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## USER'S MANUAL



# Statistical Tool for Agricultural Research

Version 1.1.0

## A NOTE TO THE READER:

An electronic copy of this user's manual comes with the STAR installer. The STAR User's Manual may be printed/copied and distributed to any number of users. STAR is a freeware developed for non-profit use. Hence, selling of either the software or the user's manual is prohibited.

Biometrics and Breeding Informatics Group  
Plant Breeding, Genetics and Biotechnology Division  
INTERNATIONAL RICE RESEARCH INSTITUTE

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# Introduction

Statistical Tool for Agricultural Research (STAR) is a computer program for data management and basic statistical analysis of experimental data. It has a user-friendly graphical interface where items are accessible via drop-down menus. Its graphical interface was created using the Eclipse Rich Client Platform (RCP) and uses the R language and environment for statistical computing and graphics.

STAR has been developed primarily for the analysis of data from agricultural field trials, but many of the features can be used for analysis of data from other sources.

## Feature Modules

STAR has the following modules:

- Data management with a spreadsheet
- Descriptive statistics
- Analysis of variance for basic experimental designs
- Correlation and linear regression analysis
- Graphics
- Utilities for randomization and electronic field book
- Non-parametric data analysis

## About the User's Manual

The STAR user's manual provides step-by-step instructions on how to perform certain tasks of interest to users. Screen images have been included as deemed helpful.

Menu items, names of dialogs and form controls are in **bold** letters. Project names, filenames, variable names and directories are *italicized*. Menus appear in the form **File | Open**, which means “choose **Open** from the **File** menu”. All of the examples used in this manual are included when the STAR package is installed.

# Getting Started

## Installation

The installer of STAR 1.1.0 and its required R packages can be downloaded from [bbi.irri.org](http://bbi.irri.org). To download the installers, click the links labeled as *STAR 1.1.0* and *R-Packages* at the right-hand side of the page.

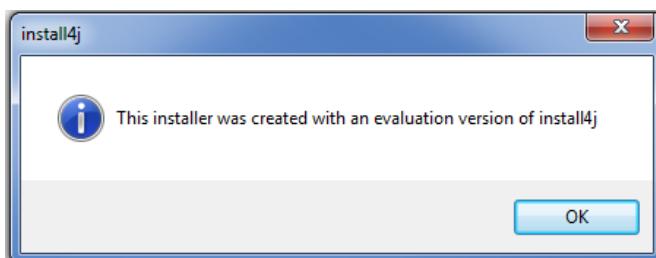
The screenshot shows the IRRI Biometrics and Breeding Informatics website. The main navigation bar includes Home, About Us, Products, Trainings, Research, and Contact Us. The 'About Us' section contains information about the group's research support, consultation, and training services. The sidebar on the right is titled 'Products Download' and lists several items:

- Statistical Tools for Agricultural Research  
[STAR 1.1.0](#) (highlighted with a red box)
- Plant Breeding Tools  
[PBTools 1.1.0](#)
- STAR and PBTools required R Packages  
[R-Packages](#) (highlighted with a red box)
- Android Tablet Application for Data Collection  
[FieldLab V2.2](#)

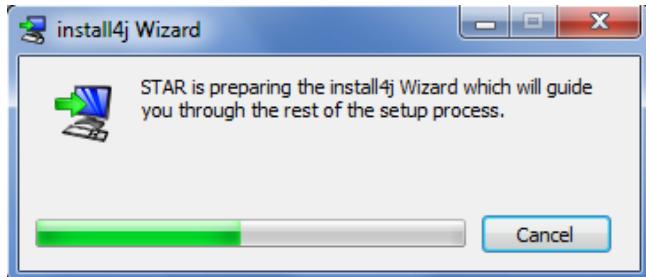
Below the sidebar, there is a 'Interact with us on' section featuring links to Facebook and Twitter.

The steps to install STAR are as follows:

- Double-click the installer icon [STAR-1.1.0-windows-setup-32bit](#) to launch the setup. A dialog as shown below is displayed. Click the **OK** button.



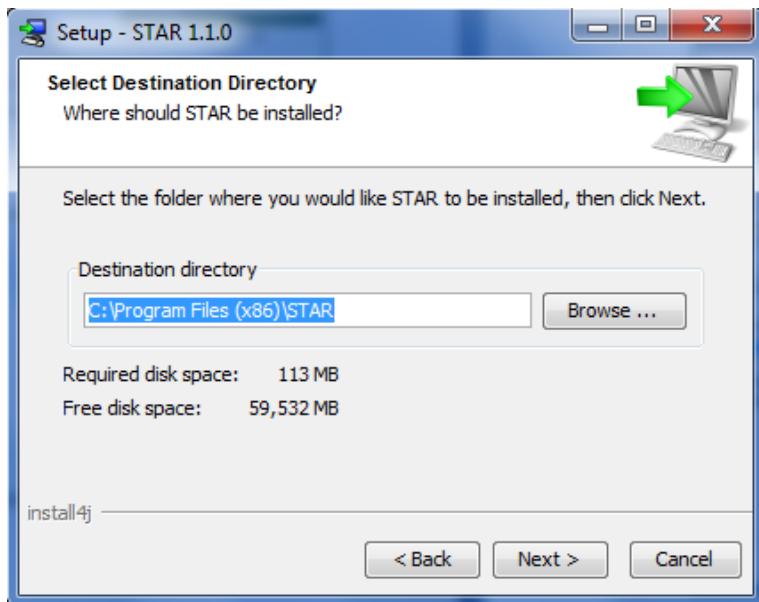
- The next step is the preparation of the wizard. A dialog with progress bar is displayed. Wait until the preparation is completed.



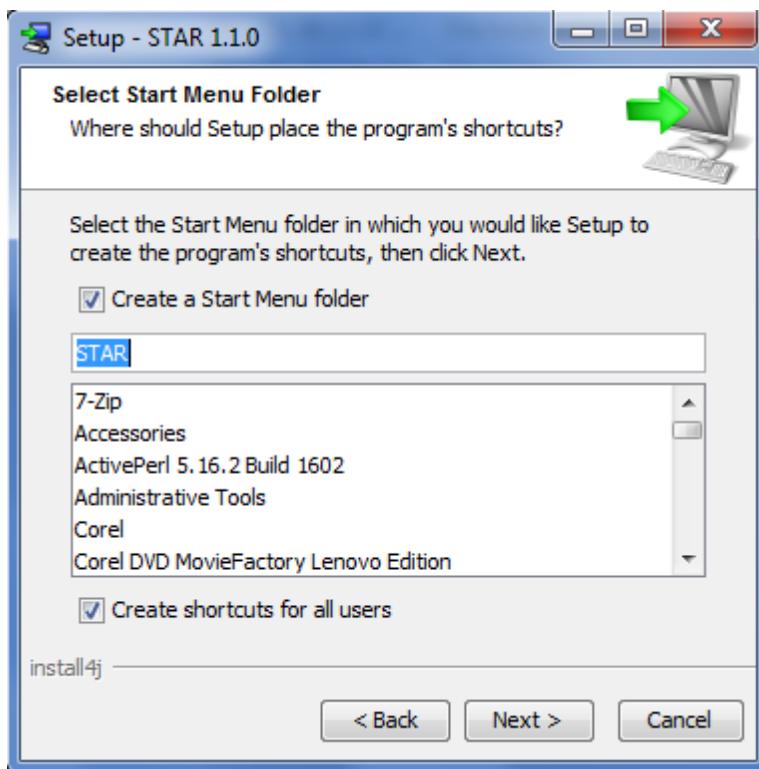
- When installing STAR for the first time, the **Welcome** dialog as shown below is displayed. Click the **Next** button.



