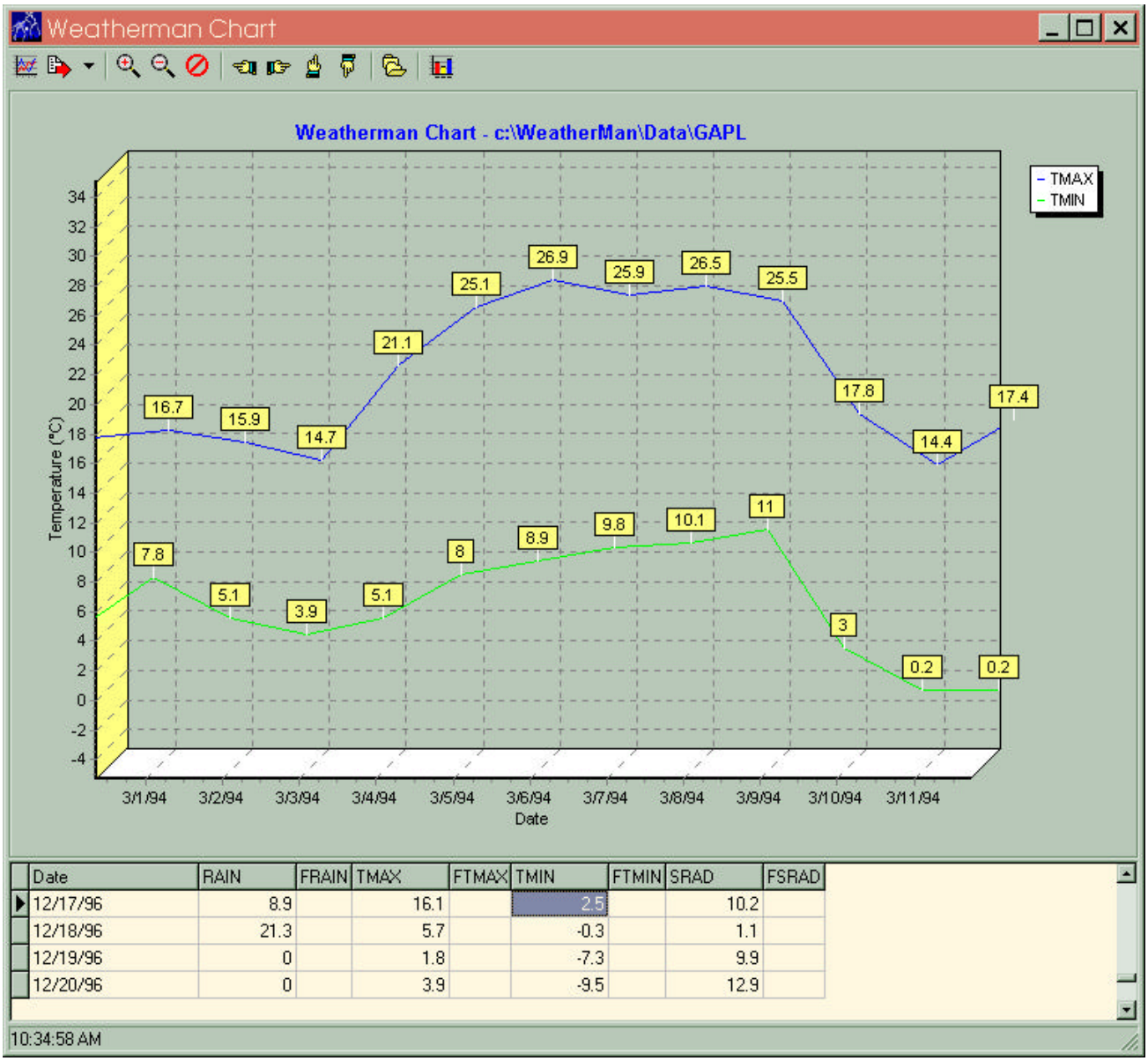
10.2.3. Plot Chart Options

Chart options are displayed on a three tier dialog. This page allows the user to choose which series to plot (none or any combination of variables) , whether the labels are plotted, and the color for that series. The same dialog is used if a second dataset is being plotted simultaneously.



10.2.4. Labels

With the labels option checked, the data values for each point are displayed on the chart. This is useful when verifying the veracity of data imported into the database.

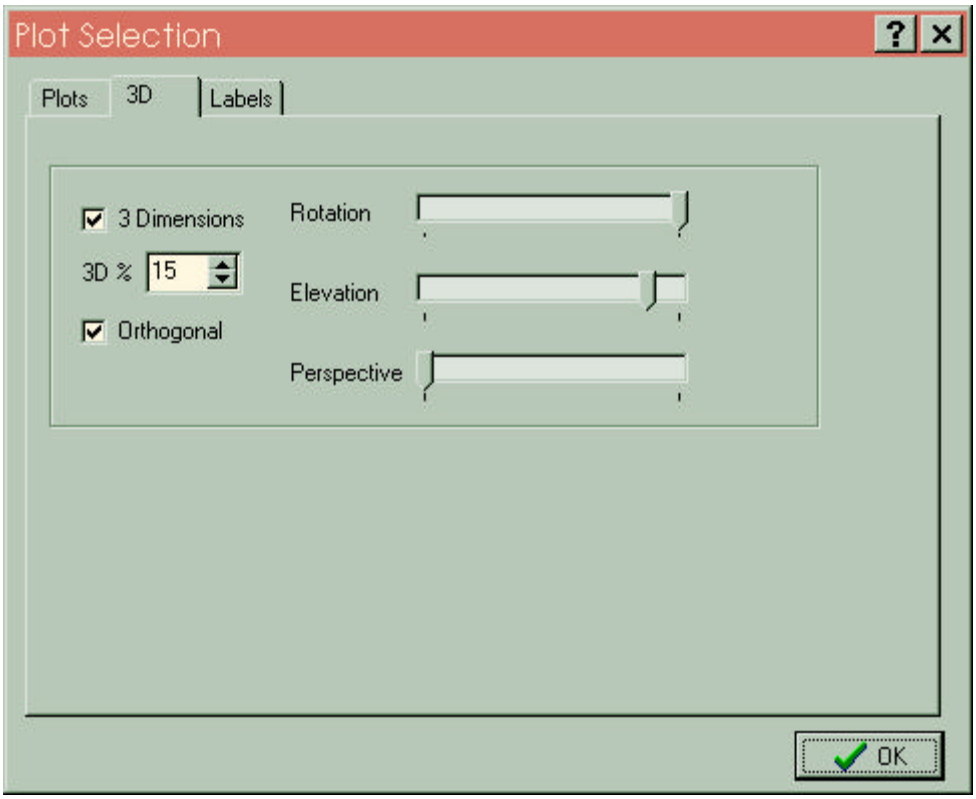


Date	RAIN	FRAIN	TMAX	FTMAX	TMIN	FTMIN	SRAD	FSRAD
12/17/96	8.9		16.1		2.5		10.2	
12/18/96	21.3		5.7		-0.3		1.1	
12/19/96	0		1.8		-7.3		9.9	
12/20/96	0		3.9		-9.5		12.9	

10:34:58 AM

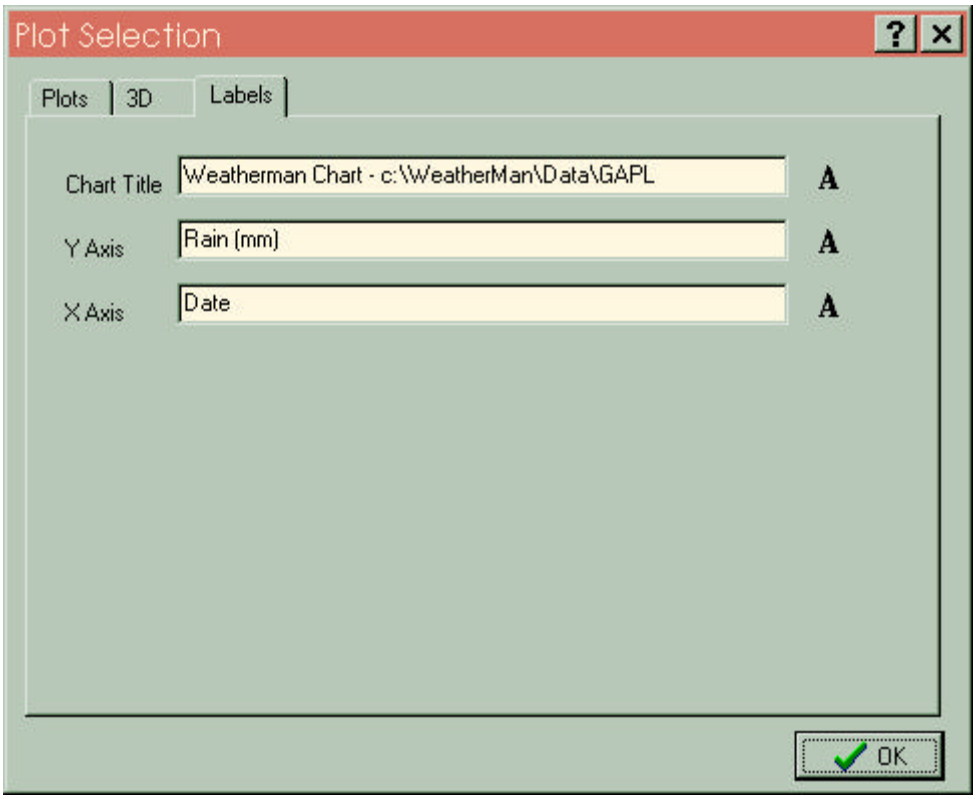
10.2.5. 3D Chart Options

This page displays options for displaying the chart in 3D.



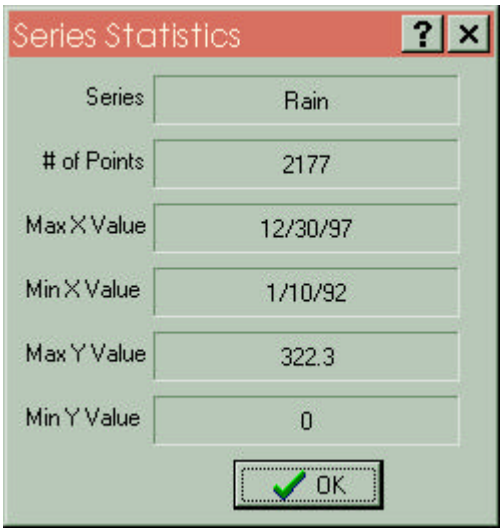
10.2.6. Plot Labels

This page defines the title and axis-labels for the chart, including the font. Clicking on the Font icon will bring up a FontDialog, where you can choose the font, color, and size of the text on the chart.



10.2.7. Series Statistics

Series Statistics are generated by clicking on a series name in the chart key.



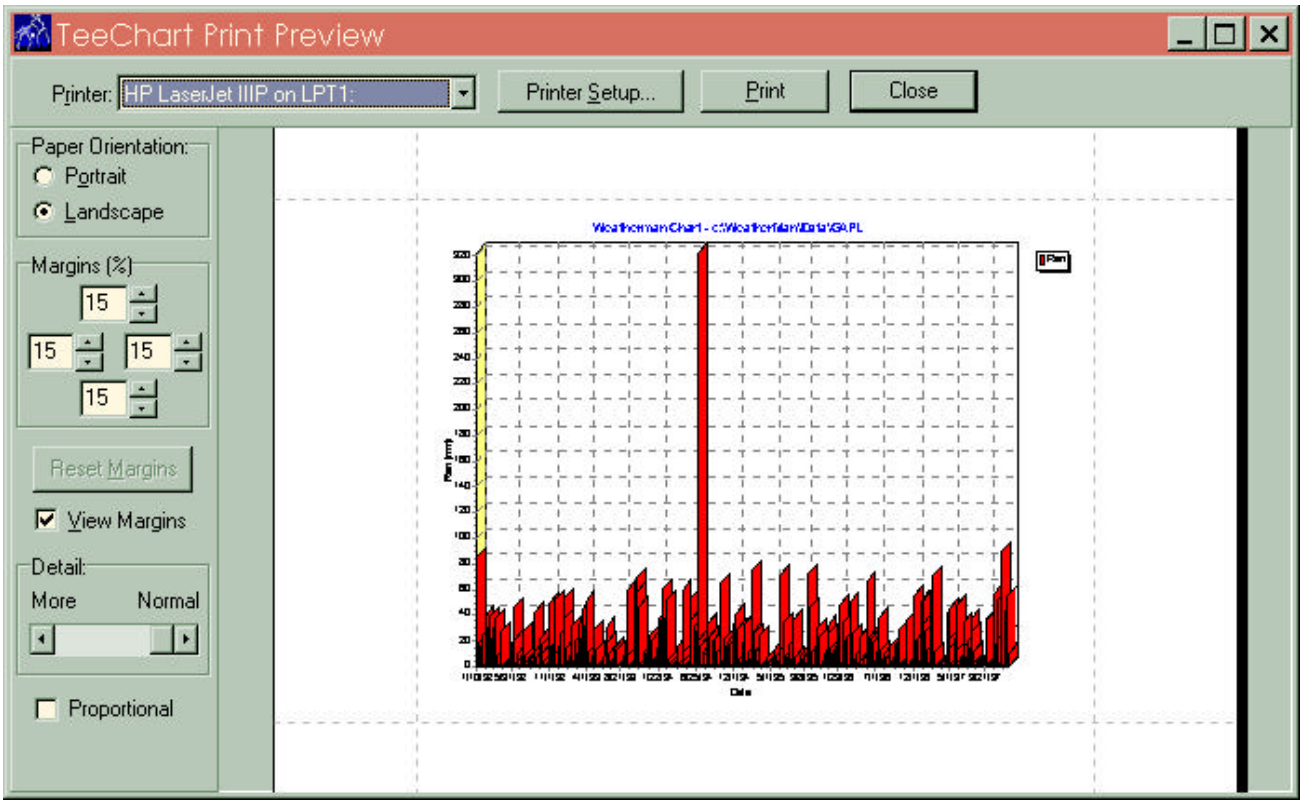
10.2.8. Selecting an additional dataset

A new data set can be loaded, or a second data set can be loaded for comparison to the original data set. Choose the Open Folder icon and select a second database (do **NOT** select the current database). When you choose a new databse, the View Chart as dialog is displayed. You can either

- Load this climate dataset and plot it out, or
- Load this dataset in conjunction with the currently selected database to plot both simultaneously for comparison.

10.2.9. Capturing Graph Output

Selecting the Graph Output option in the toolbar allows you to copy or save the current chart in a variety of formats; choosing to print the chart displays displays the Print Preview dialog box. Here, you can set the orientation of the chart, select the printer, and other print options.


TeeChart Print Preview
Printer:
HP LaserJet IIIP on LPT1:
Printer Setup...
Print
Close
Paper Orientation:
Portrait
Landscape
Margins (%)
15
15
15
15
Reset Margins
View Margins
Detail:
More
Normal
Proportional

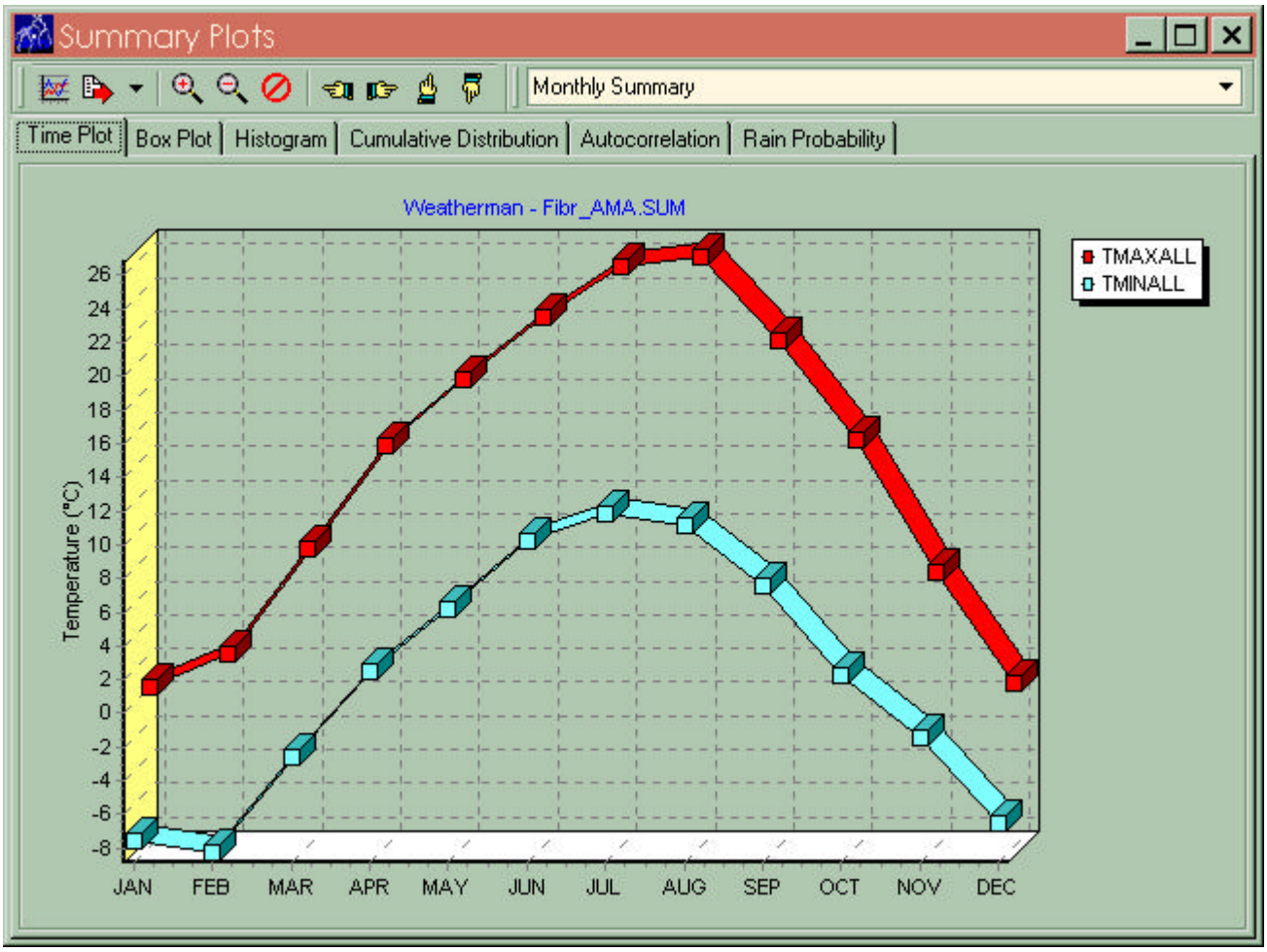
11. Plot Summary Data

11.1. Summary Data Plots

This is the main screen for displaying summary statistical data. The tool bar at the top encapsulates much of the graph functionality. The buttons (from the left) ..

- Display the plot options dialog
- Access the print/export menu options
- Zoom In
- Zoom Out
- Reset Zoom
- Scroll Left
- Scroll Right
- Scroll Up
- Scroll Down
- Select the aggregation of data; Monthly summary, monthly time series, or yearly time series.

In addition, drawing a rectangle with the left mouse button zooms in on a particular subsection of the plot.

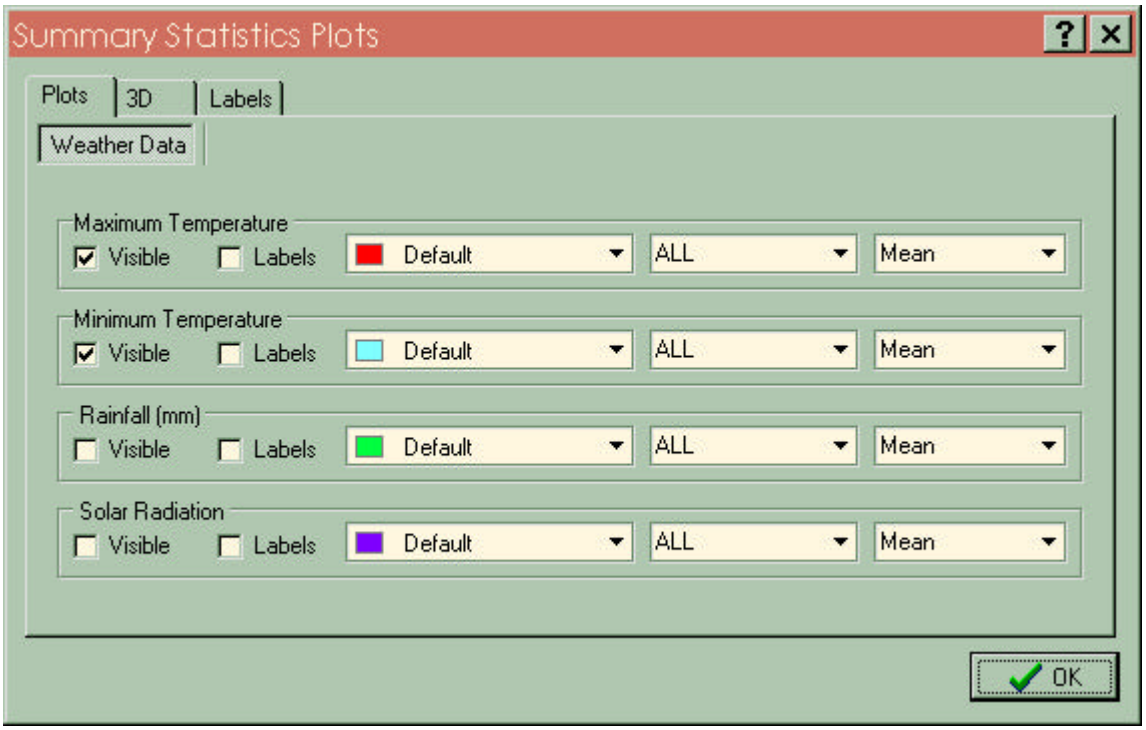


There are several plot types available to graphs the summary data; Time plots, Box Plots, Histograms, Cumulative distibution, Autocorrelation, and Rain probability. Simply click on the selected Tab to view that plot.

There are several plot groupings to choose from: a monthly summary of data, a monthly time series, and a yearly time series. These are selected by clicking on the combobox in the toolbar. In some cases, a up-down control will appear on the screen. Use this control to rapidly scroll thorough months and years on the screen when looking at monthly or yearly summary data.

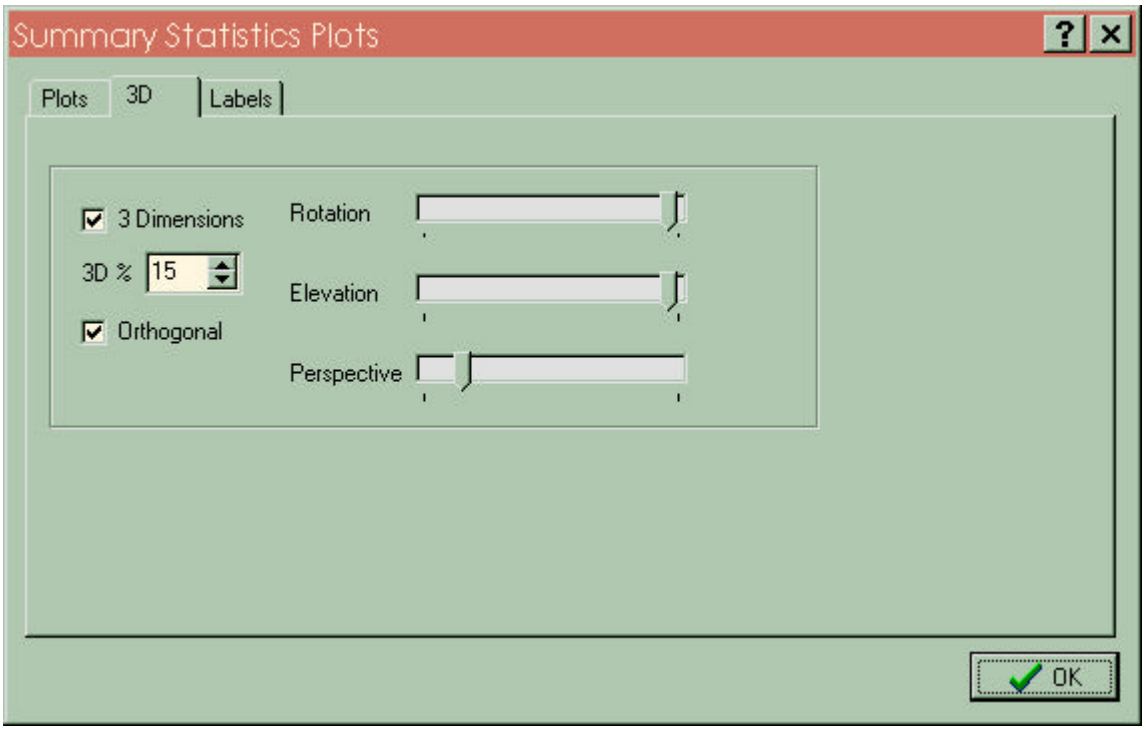
11.2. Plot Chart Options

Chart options are displayed on a three tier dialog. This page allows the user to choose which series to plot, whether the labels are plotted, the color for that series, the subset of data used (All days, Wet days, Dry days), and the statistical parameter to plot (mean, standard deviation, skew, or kurtosis)..



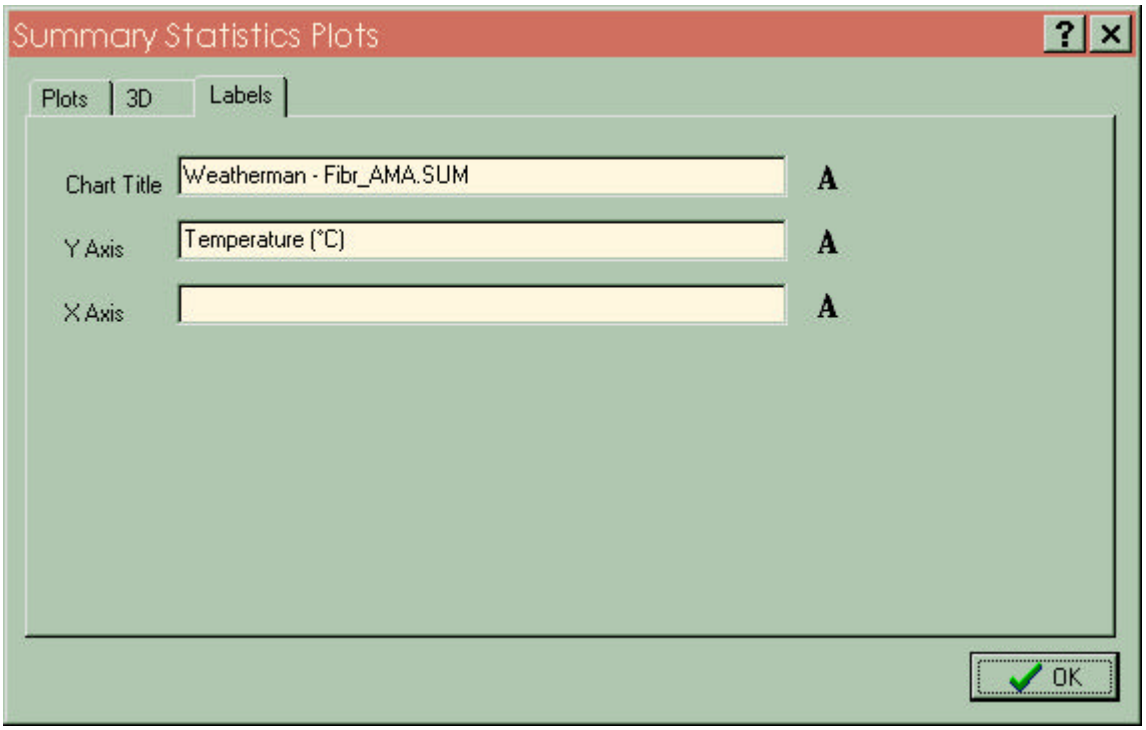
11.3. 3D Chart Options

This page displays options for displaying the chart in 3D.