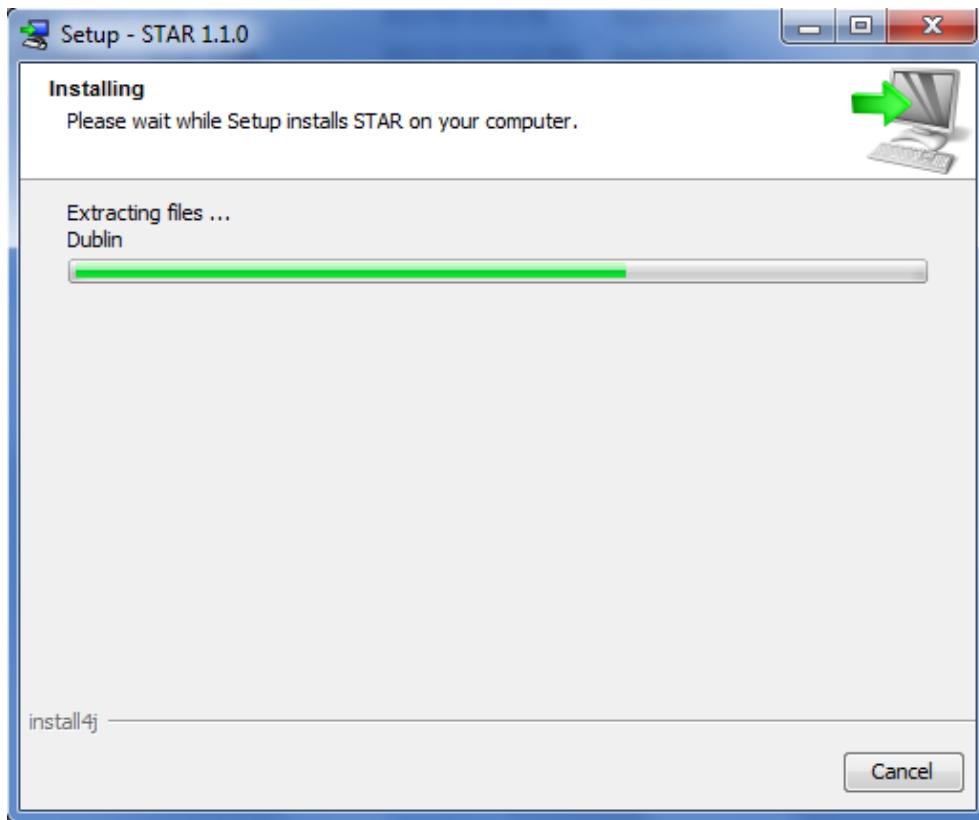
- Select the destination folder and click the **Next** button.



- Select which start menu folder you want to place the STAR icons in and click the **Next** button.



- Wait until the installation is completed.

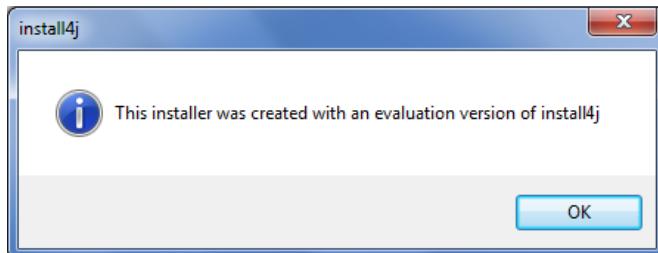


- Finally, specify if you want to create a desktop icon and run STAR. Click the **Finish** button.

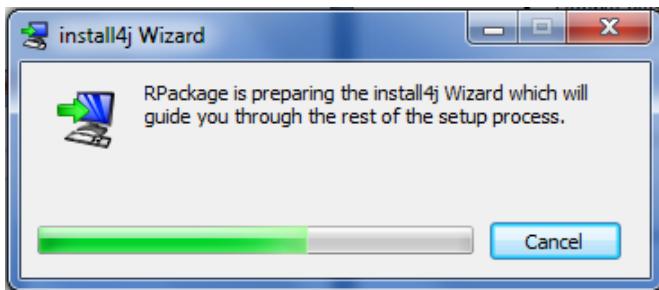


The steps to install the required R packages are as follows:

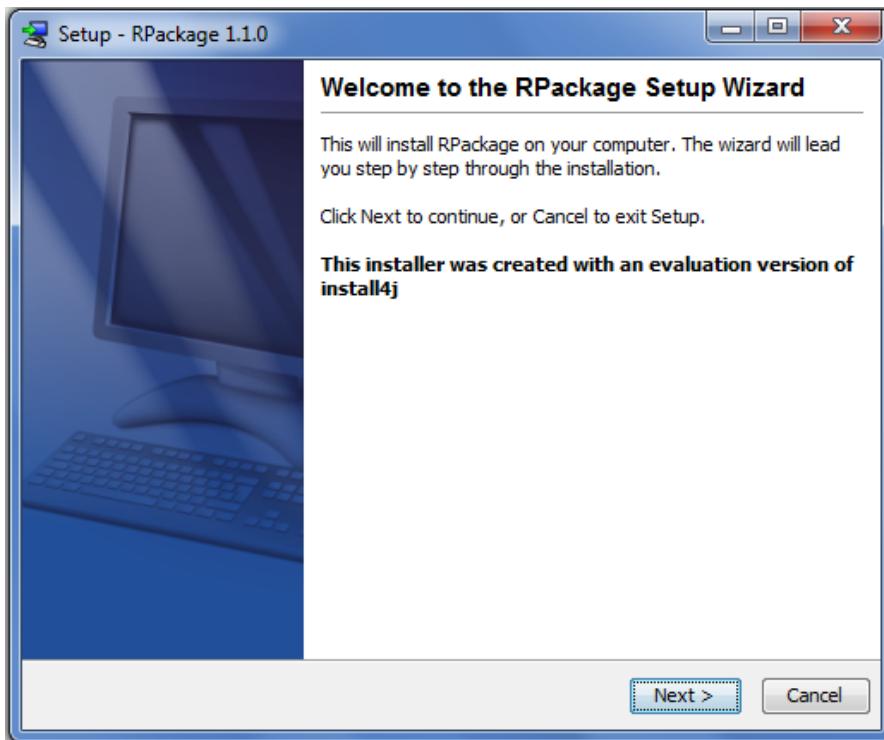
- Double-click the installer icon to launch the setup. A dialog as shown below is displayed. Click the **OK** button.



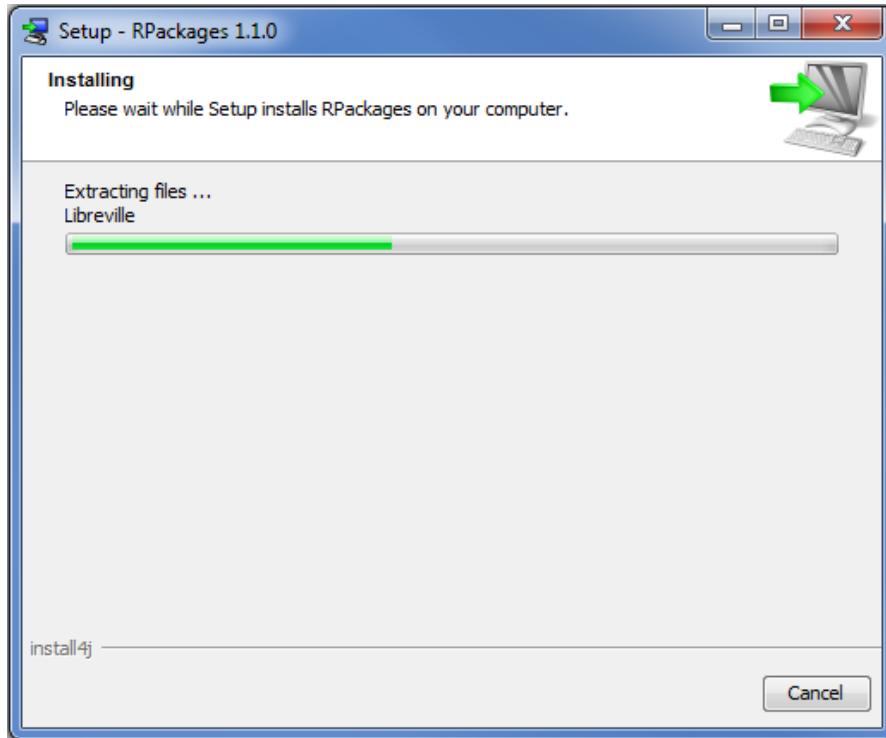
- The next step is the preparation of the wizard. A dialog with progress bar is displayed. Wait until the preparation is completed.