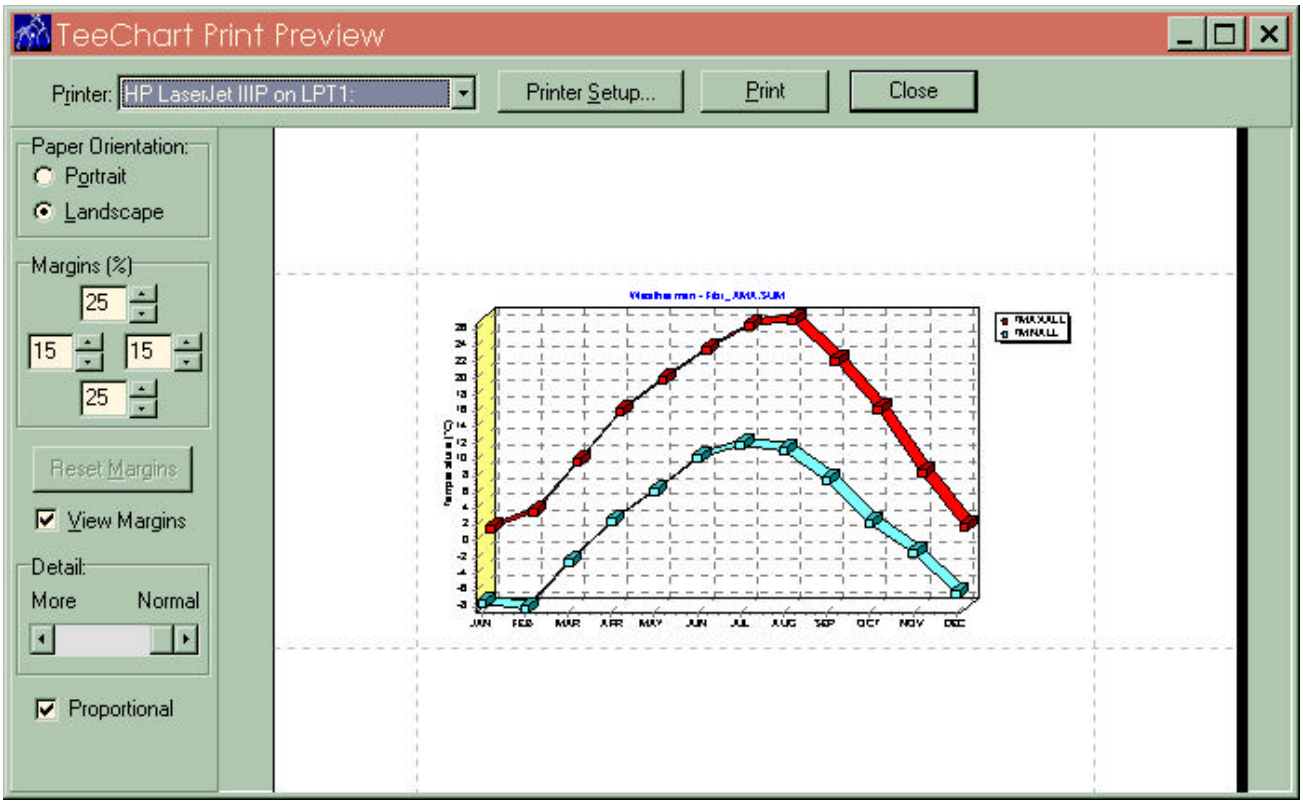
11.4. Plot Labels

This page defines the title and axis-labels for the chart, including the font. Clicking on the Font icon will bring up a FontDialog, where you can choose the font, color, and size of the text on the chart.



11.5. Print Plots

Selecting the Graph Output option in the toolbar allows you to copy or save the current chart in a variety of formats; choosing to print the chart displays displays the Print Preview dialog box. Here, you can set the orientation of the chart, select the printer, and other print options.

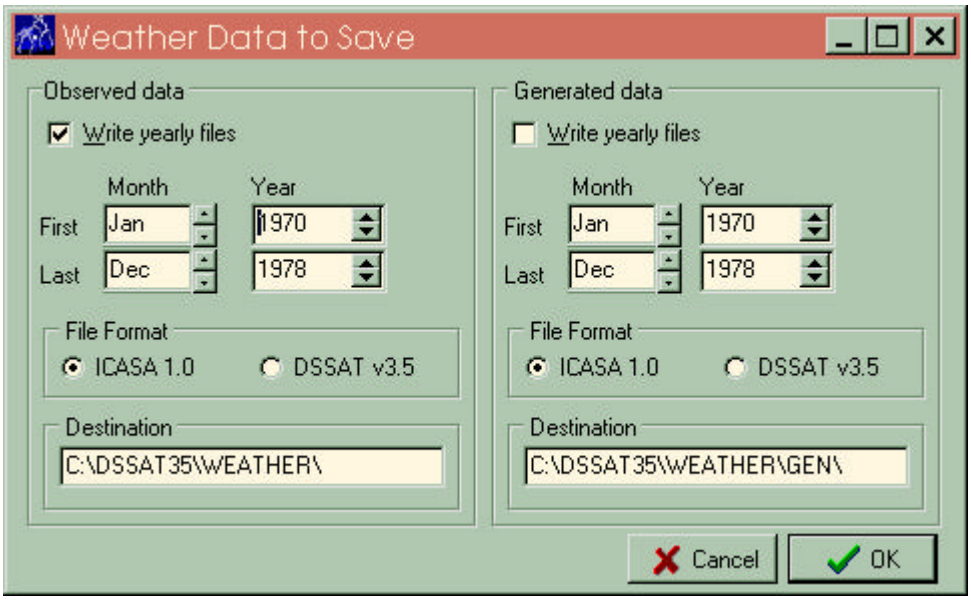

TeeChart Print Preview
Printer:
HP LaserJet IIIP on LPT1:
Printer Setup...
Print
Close
Paper Orientation:
Portrait
Landscape
Margins (%)
25
15
15
25
Reset Margins
View Margins
Detail:
More
Normal
Proportional
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC

12. Save and Export Options

12.1. Saving and Exporting Weather Data

The Weather Data to Save Dialog is used when you choose to save your data from the main menu (File|Save Station). You can choose to write out either observed weather data and/or generated data, depending on which databases exist for the currently selected climate station. You also have an option of generating ICASA 1.x weather structures or for back-compatibility, DSSAT v35 weather data. You may only export data up to and including the limits of the data in the database. By double-clicking on the destination edit boxes, you can choose an alternate destination for the weather data that is written out.

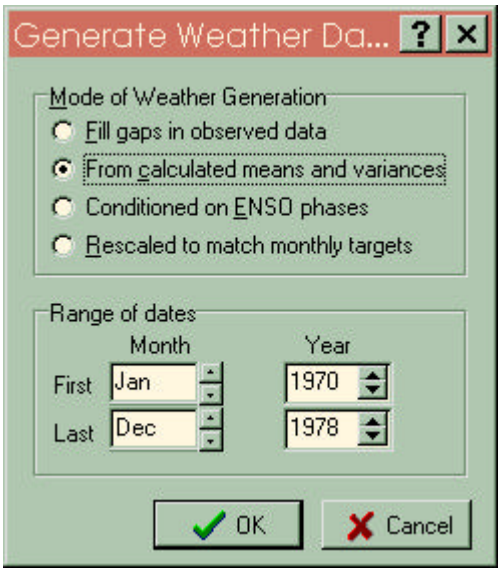
To generate more synthetic weather data, choose the Generate option.



13. Generate Weather Data

13.1. Generate Synthetic Climate Data

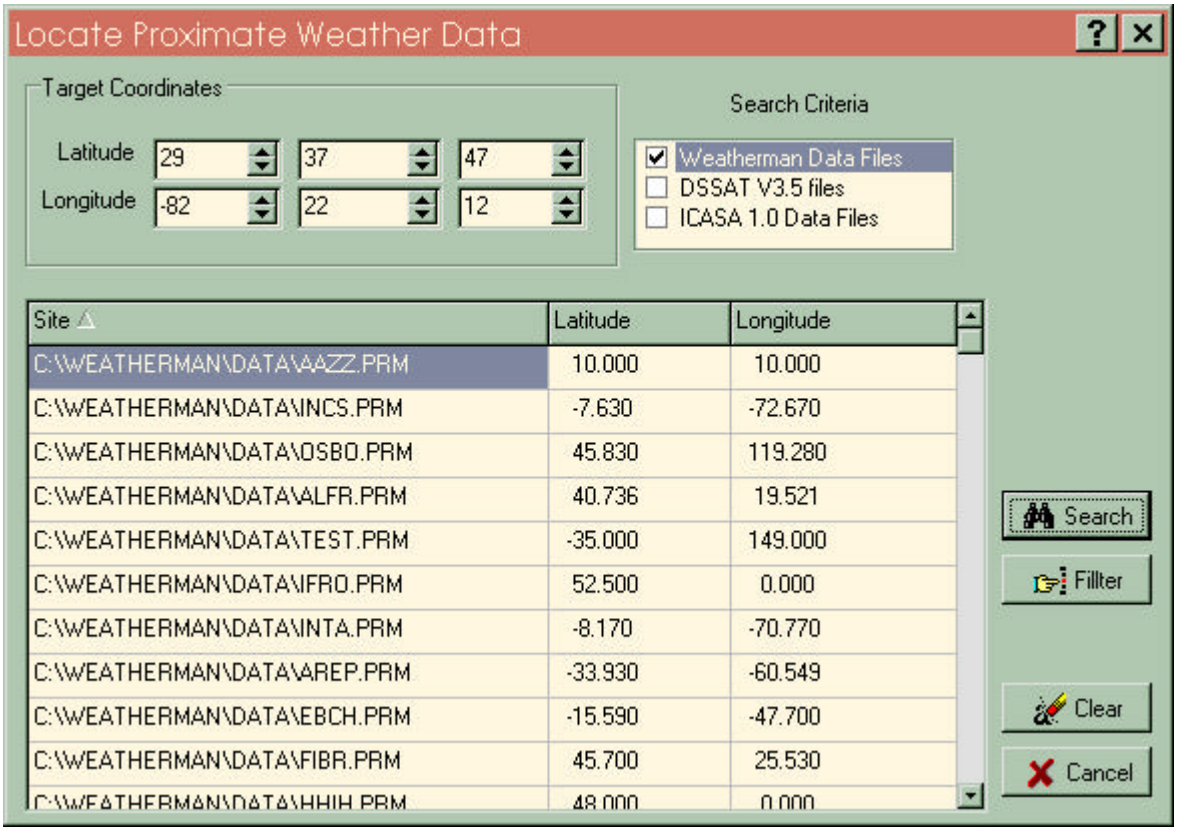
This dialog is shown when you choose the option to generate weather data (Generate|Stochastic Weather). Weather data can be generated from the calculated means and variances of the currently selected weather station, by filling in gaps in the observed weather, scaled to match monthly targets, or conditioned on ENSO phases. New and/or improved weather geneators may be implemented for generating stochastic weather.



14. Locate Proximate Weather Data

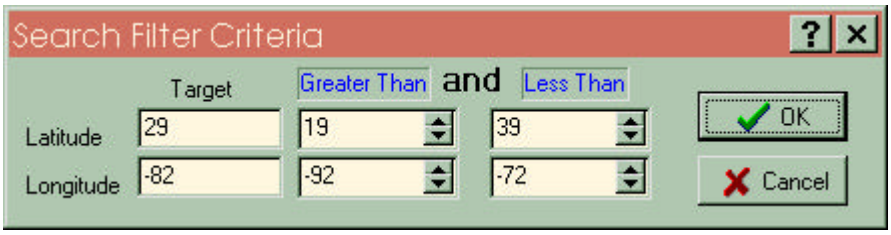
14.1. Locating Proximate Climate Stations

The Locate Proximate Weather Data dialog displays a dialog that searches all WeatherMan data files, DSSAT v35 files, and ICASA1.1 files for stations or climate files and sorts them by latitude and longitude. ou can sort the results by site, latitude, or longitude by clicking in the header bar for each variable. Clicking on the Filter button allows you to refine your search. The purpose of this functionality is to hasten the search for weather data that you have may have that is closest to a particular lat\lon location that weather data may not exist.



14.2. Search Filter Criteria

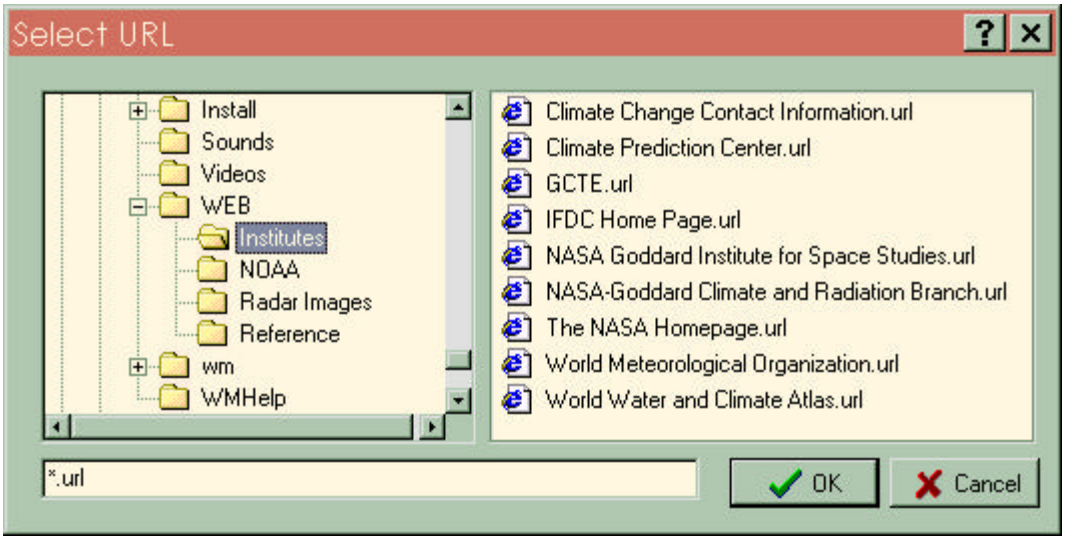
This dialog is displayed after you search for all climate data and then choose to filter the results to narrow the results.


Search Filter Criteria
Target
Greater Than
and
Less Than
Latitude
29
19
39
Longitude
-82
-92
-72
OK
Cancel

15. Web resources

15.1. Web Climate Data

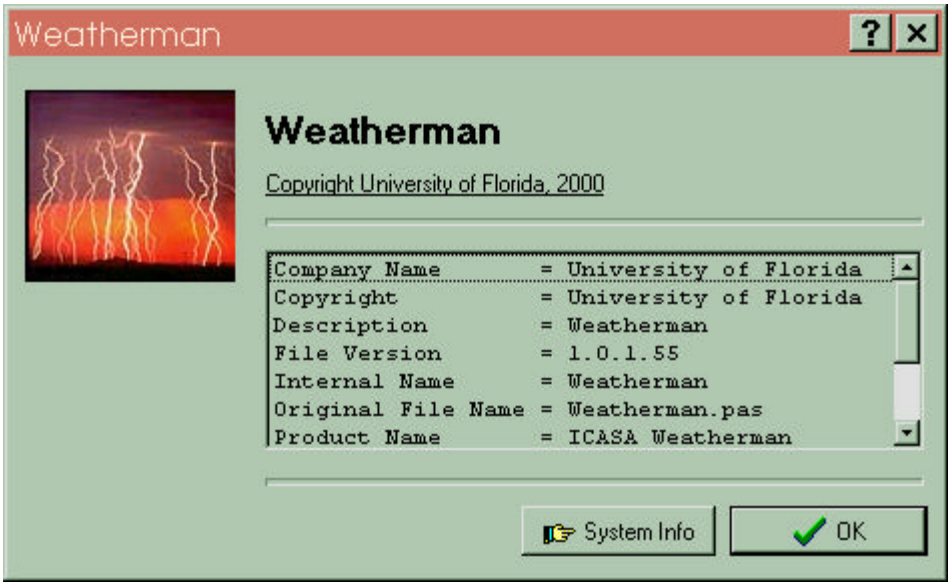
A selected list of some helpful web resources for finding, creating, and modifying climate data is installed with WeatherMan. Simply click on the web site you wish to visit and your default browser will be loaded. You can add more shortcuts to web sites you visit by saving them in any of the WEB folders.



16. About

16.1. About Weatherman

The About screen displays information on the WeatherMan executable, including the file version (build number) of the EXE file. The System Info button will attempt to load the installed system information utilities that gives detailed information on your system which may be useful in debugging problems.



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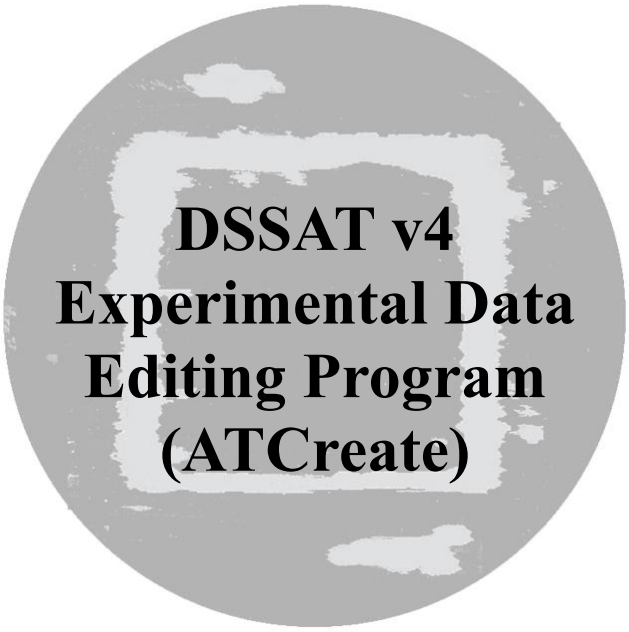
Chapter 5



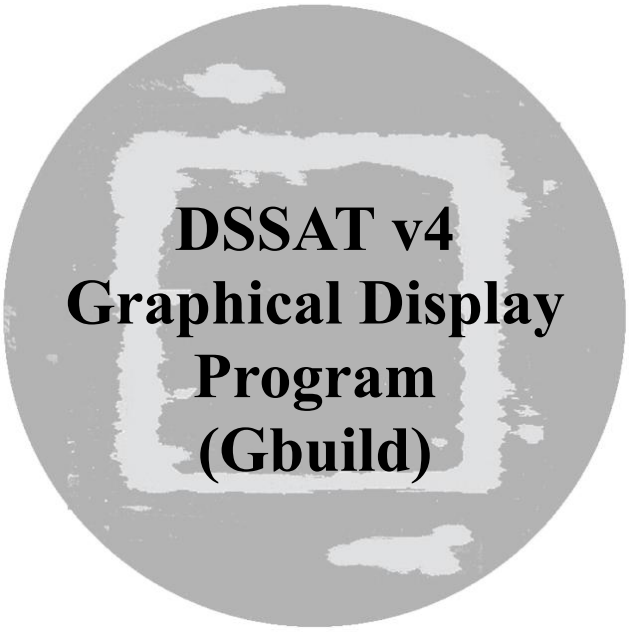
DSSAT v4 Experimental Data Editing Program (ATCreate)

P. W. Wilkens

International Center for Soil Fertility and Agricultural Development
International Consortium for Agricultural Systems Applications

This section is in development.

Chapter 6



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GBuild

Graphically display simulated and experimental data for DSSATv4

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Table of Contents

1 Introduction

GBuild is a mouse-menu-key-driven plotting tool for data visualization. It provides users with the capability to easily plot graphs that are routinely used during the development and validation of crop models. Different graphic options will give different views of the research results. GBuild lets one compare data from experimental measurements with results from simulation models. Additionally, GBuild calculates statistics based on experimental and simulated data. The output can be seen on the screen, printed, and can be saved in a file. It also provides the possibility of exporting the data into an Excel spread sheet, or to a text file. The program is user-friendly and leads thought the consequences steps for the desire results.

The basic design of GBuild is based on a set of codes that are used as headers over each column of data. The variables, those are properly documented in DSSAT v4, will be presented with the corresponding description. Simulated data corresponds to output simulated results, which are saved in the *.out files (for example PlantGro.out (Fig. 1)), Experimental data – T-files, or time course data for a crop experiment (for example UFGA8601.BNT(Fig. 2)), and Evaluated data – overview information comparing simulated results and corresponding average performance data for the crop experiment . (for example Evaluation.out (Fig. 3)).

GROWTH ASPECTS OUTPUT FILE

DSSAT Cropping System Model Ver. 4.0.001 May 16, 2003; 17:01:53

RUN 1 : IRRIGATED
MODEL : CRGRO030 - SOYBEAN
EXPERIMENT : UFGA7901 SB IRRIGATION 3I
TREATMENT 1 : IRRIGATED

YEAR	DOY	DAS	DAP	L#SD	GSTD	LAID	LWAD	SWAD	GWAD	RWAD	CWAD	G#AD	GWGD	HIAD	PWAD	P#AD	WSPD	WSGD
1979	170	0	0	0.0	0	0.00	0	0	0	0	0	0	0.0	0.000	0	0	0.000	0.000
1979	173	3	3	0.0	0	0.00	0	0	0	0	0	0	0.0	0.000	0	0	0.000	0.000
1979	176	6	6	0.2	0	0.03	18	4	0	26	23	0	0.0	0.000	0	0	0.000	0.000
1979	179	9	9	0.6	0	0.04	20	4	0	40	24	0	0.0	0.000	0	0	0.000	0.000
1979	182	12	12	1.2	0	0.07	28	6	0	49	33	0	0.0	0.000	0	0	0.000	0.000
1979	185	15	15	2.1	0	0.13	49	8	0	54	57	0	0.0	0.000	0	0	0.000	0.000
1979	188	18	18	3.0	0	0.25	82	15	0	66	97	0	0.0	0.000	0	0	0.000	0.000
1979	191	21	21	3.8	0	0.39	132	26	0	90	157	0	0.0	0.000	0	0	0.000	0.283
1979	194	24	24	4.6	0	0.58	195	48	0	124	243	0	0.0	0.000	0	0	0.000	0.175
1979	197	27	27	5.5	0	0.81	264	93	0	170	357	0	0.0	0.000	0	0	0.000	0.000
1979	200	30	30	6.3	0	1.12	337	154	0	217	491	0	0.0	0.000	0	0	0.000	0.000
1979	203	33	33	7.2	0	1.47	435	246	0	281	681	0	0.0	0.000	0	0	0.000	0.000
1979	206	36	36	8.1	0	1.87	542	359	0	349	902	0	0.0	0.000	0	0	0.000	0.000
1979	209	39	39	9.0	0	2.29	670	516	0	425	1187	0	0.0	0.000	0	0	0.000	0.000
1979	212	42	42	9.9	0	2.74	797	695	0	497	1492	0	0.0	0.000	0	0	0.000	0.000
1979	215	45	45	10.7	1	3.25	923	900	0	554	1823	0	0.0	0.000	0	0	0.000	0.000
1979	218	48	48	11.6	1	3.72	1067	1142	0	619	2209	0	0.0	0.000	0	0	0.000	0.000
1979	221	51	51	12.4	1	4.14	1219	1409	0	688	2628	0	0.0	0.000	0	0	0.000	0.000
1979	224	54	54	13.3	1	4.51	1341	1639	0	740	2980	0	0.0	0.000	0	0	0.000	0.000
1979	227	57	57	14.1	1	4.82	1479	1916	0	802	3395	0	0.0	0.000	0	0	0.000	0.000
1979	230	60	60	15.0	1	5.07	1611	2196	0	860	3807	0	0.0	0.000	0	0	0.000	0.000
1979	233	63	63	15.6	3	5.25	1735	2480	0	912	4214	0	0.0	0.000	0	0	0.000	0.000
1979	236	66	66	15.6	3	5.37	1846	2759	0	961	4617	0	0.0	0.000	12	91	0.000	0.000
1979	239	69	69	15.6	3	5.40	1941	3029	0	1001	5048	0	0.0	0.000	78	280	0.000	0.000
1979	242	72	72	15.6	5	5.36	2011	3264	0	1027	5474	44	0.0	0.000	199	495	0.000	0.000
1979	245	75	75	15.6	5	5.26	2039	3423	24	1031	5829	310	7.8	0.004	367	661	0.000	0.000
1979	248	78	78	15.6	5	5.08	1980	3390	103	987	5985	627	16.4	0.017	615	799	0.000	0.000
1979	251	81	81	15.6	5	4.93	1930	3367	246	947	6262	1103	22.3	0.039	965	944	0.000	0.000
1979	254	84	84	15.6	5	4.74	1848	3276	487	895	6495	1419	34.3	0.075	1372	1104	0.000	0.000
1979	257	87	87	15.6	5	4.54	1757	3179	780	842	6654	1742	44.8	0.117	1718	1238	0.000	0.000

Figure 1. PlantGro.out file.

*.DATA (T): UFGA7901SB BRAGG, IRRIGATED & NON-IRRIGATED

NO	DATE	L#SD	LAID	P#AD	S#AD	G#AD	L#AD	C#AD	P#AD	S#AD	G#AD	SM%D	SLAD	GUGD	HIAD	LN%D	SN%D	SHND
1	79185	1.2	0.1	-99	32	-99	36	68	-99	-99	-99	-99	289.9	-99	-99	5.89	5.08	-99
1	79192	2.8	0.29	-99	49	-99	104	153	-99	-99	-99	-99	283.3	-99	-99	5.31	3.18	-99
1	79199	4.2	0.71	-99	137	-99	228	365	-99	-99	-99	-99	310.6	-99	-99	5.43	2.66	-99
1	79206	6.3	1.7	-99	390	-99	446	836	-99	-99	-99	-99	381.2	-99	-99	5.06	1.71	-99
1	79213	8	2.75	-99	871	-99	798	1669	-99	-99	-99	-99	365	-99	-99	5.04	1.44	-99
1	79220	9.8	4.42	-99	1583	-99	1168	2750	-99	-99	-99	-99	370.4	-99	-99	5.03	1.47	-99
1	79227	10.1	4.09	-99	1830	-99	1169	2999	-99	-99	-99	-99	348.4	-99	-99	5.06	1.55	-99
1	79234	10.2	4.71	-99	2491	-99	1479	3970	-99	-99	-99	-99	314.5	-99	-99	4.86	1.55	-99
1	79241	11.4	4.47	698	2649	-99	1548	4444	246	246	-99	-99	285.7	-99	-99	5.09	1.71	4.94
1	79248	10.9	3.92	1421	2596	291	1629	5603	1178	867	3452	24.7	215.1	8.4	0.052	5.15	1.83	4.1
1	79255	11.4	4.69	1560	3214	642	1670	6268	1384	742	2051	46.39	280.9	31.3	0.102	4.96	1.74	3.12
1	79262	11.4	4.42	1292	3137	1309	1571	6819	2111	802	2092	62.01	283.3	62.6	0.192	4.66	1.64	2.71
1	79269	11.1	4.03	1172	2555	1795	1447	6649	2648	853	2099	67.79	277.8	85.5	0.270	4.34	1.6	2.36
1	79276	11.1	4.1	935	2779	2665	1453	7878	3646	981	2235	73.09	280.1	119.2	0.338	3.65	1.01	1.76
1	79283	11	2.68	959	2367	2960	1009	7272	3906	946	1999	75.78	266	148.1	0.407	2.6	0.74	1.39
1	79290	11.1	1	1026	2241	3053	378	6548	3928	875	1832	77.72	250	166.7	0.466	2.24	0.74	1.15
1	79297	11.1	0.06	906	1455	2728	20	5013	3539	811	1698	77.08	274.7	160.7	0.544	3.13	0.7	1.33
2	79185	1.3	0.13	-99	33	-99	41	73	-99	-99	-99	-99	310.6	-99	-99	5.77	4.54	-99
2	79192	2.6	0.34	-99	51	-99	106	157	-99	-99	-99	-99	320.5	-99	-99	5.24	2.82	-99
2	79199	4.1	0.76	-99	146	-99	216	363	-99	-99	-99	-99	347.2	-99	-99	5.14	2.63	-99
2	79206	6	1.66	-99	361	-99	425	785	-99	-99	-99	-99	392.2	-99	-99	5.22	1.82	-99
2	79213	7.2	2.53	-99	762	-99	749	1510	-99	-99	-99	-99	334.5	-99	-99	4.87	1.7	-99
2	79220	8.9	3.35	-99	1131	-99	915	2046	-99	-99	-99	-99	369	-99	-99	4.84	1.45	-99
2	79227	10.1	4.36	-99	1810	-99	1207	3017	-99	-99	-99	-99	361	-99	-99	4.91	1.49	-99
2	79234	10.1	3.51	-99	1603	-99	1079	2682	-99	-99	-99	-99	324.5	-99	-99	4.57	1.67	-99
2	79241	11	3.81	653	2193	-99	1445	3803	166	166	-99	-99	267.4	-99	-99	4.76	1.66	4.8
2	79248	10.7	3.73	1173	2443	165	1866	5175	866	701	2931	19.05	207	5.6	0.032	4.86	1.68	3.94
2	79255	10.7	4.08	1075	2603	406	1428	5023	992	586	1718	40.93	262.5	23.6	0.081	4.79	1.71	3.15
2	79262	10.9	4.33	872	2671	921	1612	5947	1664	743	1917	55.35	271.7	48	0.155	4.43	1.63	2.85
2	79269	10.8	3.39	915	2353	1488	1235	5789	2173	685	1770	68.11	275.5	84.1	0.257	4.18	1.48	2.25
2	79276	10.9	2.86	935	2157	2017	1334	6370	2847	830	1810	70.85	274.7	111.4	0.317	3.76	1.08	1.72
2	79283	10.6	2.66	904	2180	3130	1074	7403	4149	1019	2157	75.44	253.2	145.1	0.423	2.32	0.91	1.39
2	79290	10.7	0.54	978	1932	3097	222	6173	4020	923	1977	77.04	243.9	156.7	0.502	2.04	0.61	1.19
2	79297	10.7	0.04	978	1395	2669	13	4896	3489	820	1678	76.5	295	159	0.545	2.6	0.57	1.3
3	79185	1.2	0.1	-99	32	-99	36	68	-99	-99	-99	-99	289.9	-99	-99	5.89	5.08	-99
3	79192	2.8	0.29	-99	49	-99	104	153	-99	-99	-99	-99	283.3	-99	-99	5.31	3.18	-99
3	79199	4.2	0.71	-99	137	-99	228	365	-99	-99	-99	-99	310.6	-99	-99	5.43	2.66	-99

Figure 2. UFGA7901.SBT file.