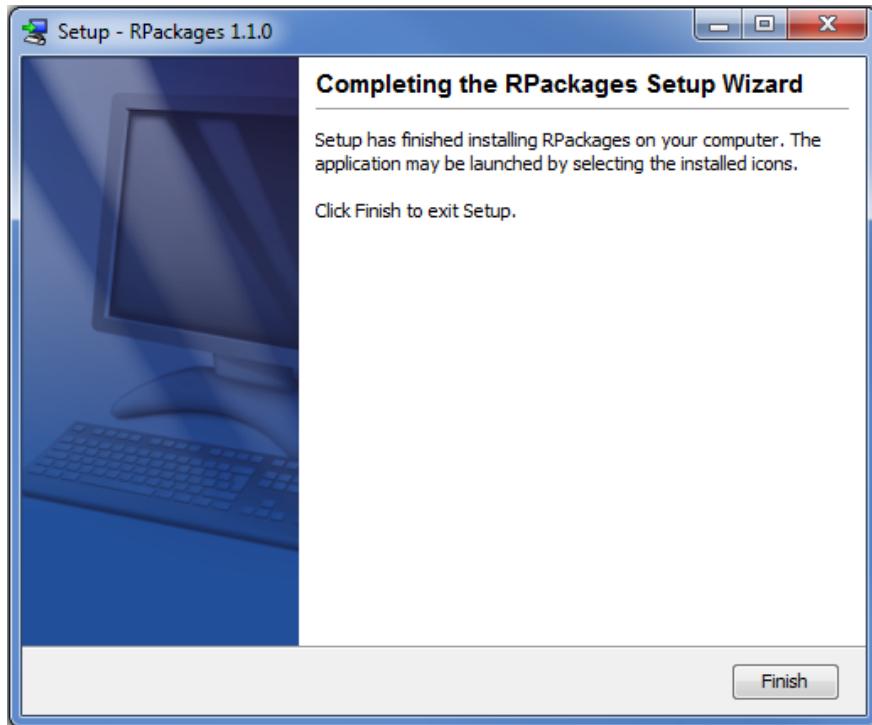
- When installing R Packages for the first time, the Welcome dialog as shown below is displayed. Click the **Next** button.



- Wait until the installation is completed.



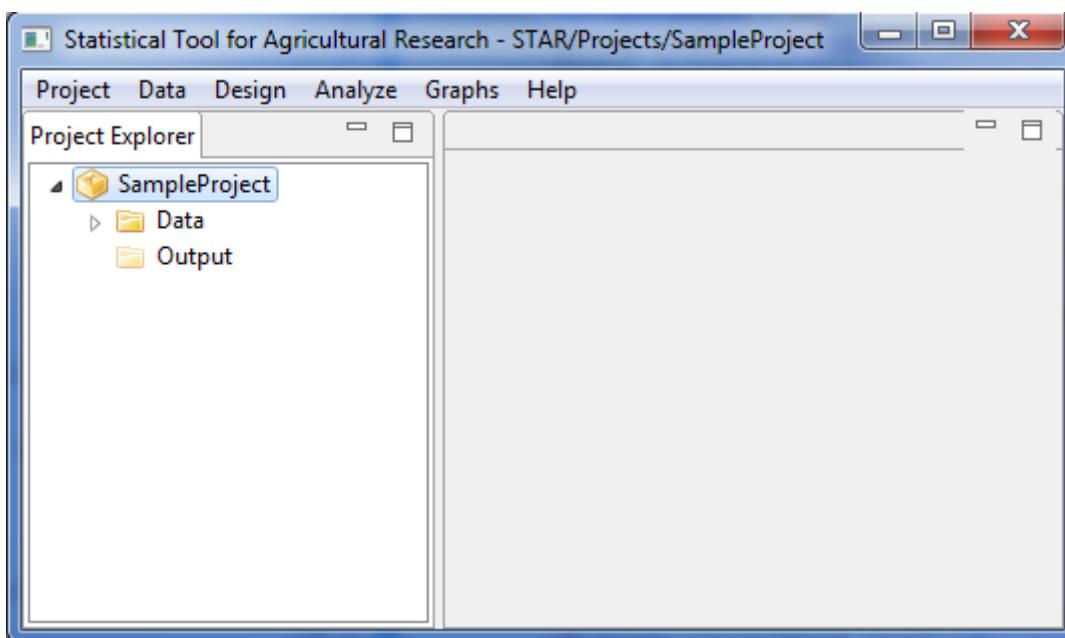
- Click the **Finish** button to exit Setup.



## Launching STAR

To launch STAR, the user can either double-click the STAR shortcut icon on the desktop (if there is one) or click Start on the Windows task bar, choose All Programs, then click on the STAR folder and click the STAR icon.

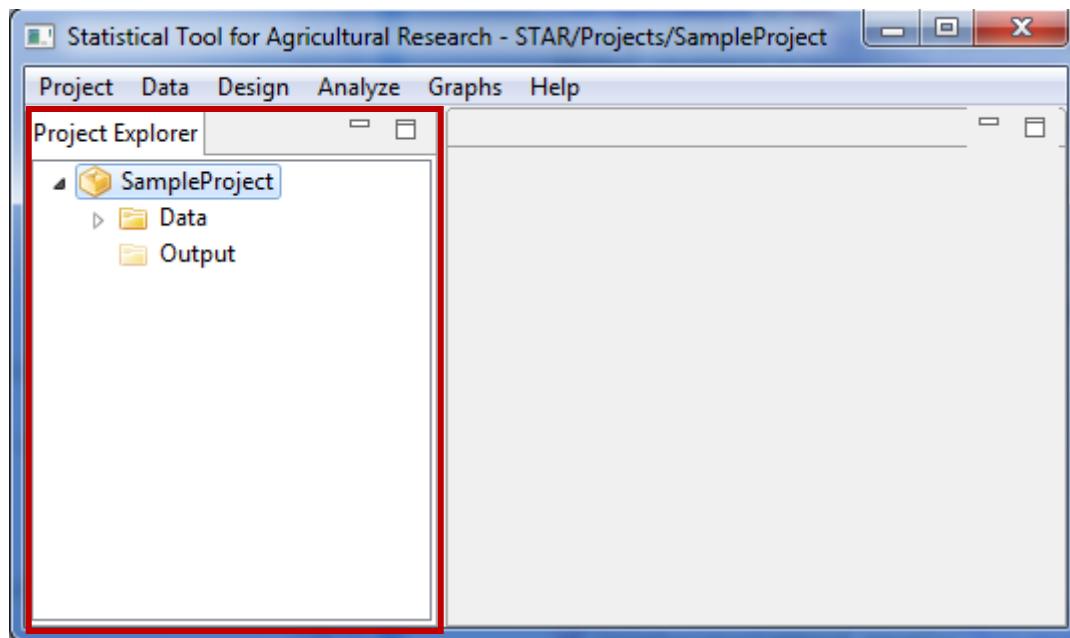
Upon launching, the splash image then the main window will appear.



STAR main window has a menu bar and is divided into two panels, the **Project Explorer** panel located on the left-hand side and the **Editor Panel** on the right-hand side.