*EVALUATION FILE - SIMULATED VS. OBSERVED VALUES

ADAPP	ADAPO	PD1PP	PD1PO	PDFPP	PDFPO	MDAPP	MDAPO	HWAMP	HWAMO	PWAMP	PWAMO	H#AMP	H#AMO	HWUMP
44	43	63	60	72	-99	114	119	3133	2891.	3967	3734	2011	1765.	0.156
44	45	64	66	72	-99	114	119	3085	2883.	3911	3755	1963	1827.	0.157
44	-99	63	-99	72	-99	102	-99	946	-99	1344	-99	908	-99	0.104

Figure 3. Evaluate.OUT file.

GBuild program is specially designed for the DSSAT v4 software package and can be installed and used only is the database is available on the system. GBuild can work as stand-alone program and as part of the DSSAT v4 Shell (see Shell Manual)

1.1 System Requirements

- PC with at least 35 MB of free disk space
- Windows 98/NT/2000/XP Operating System
- DSSAT v4
- A display with at least 800x600 resolution recommended

1.2 Installation

1. DSSAT4 must be installed prior to installing GBuild.
2. Insert the installation CD and run the setup program. Windows will execute the setup

program and display two preliminary dialog boxes. Then the program will display the dialog box (Fig.4). Although the setup program lets the user select the directory to install the program, it is recommended that the default directory be used. The default directory for installing GBuild is C:\DSSAT4\Tools\GBuild\. After clicking on the button shown in Figure 4, the installation begins.

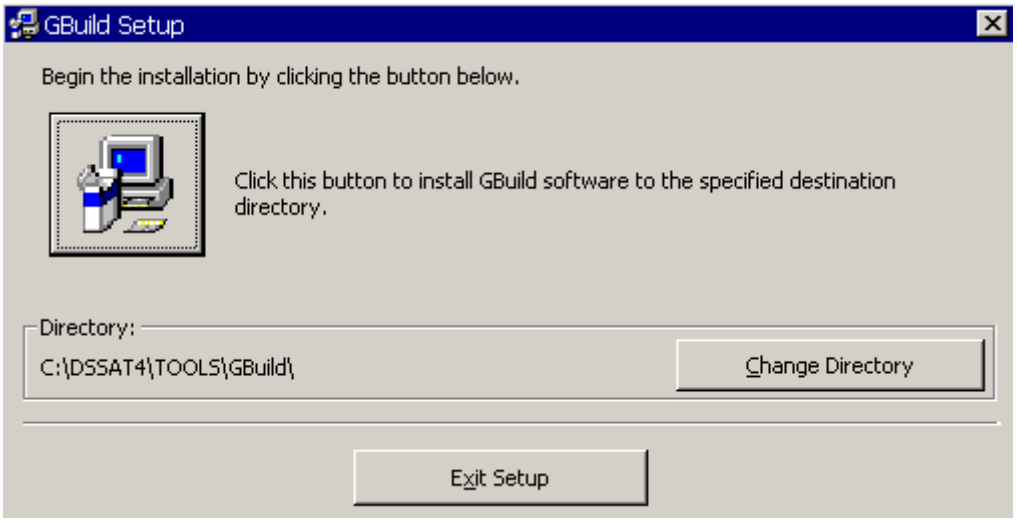


Figure 4. Window displayed by Setup.exe, prompting the user to click the button to begin installation, and offering an opportunity to change installation directory.

During installation, the program registers all OCXs (ActiveX controls) and copies all necessary files. If some of the files already exist on your system, warning messages will be displayed. It is recommended that you keep the newest version of the files when you are prompted.

After the installation is completed, GBuild is ready to use without rebooting the computer.

1.3 Guidelines

GBuild is a MS Windows application program. The user interface with the program is via menus and dialog boxes, and the program information via windows. GBuild makes use of the DSSAT directory structure and communication protocol, which designates the location of all programs and data.

GBuild can be used as stand-alone program and as part of DSSAT4 Shell:
- When running GBuild under the DSSAT Shell, the user selects the files from Shell list and by selecting the button **Plot** activates GBuild (See the Shell Manual).

- When running GBuild as a stand-alone program, the user has to select the file(s) from **File/Open** menu option of the GBuild program.

2 Menu Structure

GBuild is like many other Windows applications. It has a menu bar at the top of its main window. With the following main menu options:

- **File**
- **Variable Selection**
- **Options**
- **Help**

2.1 File

The **File** menu option allows user to
(1) **Open** file(s)
(2) **Close** the files and **Exit** the program

Open file menu option will display a common dialog box .
Under **List files of type** the users can select type of the file(s) (Fig.5):

- ***Output Files*** **:** all output file that are listed in the file List.out.(Fig.6);
- ***Alt..Files*****:** all output files that are available in the folder;
- ***T-Files*****:** all experimental t-files that are available in the folder;
- ***Evaluation***: Evaluate.out and (*.oev) files (Fig.7);
- ***All Files*****.**

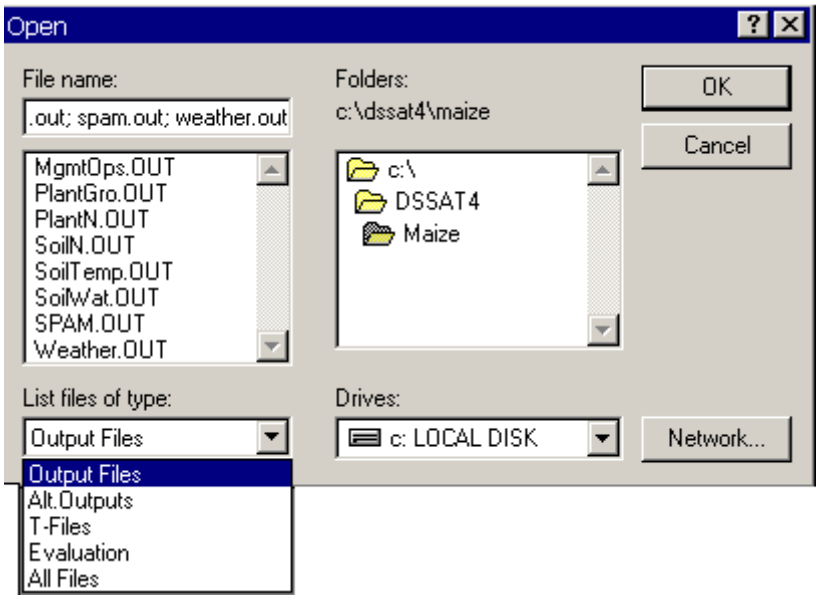


Figure 5. Common dialog box with list of available File types

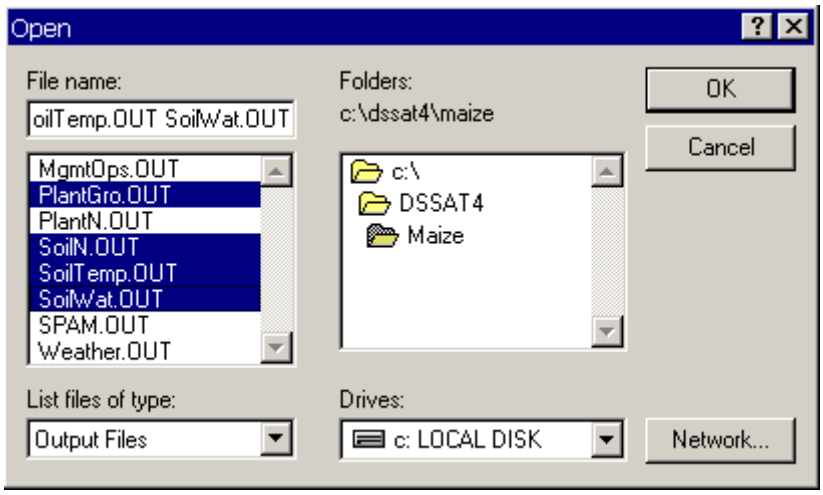


Figure 6. .Selection of Output files.

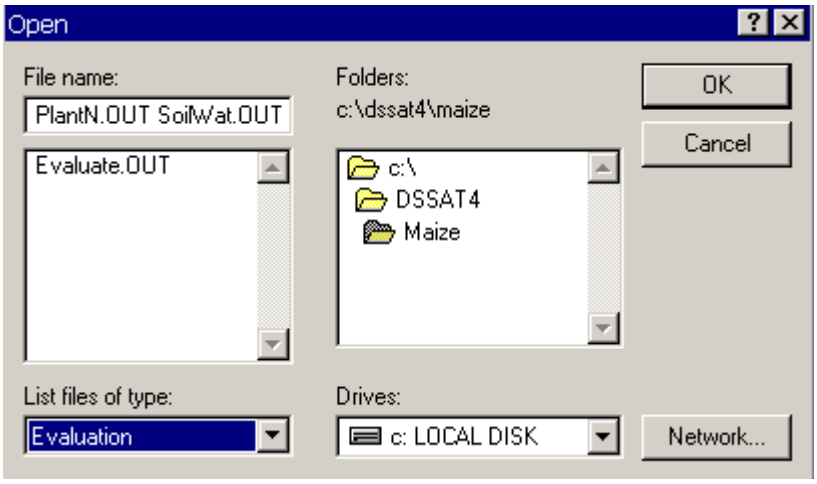


Figure 7. Evaluation files.

Note: *Not all listed files can be plotted. The program will alert the user if the file selected for plotting cannot be plotted.*

The use may open one or more Output files.
T-file or Evaluation type of file can be opened only one in a time.

After the files are selected, the **Selection** screen is displayed. This screen gives users access to the selected files. The user may select any combination of the variables and runs/treatments, remove selections, reload data, and proceed to the next step, which is to display the graph.

2.2 Variable Selection

The **Variable Selection** menu option is disabled *before* the files are selected. This menu option opens **Selection** screen on any step of the program.

2.3 Options

The **Option** menu button offers various options for type of graph, that is time series or scatter plot, showing experimental data together with simulated data, displaying data in markers or connected lines and other. The options may be different for different file types.

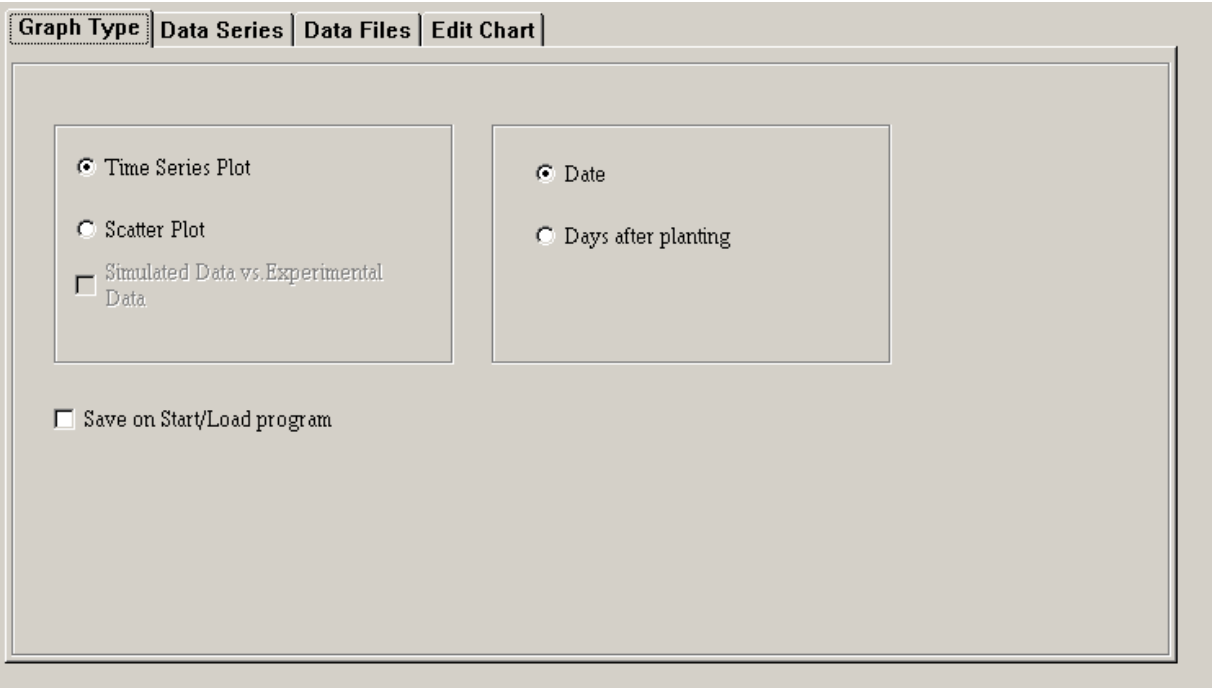


Figure 8. Option Screen.

Note *Options are available only after the file is selected.*

- Graph Type
  - Time series (display the simulated data as a function of **Date** or **Days after planting**).
  - Scatter Plot
  - Simulated Data vs. Experimental Data
- Data Series
  - Experimental Data (plot or don't plot)
- Data Files
  - Database Path
  - File Path
- Edit Chart (Lines, Gridlines, Markers)

Default options can be changes by checking the corresponding boxes. These values will be kept for the further program use if the user selects the **Save on Start/Load Program** box.

2.4 Help

Displays help.

3 Getting Started

- Select file **type** and file(s) from **File/Open** menu option; open the file(s)
- Select, if needed, **Graph Type**, and other options from **Options** screen.
- Select variable(s) from **Selection** screen and press the **Next** button.
- Graphic will be displayed.

Under **File List Type** three basic file types options are available: OUTPUT FILES, EXPERIMENTAL FILES, and EVALUATION FILES. Selecting one of the options enables the user to plot a graph.

3.1 OUTPUT FILES

Output file are files that contain simulated results, for example WaterC.out (Water balance); PlantGro.OUT (Growth).The user may select one or more output files for plotting as seen in Figure 6.
Two **Options** are available for output files: TIME SERIES PLOT and SCATTER PLOT.

3.1.1 Time Series Plot

Time series option allows user to plot simulated data over a period of time., that cold be calendar dates or days after planting. In some cases, if days after planting are not available, days after simulation will be presented on the time axis. Default time axis is **Days after Planting**.

Simulated data are plotted together with available experimental data. On the **Selection** screen, the variables with available experimental date are listed in bold.

When one or more files are selected, the **Selection** screen will be opened (Fig.9). The user may select any combination of the variables and runs. . The **Clear All** button will remove all selections. The **Reload Data** button will read the selected file again and reload the data. The **Close** button will close the screen. The **Next** button will open the **Graph** screen and display the graph.

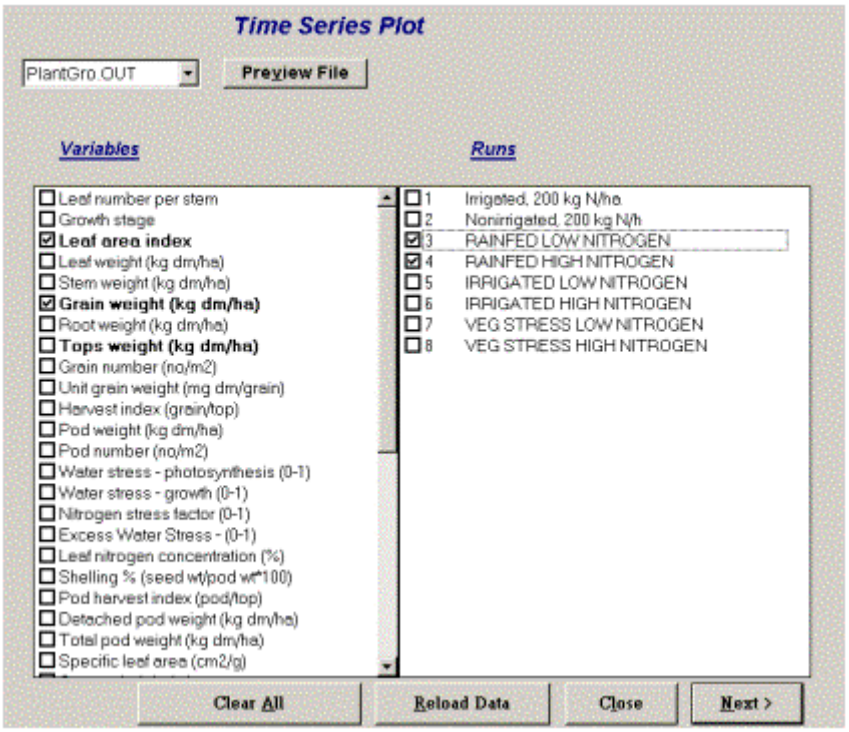


Figure 9. Selection screen for OUTPUT FILES (Example: PlantGro.out)

After the selection is complete, the **Next** button opens the screen with the graph, where the time axis can be **Days after planting**(Fig. 10) or **Dates**(Fig. 11).

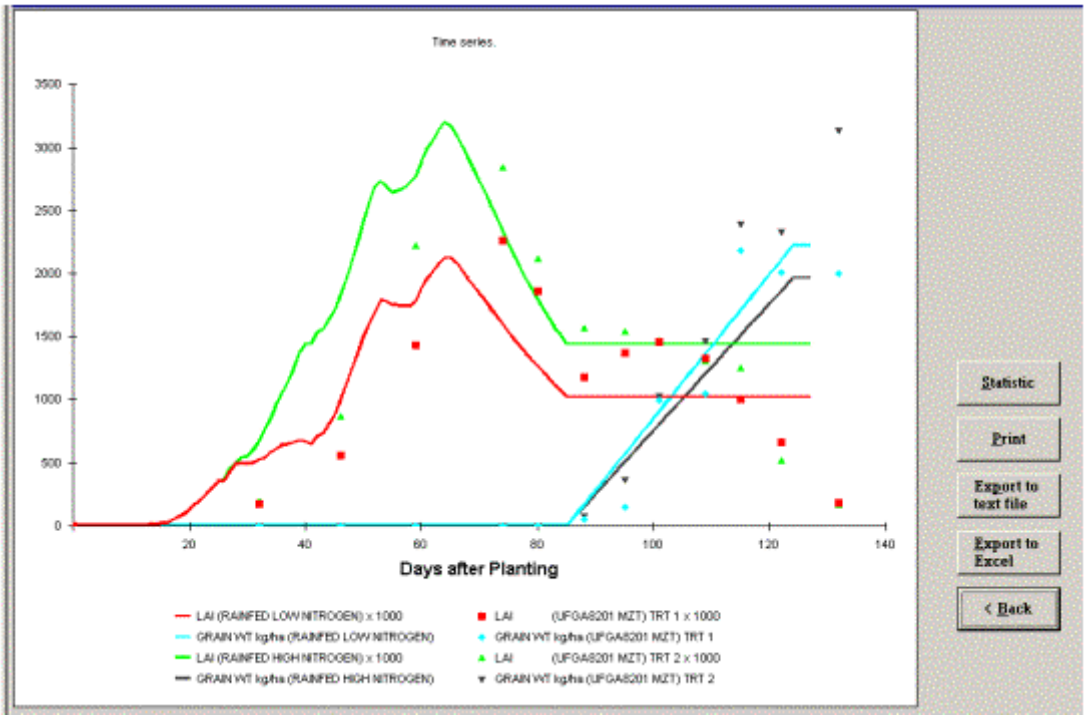


Figure 10. Graph screen with Days after Planting as time axis.

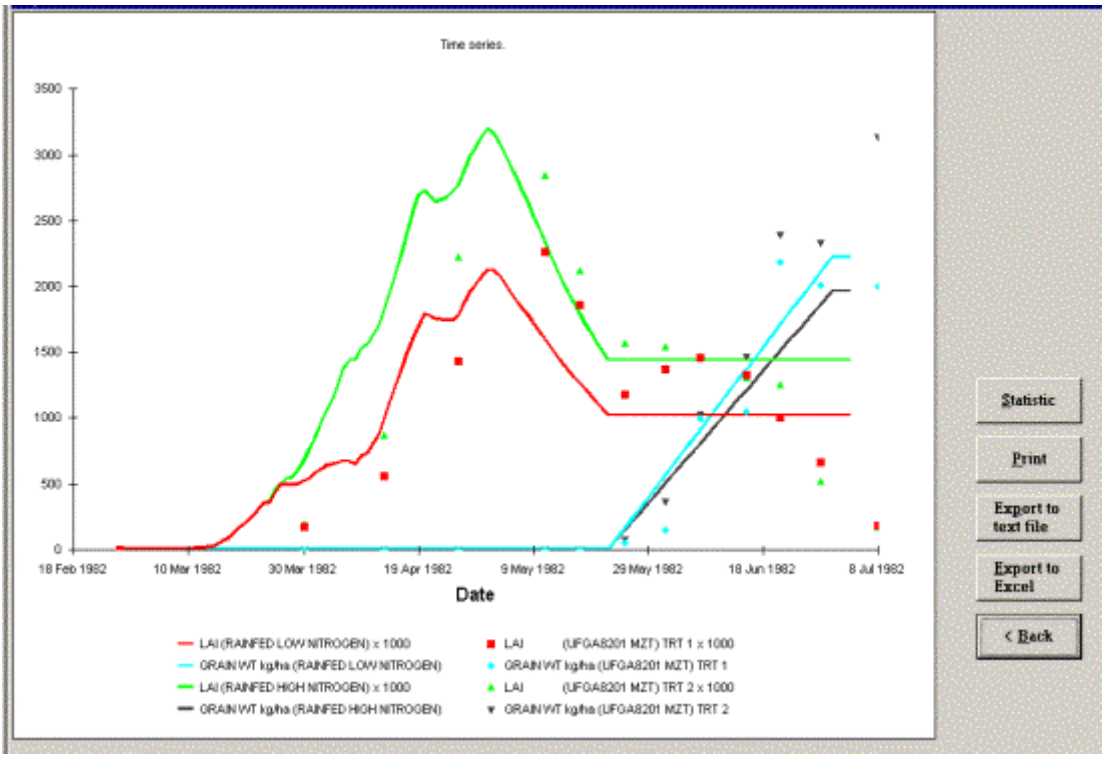


Figure 11. Graph screen with Dates as time axis.

There are five buttons on the lower right comes of the Graph screen(Fig.10, 11):
Statistic – displays statistics based on experimental and simulated data (Fig 12);
For comparison of the difference between estimated parameters and field-measured values, the mean absolute error ($MAE = 1/N * \sum_{i=1}^{N} | P_i - O_i |$), root mean square error ($RMSE = [1/N * \sum_{i=1}^{N} (P_i - O_i)^2]^{0.5}$) and the index of agreement ($d = 1 - \left[\sum_{i=1}^{N} (P_i - O_i)^2 / \sum_{i=1}^{N} (|P_i'| + |O_i'|)^2 \right]$) were computed (Willmott, 1982); in these equations P_i and O_i are, respectively, the predicted and observed values, N is the number of cases and $P_i' = P_i - \overline{O}$ and $O_i' = O_i - \overline{O}$.

Willmott (1982) described MAE and RMSE as "among the best overall measures of model performance", of which RMSE is more sensitive to extreme values due to its exponentiation; it therefore can be considered as a high estimate of the actual average error. The index of agreement (Willmott, 1981) is a standardized measure (scale 0 - 1) of the degree to which a model's predictions are error free.

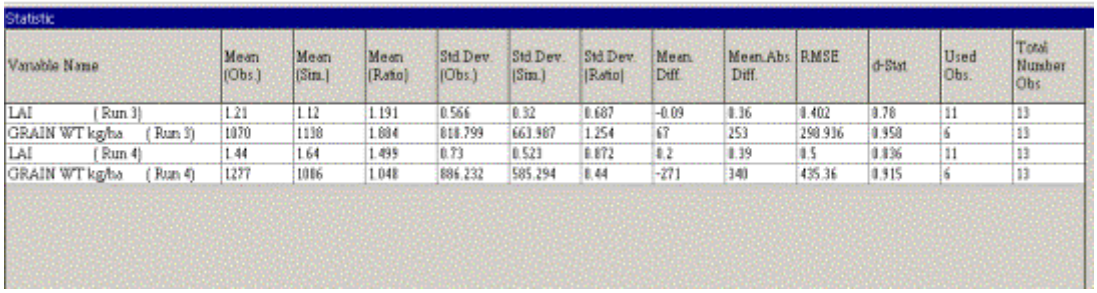
Print – prints the graph.

Export to Text file – displays the selected columns from output file in text format. If the data

are not saved, it will be rewritten each time when the **Export to text file** button is selected (Fig. 13).
Export to Excel – This option is available for the user who has Excel 2000 or higher on the system. The button will export data and graph to the Excel spread sheet (Fig.14).

Note: *GBuild adjusts the scale of data for plotting. Exported data are NOT adjusted.*

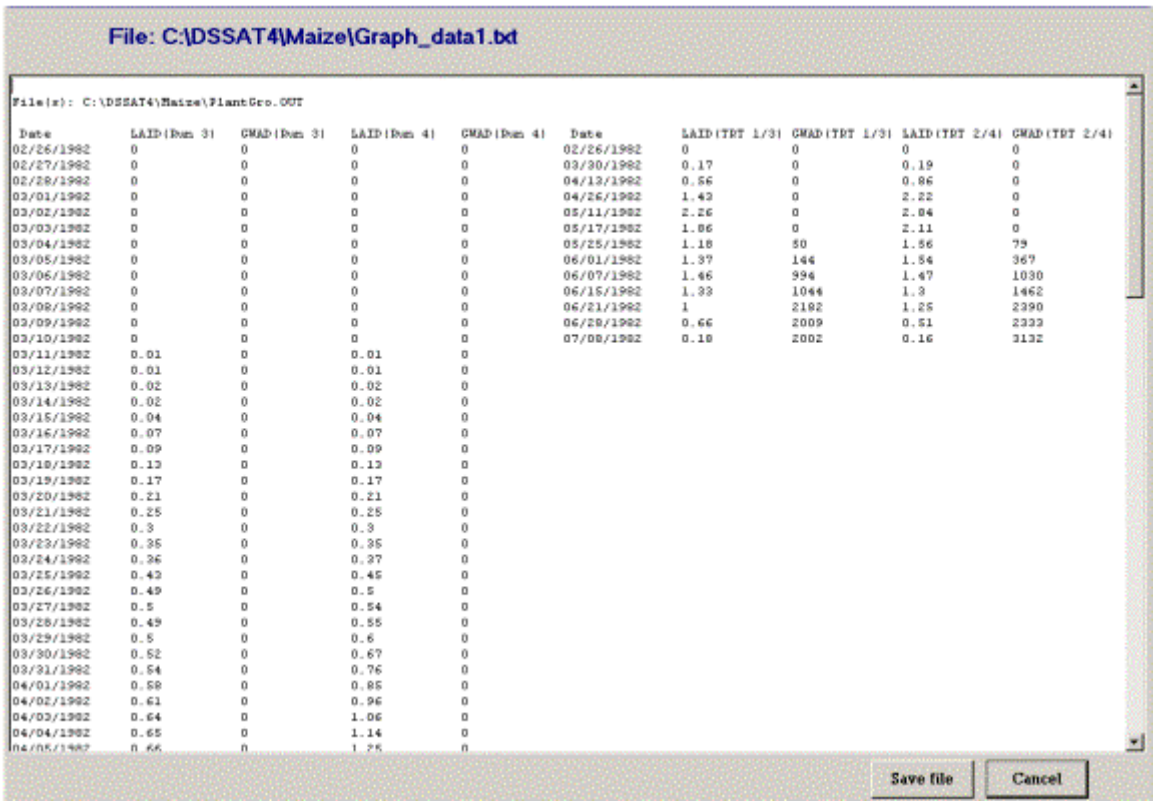
Back – returns to the Selection screen.



Statistic

Variable Name	Mean (Obs.)	Mean (Sim.)	Mean (Ratio)	Std.Dev. (Obs.)	Std.Dev. (Sim.)	Std.Dev. (Ratio)	Mean. Diff.	Mean.Abs. Diff.	RMSE	d-Stat.	Used Obs.	Total Number Obs.
LAI (Run 3)	1.21	1.12	1.191	0.566	0.32	0.687	-0.09	0.36	0.402	0.78	11	13
GRAIN WT kg/ha (Run 3)	1070	1138	1.884	818.799	663.987	1.254	67	253	298.936	0.958	6	13
LAI (Run 4)	1.44	1.64	1.499	0.73	0.523	0.872	0.2	0.39	0.5	0.836	11	13
GRAIN WT kg/ha (Run 4)	1277	1086	1.048	886.232	585.294	0.44	-271	340	435.36	0.915	6	13

Figure 12 Statistic table.