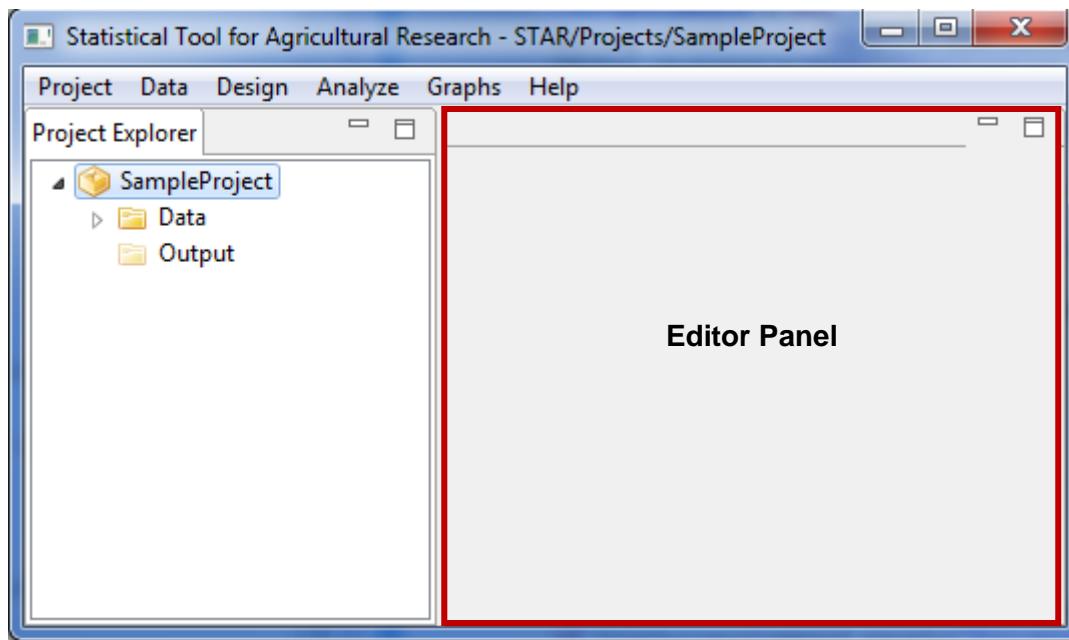
## Project Explorer Panel

Project Explorer can be seen at the left-hand side of the main window. It serves as a file manager of the active project, where data and results of the analysis are displayed in a tree. It displays the last opened project from the previous STAR session. When STAR is opened for the first time, a default project names *SampleProject* is displayed with *Data* folder and *Output* folder inside it. The *Data* folder contains some sample datasets that will be used in this manual. The *Output* folder, on the other hand, will contain all output files that will be created when an analysis is performed.



## Editor Panel

Editor panel is located at the right-hand side of the main window. It consists of **Data Viewer** tab and the **Result Viewer** tab. By default, the editor panel is empty.

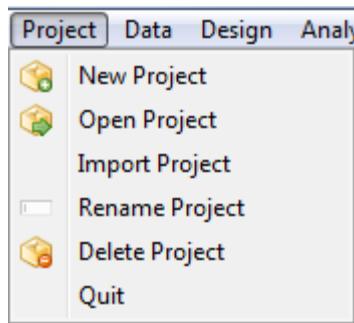


## Menu Bar

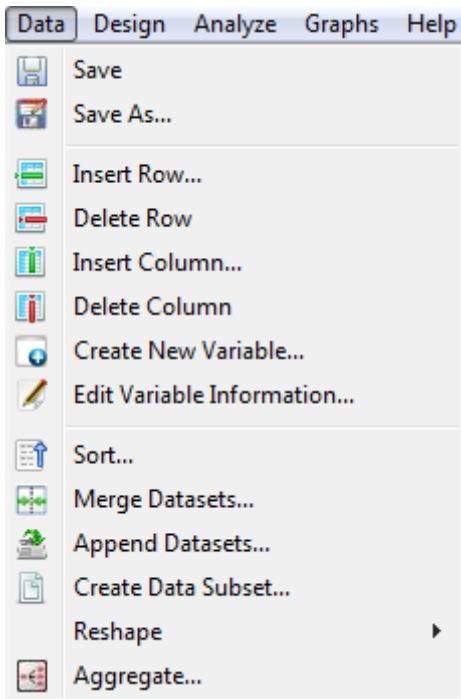
Most of the tasks that you perform in STAR start with menu selections. There are six drop-down menus available and this are:

Project Data Design Analyze Graphs Help

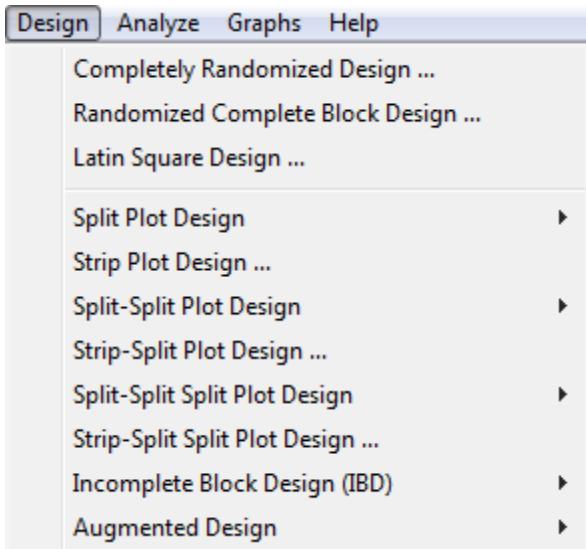
**Project** Menu contains functions for creating and managing project. This menu can also be used to quit or terminate sessions in STAR. It contains the following submenu items:



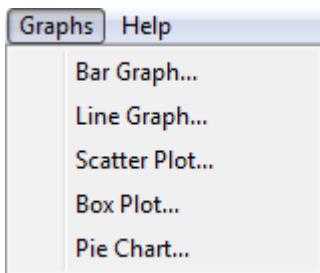
**Data** Menu contains functions for reading, managing and manipulating datasets. Items under this menu become visible only when a data in CSV format is displayed in the active tab of the editor panel. It contains the following submenu items:



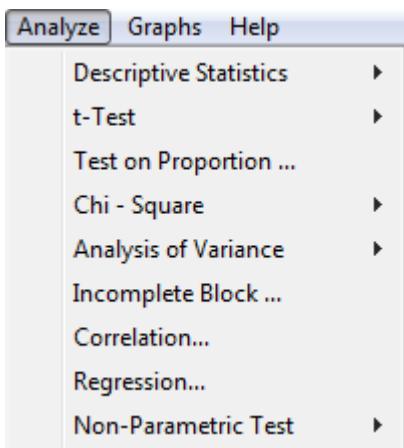
**Design** Menu contains functions for generating random assignment of factor levels for commonly used experimental design. It contains the following submenu items:



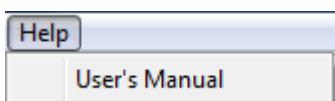
**Graph** Menu contains functions for creating the basic graphs. It contains the following submenu items:



**Analyze** Menu contains functions to perform statistical analysis. Items under this menu become visible only when a data in CSV format is displayed in the active tab of the editor panel. It contains the following submenu items:

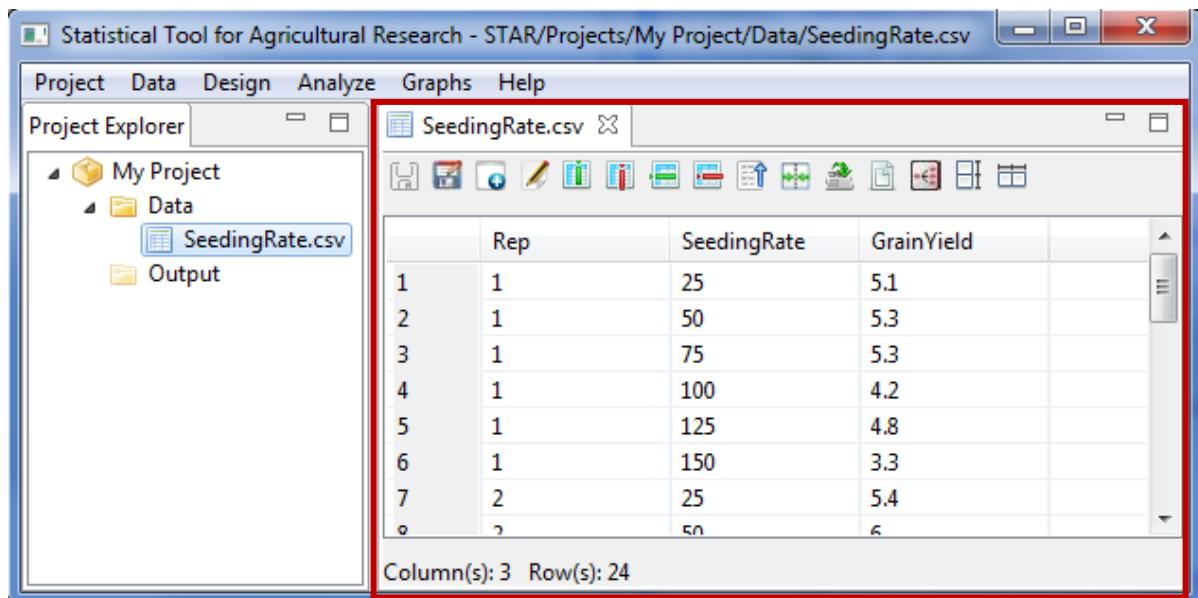


**Help** Menu used to access STAR's Help System or User's Manual. It contains the following submenu items:



## Data Viewer

Data Viewer tab is displayed in the editor panel when a data in CSV format is double-clicked from the Project Explorer tree. It is used for viewing data in spread-sheet format, editing data values and performing data management. Several **Data Viewer** tabs can be seen simultaneously inside the **Editor Panel**. Each Data Viewer tab contains toolbars which can be used for managing the data. The toolbars have the same functionalities as the options under the **Data** menu.