File: C:\DSSAT4\Maize\Graph_data1.txt

File(x): C:\DSSAT4\Maize\PlantGro.OUT

Date	LAID(Run 3)	GWAD(Run 3)	LAID(Run 4)	GWAD(Run 4)	Date	LAID(TRT 1/3)	GWAD(TRT 1/3)	LAID(TRT 2/4)	GWAD(TRT 2/4)
02/26/1982	0	0	0	0	02/26/1982	0	0	0	0
02/27/1982	0	0	0	0	03/30/1982	0.17	0	0.19	0
02/28/1982	0	0	0	0	04/13/1982	0.56	0	0.86	0
03/01/1982	0	0	0	0	04/26/1982	1.43	0	2.22	0
03/02/1982	0	0	0	0	05/11/1982	2.26	0	2.04	0
03/03/1982	0	0	0	0	05/17/1982	1.86	0	2.11	0
03/04/1982	0	0	0	0	05/25/1982	1.18	50	1.56	79
03/05/1982	0	0	0	0	06/01/1982	1.37	146	1.54	367
03/06/1982	0	0	0	0	06/07/1982	1.46	996	1.47	1030
03/07/1982	0	0	0	0	06/15/1982	1.33	1044	1.3	1462
03/08/1982	0	0	0	0	06/21/1982	1	2102	1.25	2390
03/09/1982	0	0	0	0	06/28/1982	0.66	2009	0.51	2333
03/10/1982	0	0	0	0	07/08/1982	0.18	2002	0.16	3132
03/11/1982	0.01	0	0.01	0					
03/12/1982	0.01	0	0.01	0					
03/13/1982	0.02	0	0.02	0					
03/14/1982	0.02	0	0.02	0					
03/15/1982	0.04	0	0.04	0					
03/16/1982	0.07	0	0.07	0					
03/17/1982	0.09	0	0.09	0					
03/18/1982	0.13	0	0.13	0					
03/19/1982	0.17	0	0.17	0					
03/20/1982	0.21	0	0.21	0					
03/21/1982	0.25	0	0.25	0					
03/22/1982	0.3	0	0.3	0					
03/23/1982	0.35	0	0.35	0					
03/24/1982	0.36	0	0.37	0					
03/25/1982	0.43	0	0.45	0					
03/26/1982	0.49	0	0.5	0					
03/27/1982	0.5	0	0.54	0					
03/28/1982	0.49	0	0.55	0					
03/29/1982	0.5	0	0.6	0					
03/30/1982	0.52	0	0.67	0					
03/31/1982	0.54	0	0.76	0					
04/01/1982	0.58	0	0.85	0					
04/02/1982	0.61	0	0.96	0					
04/03/1982	0.64	0	1.06	0					
04/04/1982	0.65	0	1.14	0					
04/05/1982	0.66	0	1.25	0					

Save file Cancel

Figure13. Data are exported to the file "C:\DSSAT4\Maize\Graph_data1.txt".

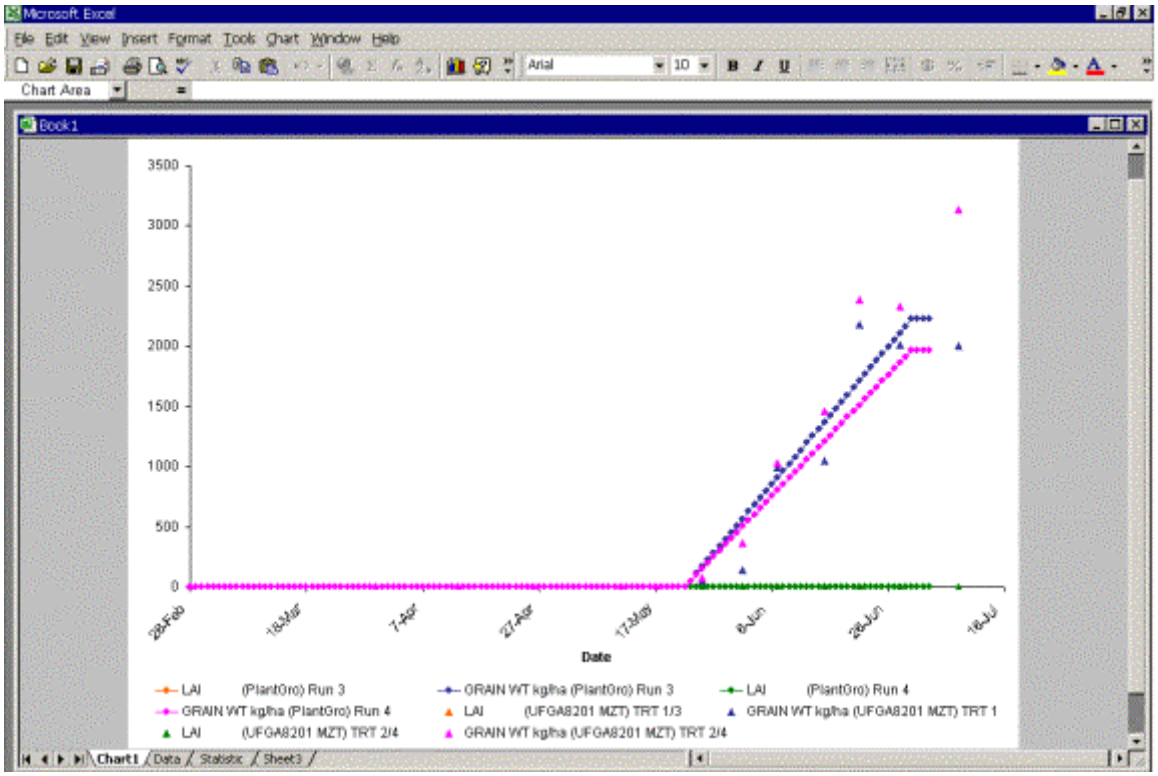


Figure 14. Excel spread sheet with exported graph and data.

3.1.2 Scatter Plot

a) Scatter option allows users to select a variable for the X-axis and several other variables for the Y-Axis. Simulated data will be plotted together with experimental data if it is not indicated otherwise. On **Selection** screen, the variables with available experimental date are listed bold. When one or more files are selected, **Selection** screen will be opened. The user may select any combination of the variables and runs. . The **Clear All** button will remove all selections. The **Reload Data** button will read the selected file again and reload the data. The **Close** button will close the screen. The **Next** button will open the **Graph** screen and display the graph (Fig.15).

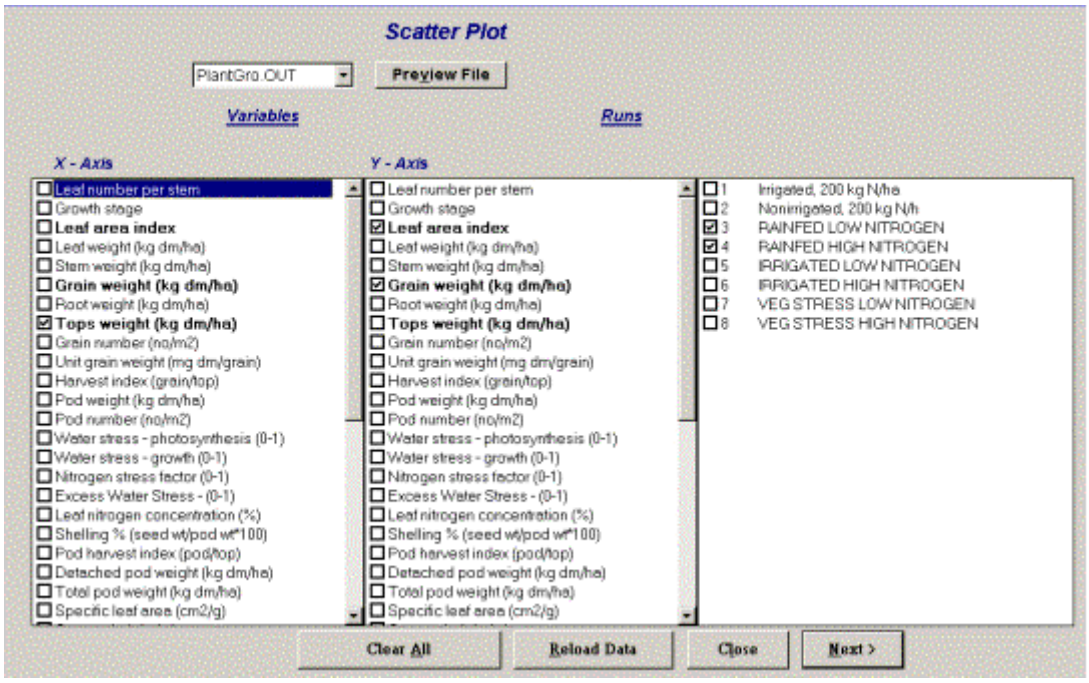


Figure 15. Selection screen for X vs. plotting.

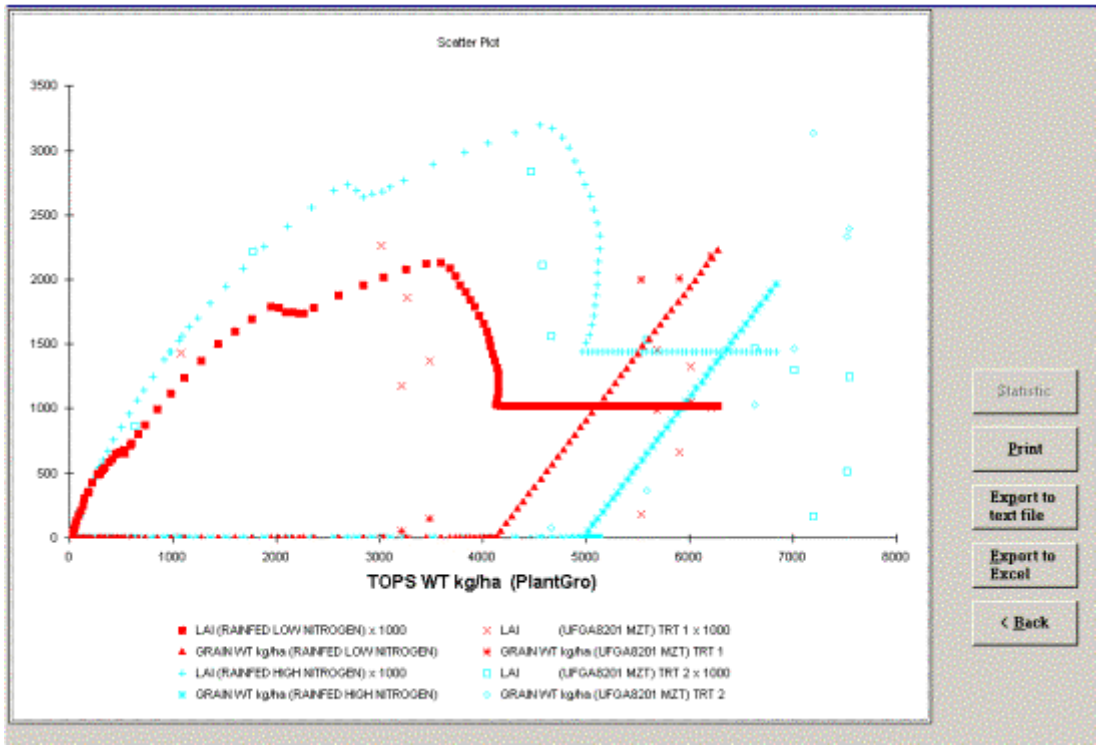


Figure 16. Scatter plot.

Every run is presented with a different color. Simulated data are plotted vs. Simulated data, and experimental data vs. experimental data.

There are five buttons on the lower right of the Graph screen(Fig.16):
Print – prints the graph.
Export to Text file – displays the selected columns from output file in text format. If the data are not saved, it will be rewritten each time the **Export to text file** button is selected.
Export to Excel – This option is available for the user who has Excel 2000 or higher on the system. The button will export data and graph to an Excel spread sheet .
Back – returns to the **Selection** screen
b) GBuild can plot Simulated data vs. Experimental, if experimental data are available. If this option is selected from **Options** menu, The **Selection** screen will list the variables available for plotting (Fig.17)
Figure 17. Simulated vs. Experimental selection screen.

Note: *Only the variables where experimental data are available are listed.*

After the selection is complete, the **Next** button opens the screen with graph (Fig.18).
This graph has 1x1 line that shows users how close simulated values are to observed values.
This screen has the same buttons as that for output file time series plotting:
Statistic – displays statistic based on experimental and simulated data;
Print – prints the graph.
Export to Text file – displays the selected columns from output file in text format. If the data is not saved, it will be rewritten each time when the **Export to text file** button is selected.
Export to Excel – This option is available for the user who has Excel 2000 or higher on the system. The button will export data and graph to an Excel spread sheet.
Back – returns to the Selection screen.

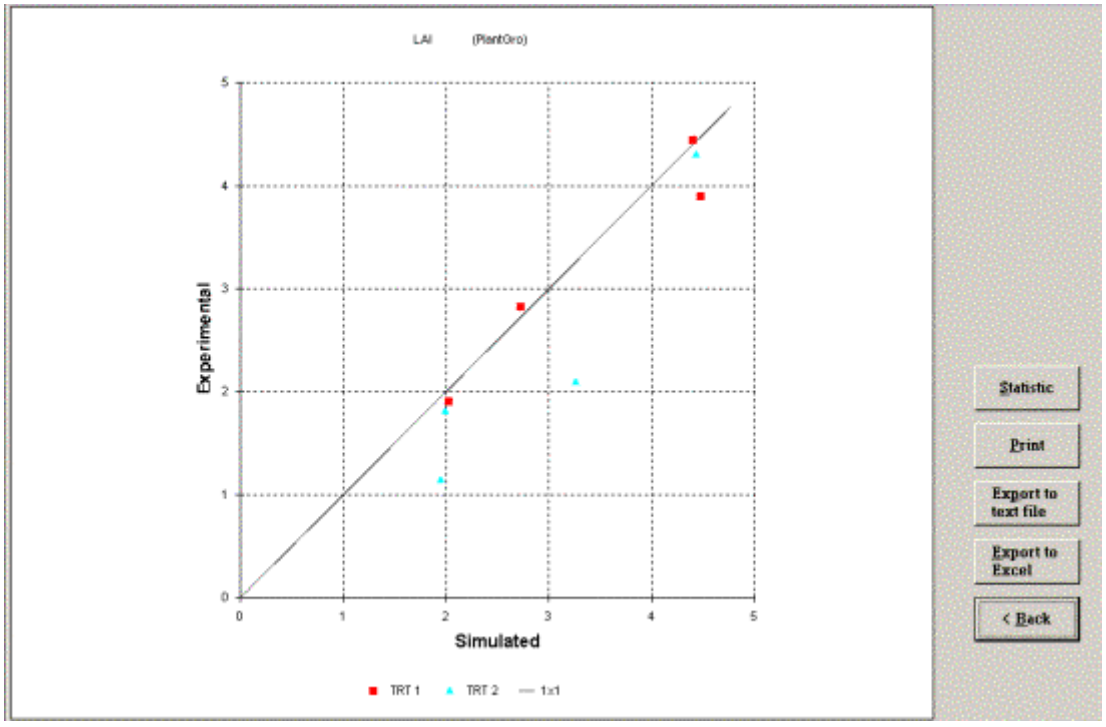


Figure 18. Simulated vs. Experimental Selection screen.

3.2 EXPERIMENTAL FILES

Experimental data file, which is referred to as FILE-T (Example IUCA7901.SBT), can be plotted with GBuild. If the file is selected, the **Selection** screen will be opened (Fig.19). Only one experimental data file can be opened at a time. The user may select any combination of variables and treatments to graph.

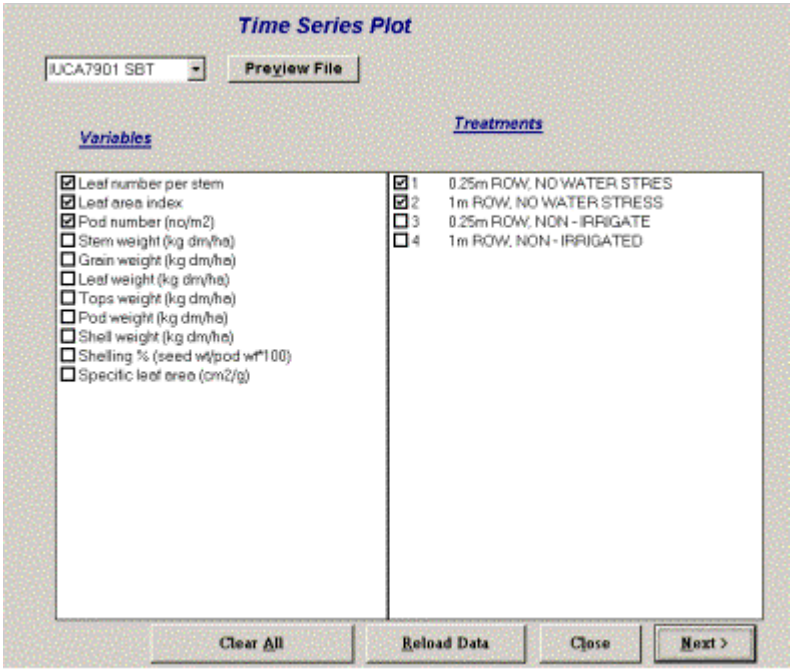


Figure 19. Selection screen for experimental data (UFGA8201.MZT).

The **Clear All** button will remove all selections. The **Reload Data** button will read the selected file again and reload the data. The **Close** button will close the screen. The **Next** button will open the **Graph** screen and display the graph (Fig.20).

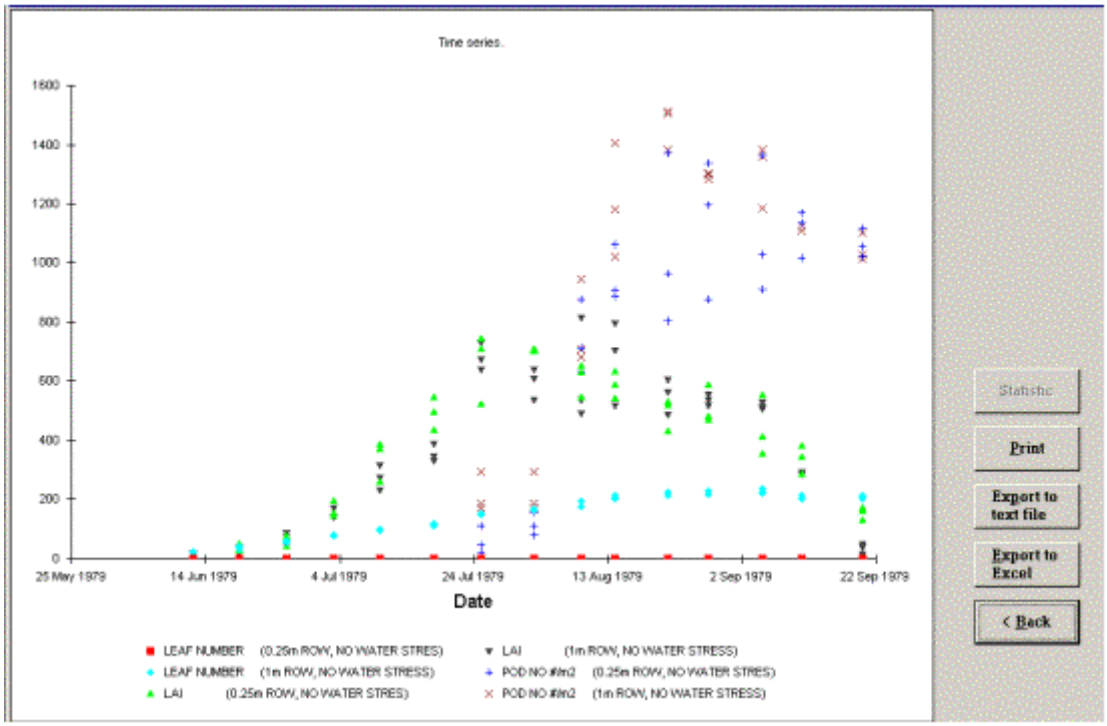


Figure 20. Graph of experimental data (UFGA8201.MZT).

The user can **Print** the graph, **Export** the data **to text file**, **Export** the data and graph **to Excel**.

3.3 EVALUATION FILES

Evaluation files are files used for comparison of average values of performance data with summary model results. Only one evaluation file can be opened at a time. If the file is selected, the **Selection** screen will be opened (Fig. 21). The user may select any combination of the variables. The **Clear All** button will remove all selections. The **Reload Data** button will read the selected file again and reload the data. The **Close** button will close the screen. The **Next** button will open the **Graph** screen and display the graph (Fig 22).

***Note**: There is no option for selecting Runs or Treatments for Evaluation files.*

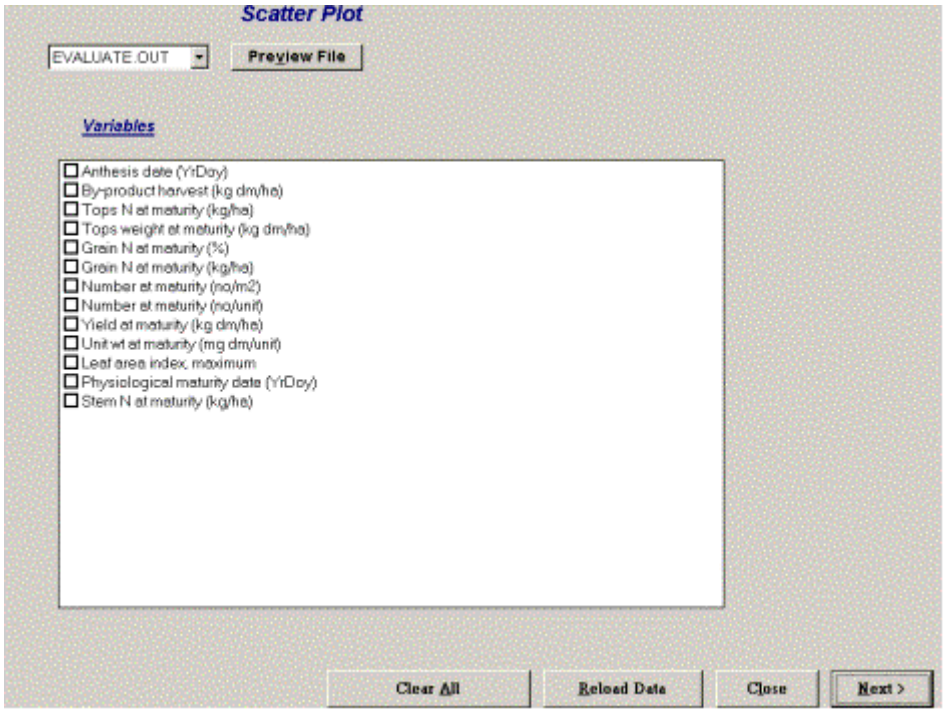


Figure 21. Selection screen for EVALUATION FILES (Evaluate.out)

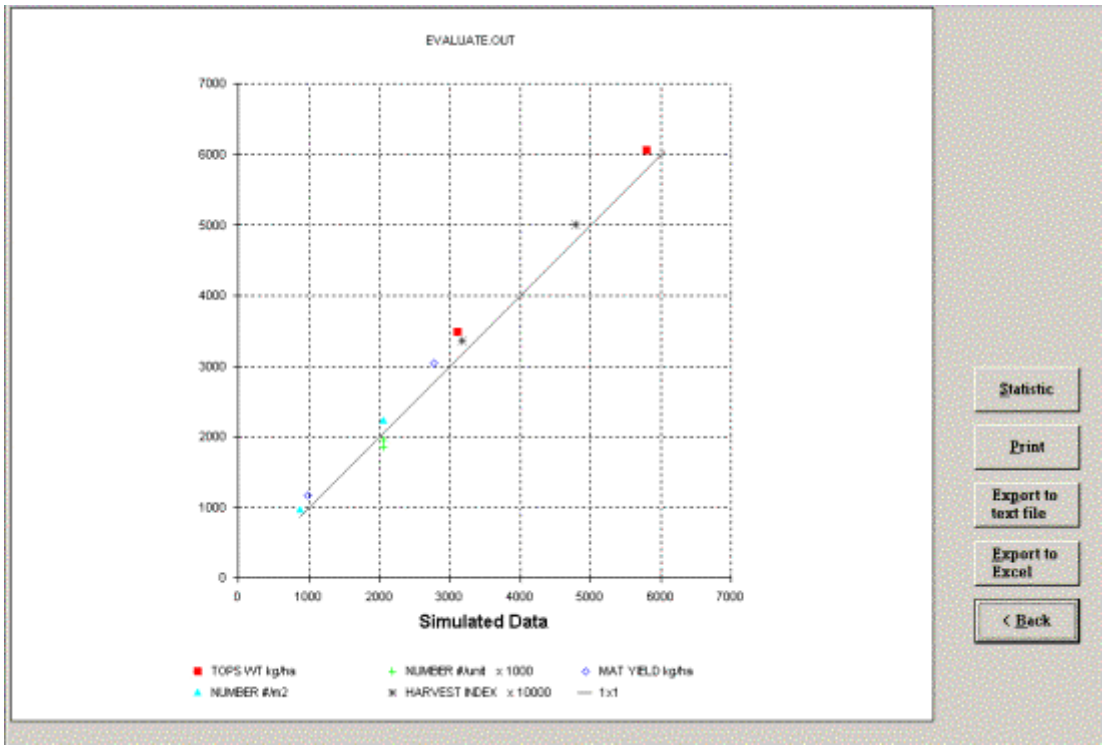


Figure 22. Graph of the selected variables of Evaluate.out.

4 Tips

- The **Selection** screen lists the description of variables for plotting. If the description is bold, this means that experimental data are available for at least one treatment in the list..
- The **Graph** screen may has the **Export to Excel** button. If the computer has MS Excel 98 or lower version os MS Excel, this button will be disabled.
- There are no limits on the number of variables to be plotted. GBuild uses different patterns and colors for different data. Although, when too many variables are selected – the color or pattern can be repeated. To find a necessary pattern – the user must click on the marker/line in the legend. The corresponding data series will be selected on the plot.
- Data on the **Graph** are adjusted to the scale. The same multiplier will adjust the data for the same variable. The exported data are NOT adjusted.
- All plot options may not be available for different types of the files.
- **Days after planting** is an option that available for OUT files. If this option is selected, X-axis will present Days after planting. If the output file does not have a DAP (days after planting) column, **Days after Start of Simulation** (DAS) will be presented as X-axis. If more than one output file is selected, and at least one file has Days after planting column – the graph will have Days after planting as X-axis.
- The **File Open** dialog box may list the files that cannot be plotted with the program.
- Multiple selections of the files are available only for OUT files.
- It is recomended to select an option **Days after Planting** instead of **Date** if years for more then three years: it may take a few minutes to create a graph fo calendar dates.

Chapter 7

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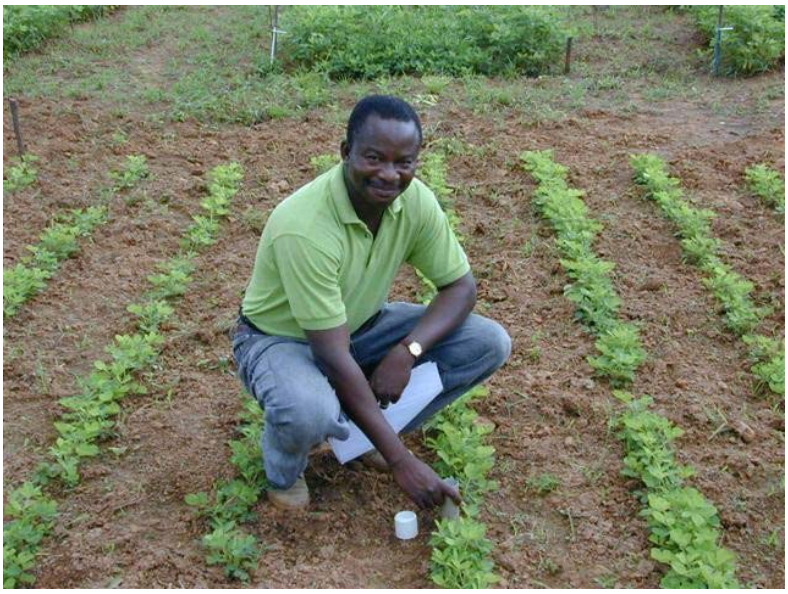
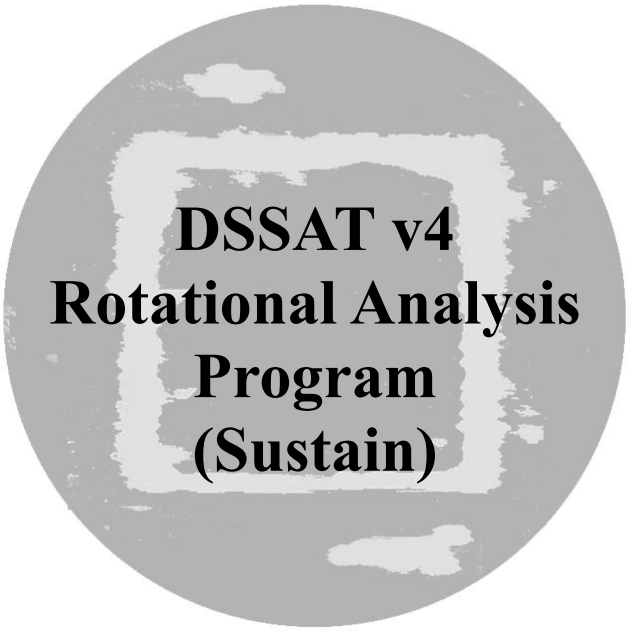


This section is in development.

Chapter 8



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This section is in development.