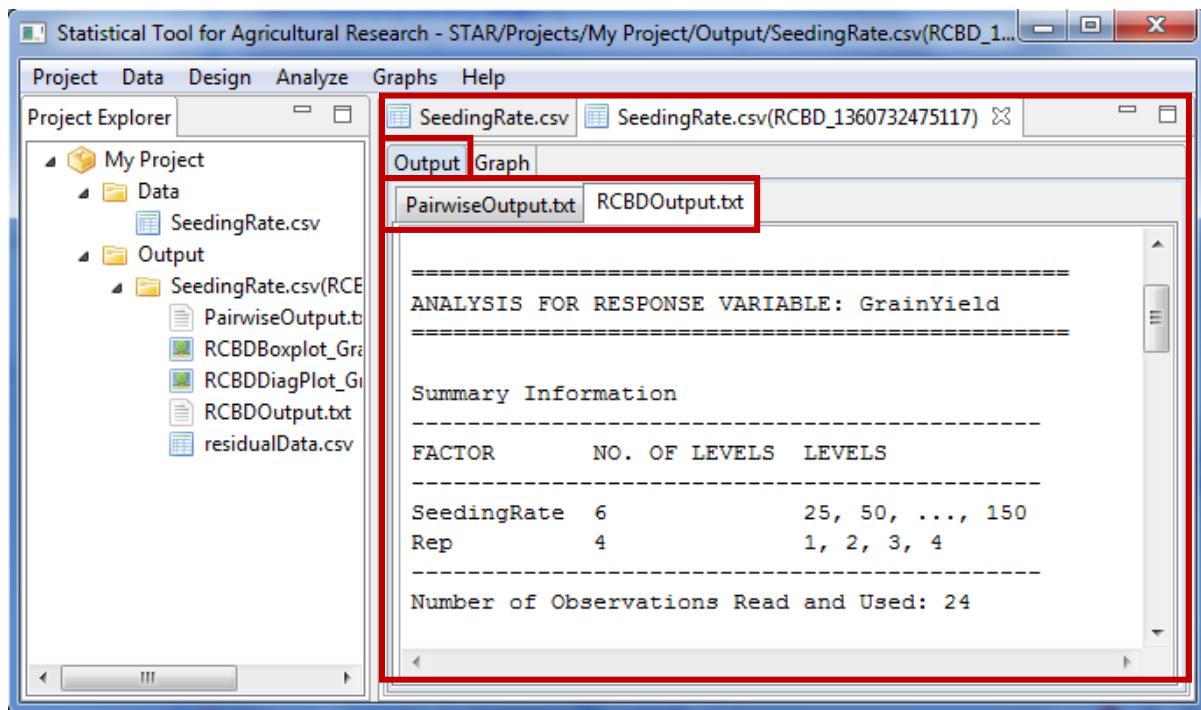


The name of the tab indicates the name of the dataset. When an asterisk appears in the tab

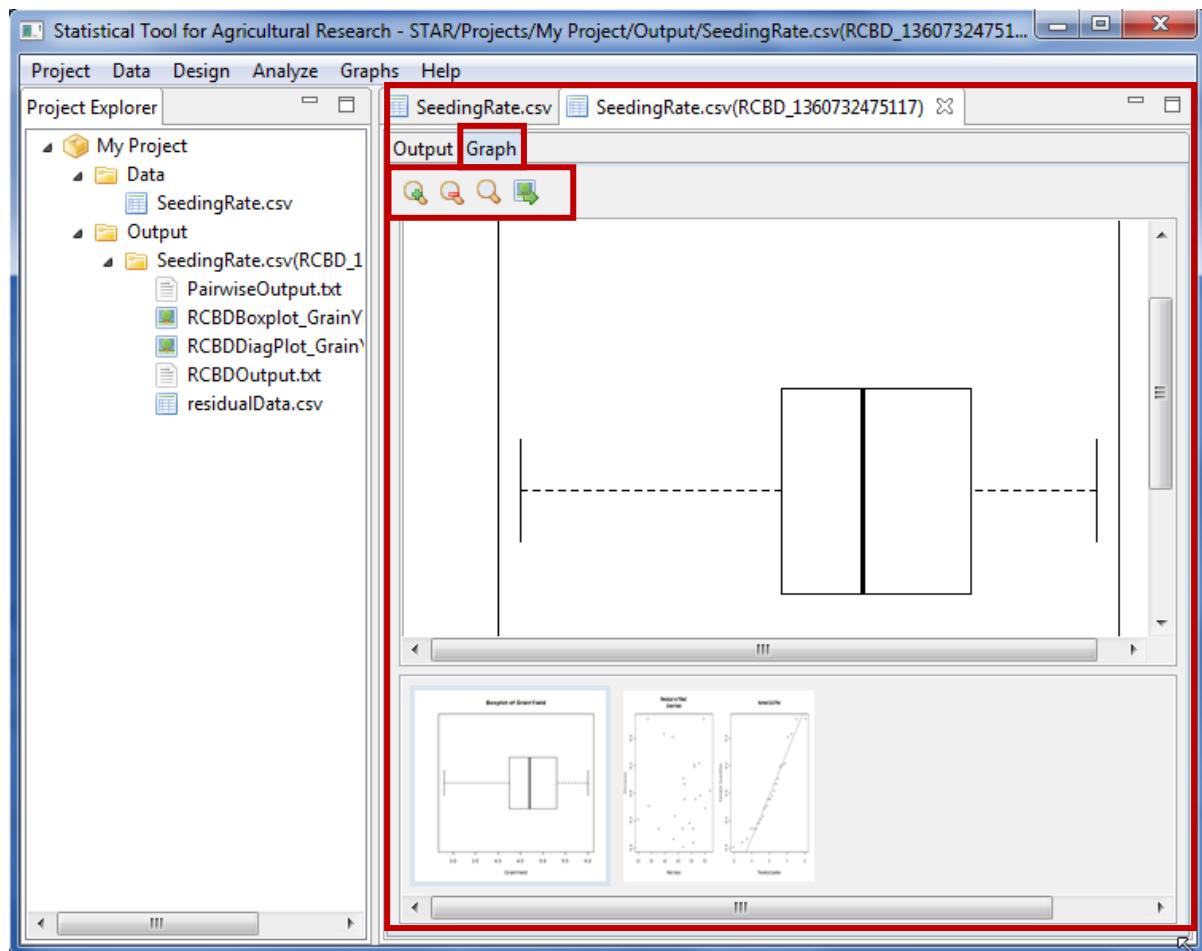
name it indicates that there has been modification made in the dataset and user needs to save the dataset for the modification to take effect. If a data with unsaved changes is used in an analysis or used in creating graphs, the original dataset will be used not the modified one. If a Data Viewer with unsaved changes is closed, the user will be prompted to save the changes.

## Result Viewer

Results Viewer tab is displayed in the editor panel when an analysis is performed or by double-clicking a results folder inside the *Output* folder. Depending on the contents of the results folder, the Result Viewer may have an *Output* page and/or the *Graph* page.



All outputs in *txt* format are displayed in the *Output* page while all graphical outputs in *png* format are displayed in the *Graph* page. The *Graph* page has toolbars that can be used to minimize, maximize, and view the graph to normal size and to export graph to external sources. To view other graphs in the page, the left and right arrow keys can be used

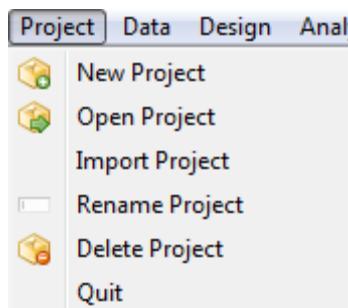


# Project and File Management

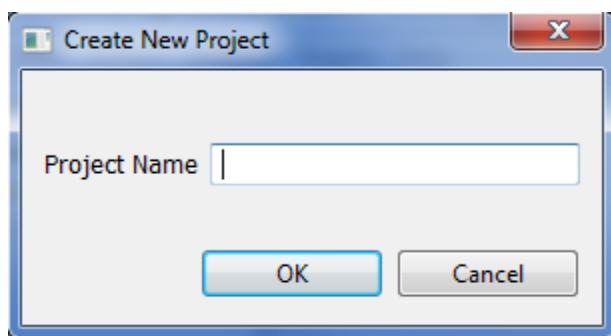
## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

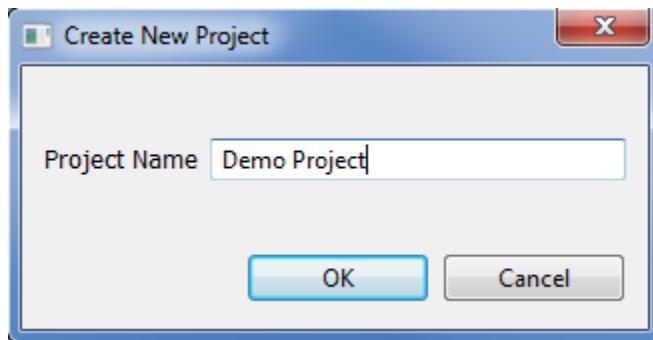


In naming a project, the following rules apply:

- The name must start with a letter. The remaining characters can be any letter, any digit, a period, underscore, blank or dash.
- Project names cannot end with a period, underscore, blank or dash.

- The length of the name should not be less than 4 characters
- Each project name must be unique; duplication is not allowed.
- Project name is not case sensitive.

For the example, type *Demo Project*. The completed dialog box will appear as shown below:



- Click the **OK** button.
- The new project named *Demo Project*, will now be displayed in the **Project Explorer** panel. By default, two empty folders under the project name will be automatically

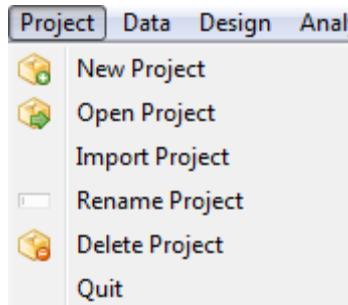
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#### *Project and File Management*

## **Creating New Project**

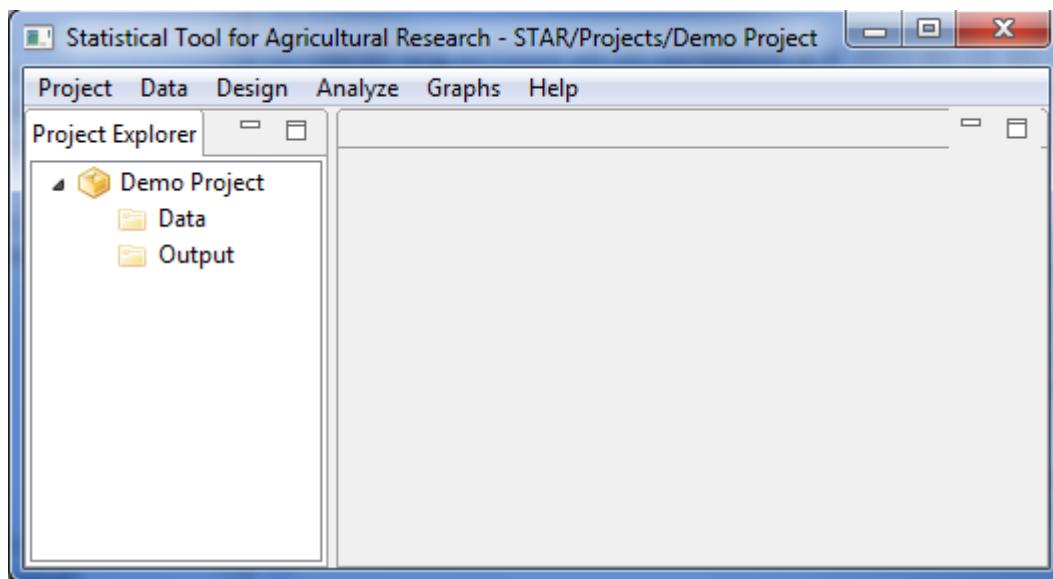
The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

created, the *Data* and *Output* folders. Note that these folders cannot be deleted, rename or move to another location.



Note: As part of the examples, create another folder named *My Project*.

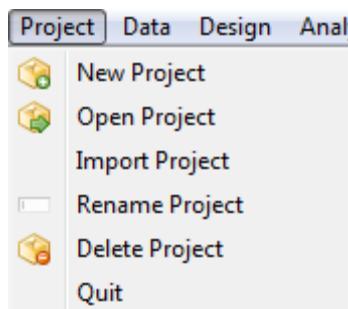
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#### Project and File Management

## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

## Open Existing Project

The steps for opening existing project inside the STAR workspace are listed below.

- Select **Project | Open Project** from the main menu.
- The **Open Existing Project from the Workspace** dialog box will appear. The list of all existing projects in the workspace can be seen.

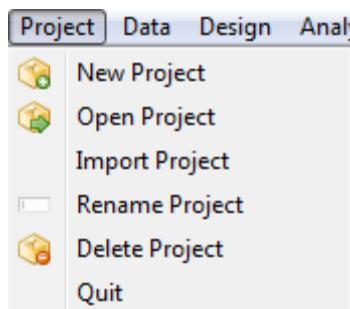
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### *Project and File Management*

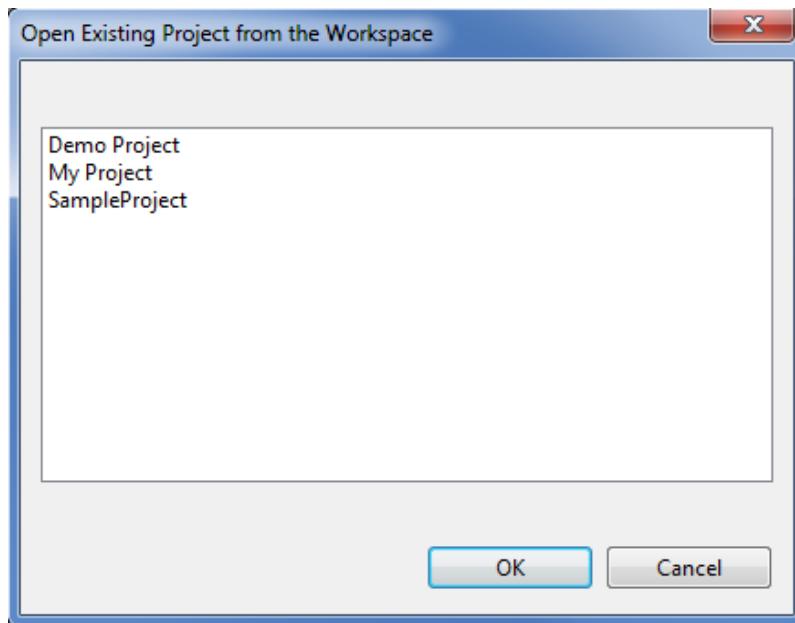
## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.



- For the example, select the project named *Demo Project*. Click the **OK** button. *Demo Project* should now be the active project in the **Project Explorer**.

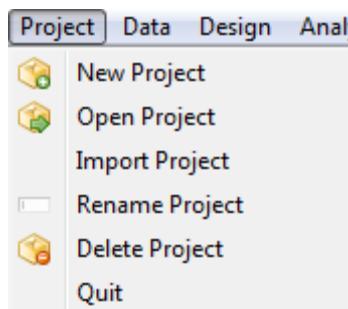
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### Project and File Management

## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.

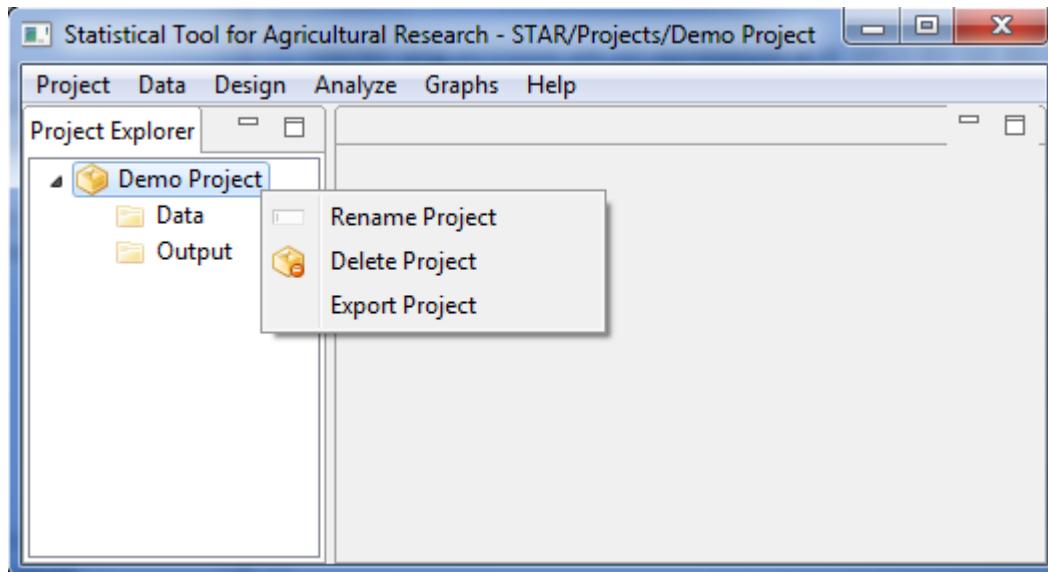


- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

## Renaming Project

The steps for renaming the active project are listed below.

- Right-click on the active project, say *Demo Project*, then select **Rename Project** or select **Project | Rename Project** from the main menu.



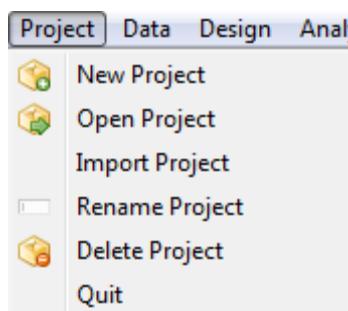
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### Project and File Management

## Creating New Project

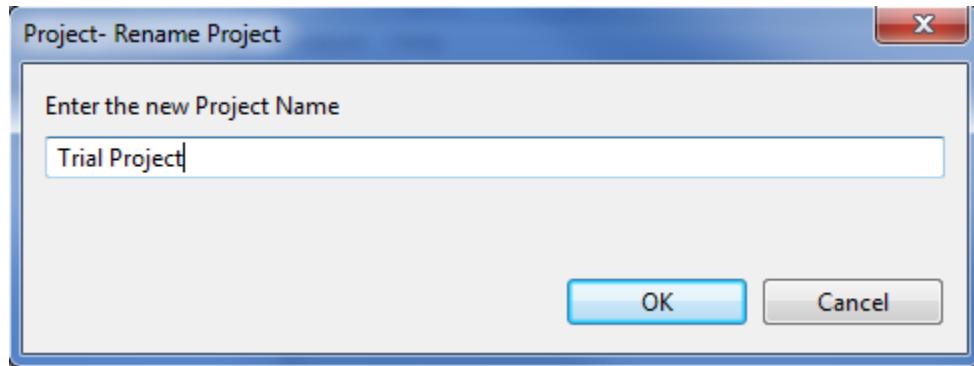
The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

- The **Rename Project** dialog box will appear. In the **New Project Name** field, specify a new project name, say *Trial Project*. Click the **OK** button.



- The project should be displayed in the **Project Explorer** with the new name.

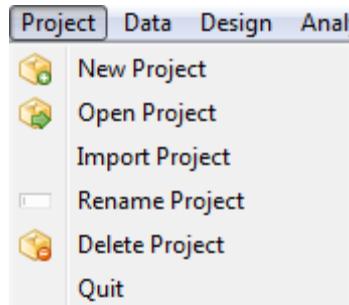
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## Project and File Management

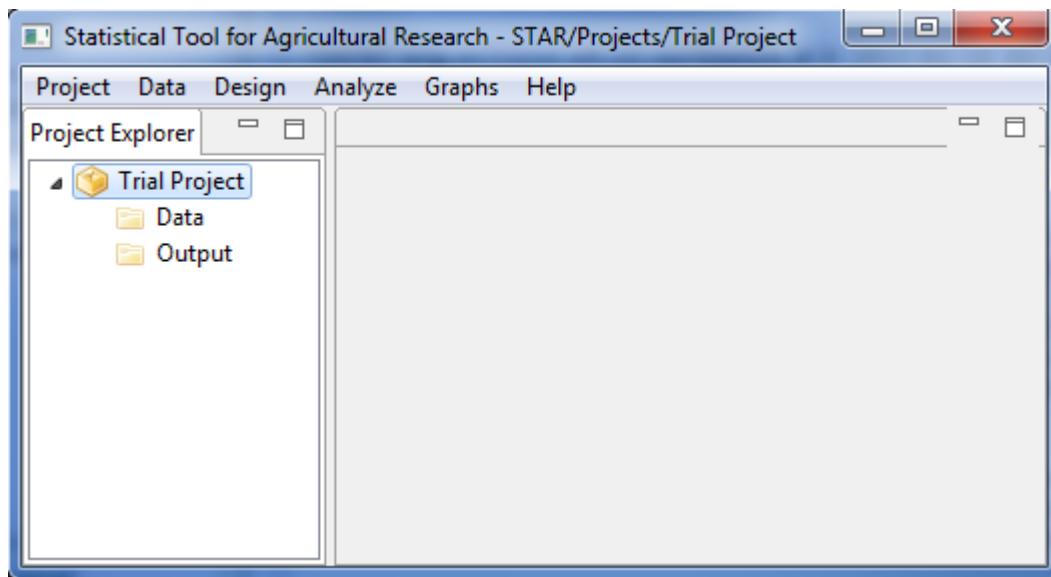
### Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.



## Exporting Project

If the user wants to save the active project to a different directory, the export project feature can be used. The steps are listed below.

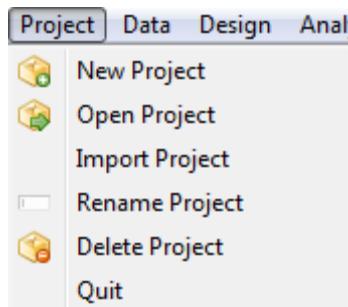
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### *Project and File Management*

## Creating New Project

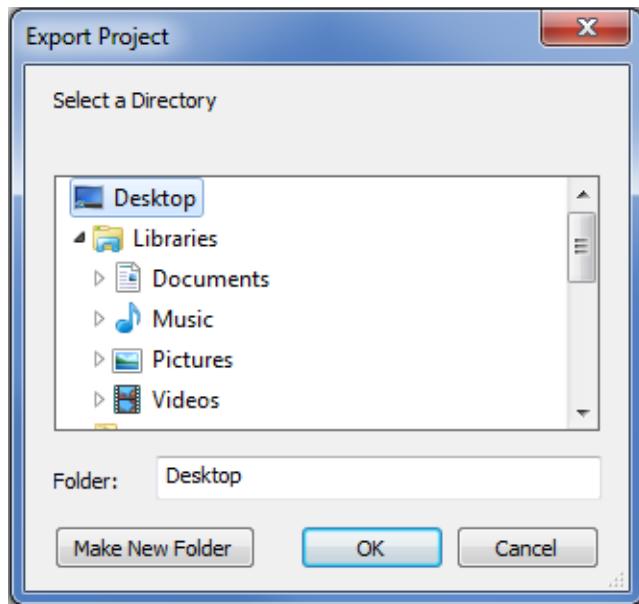
The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

- Right-click on the active project, say *Trial Project*, then select **Export Project**.
- Select the directory where the active project will be saved. For the example, choose *Desktop*. Click the **OK** button.



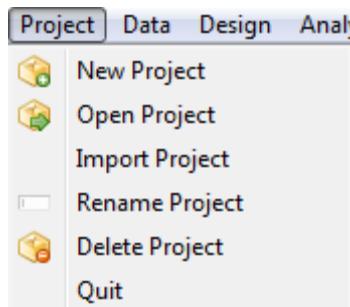
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## Project and File Management

### Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

- The *Trial Project* folder is now on the desktop.

## Deleting Project

The steps for deleting an existing project inside the STAR workspace are listed below.

- Right-click on the active project, say *Trial Project* then select **Delete Project** or select **Project | Delete Project** from the main menu.

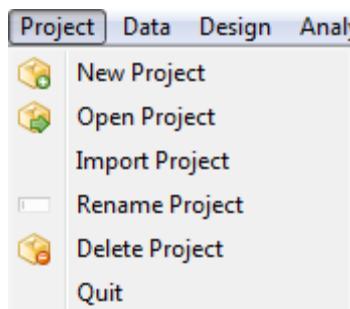
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## *Project and File Management*

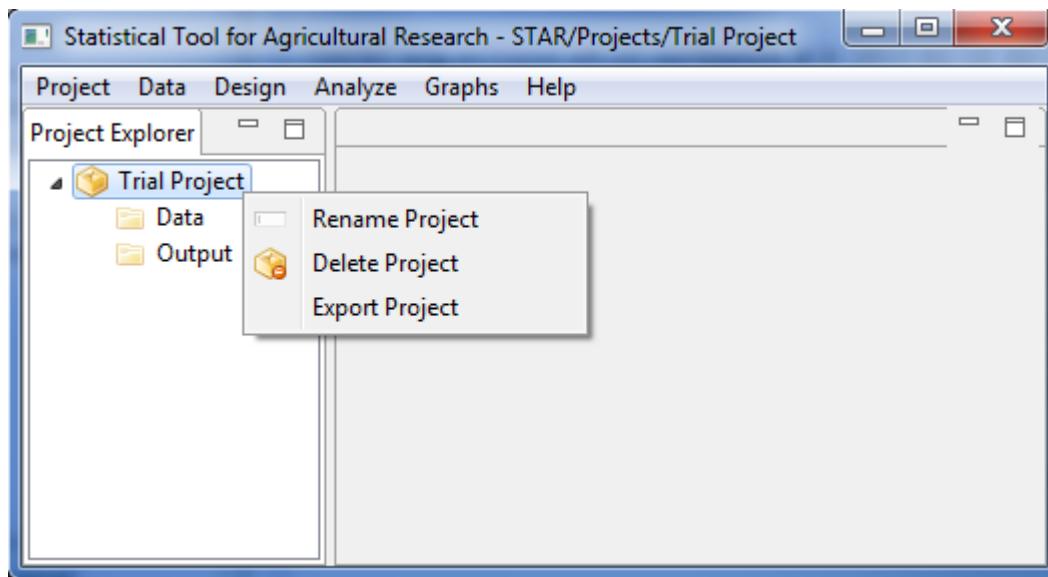
## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.



- Another dialog will be displayed. If the user wants to delete multiple projects, click on the check box labeled **I want to delete multiple** projects then select from the list the projects to be deleted. For the example, delete only *Trial Project* by clicking **OK**.

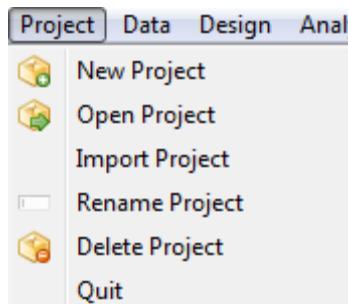
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### Project and File Management

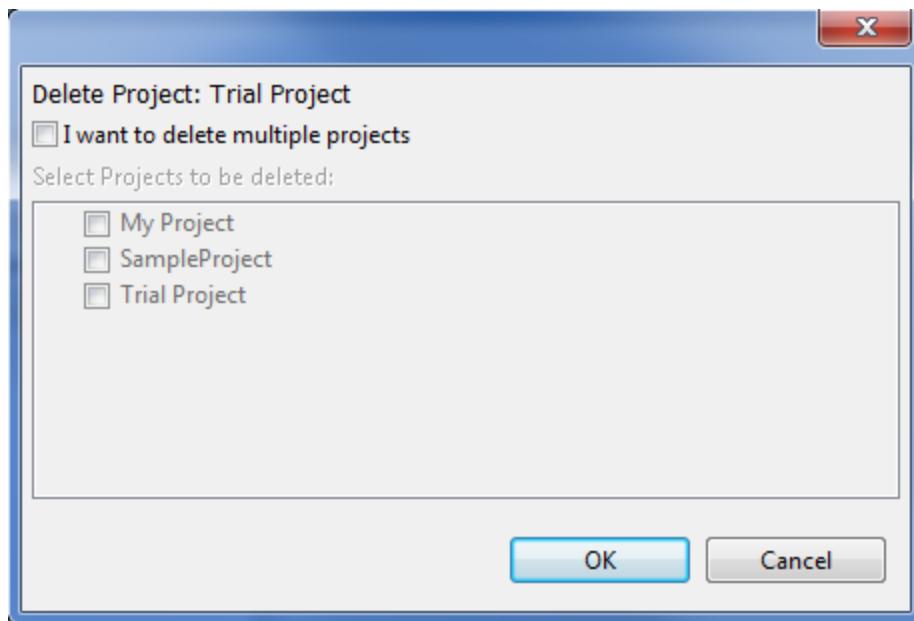
## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.



- Since *Trial Project* is now deleted from the STAR workspace, there is no active project displayed in the Project Explorer as shown below.

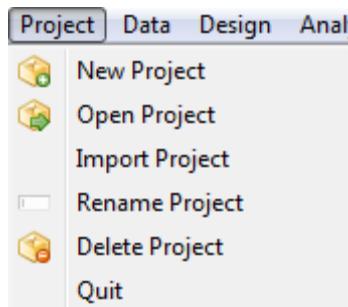
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#### Project and File Management

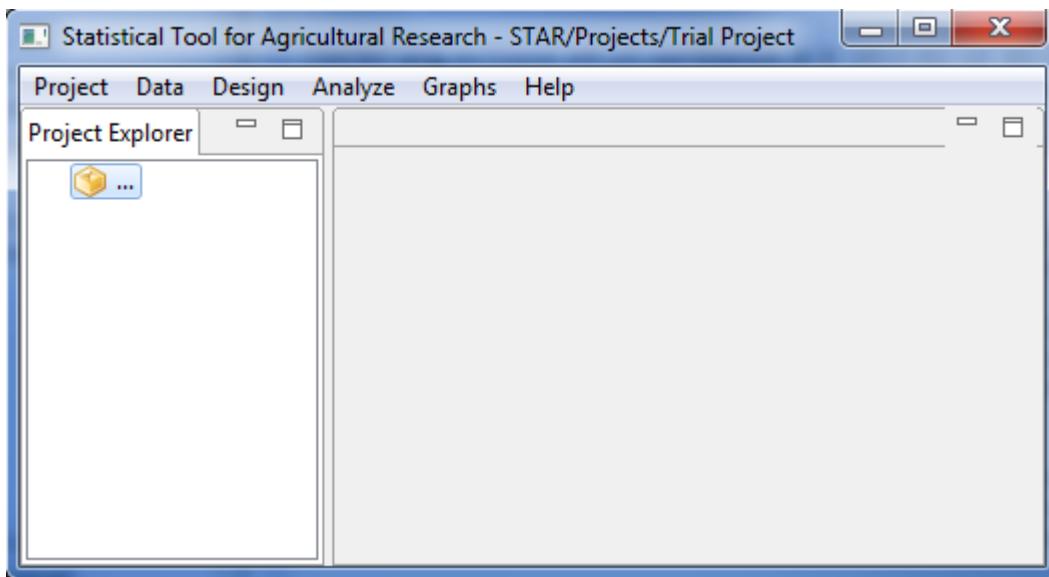
## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.



## Importing Project

Projects, as long as it is a valid STAR project, can be saved inside the STAR workspace by using the import project feature. The steps are listed below.

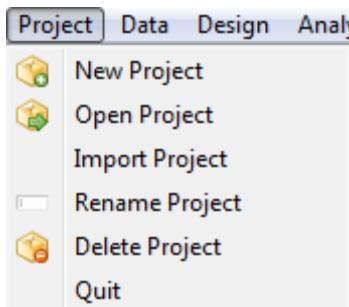
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### *Project and File Management*

## Creating New Project

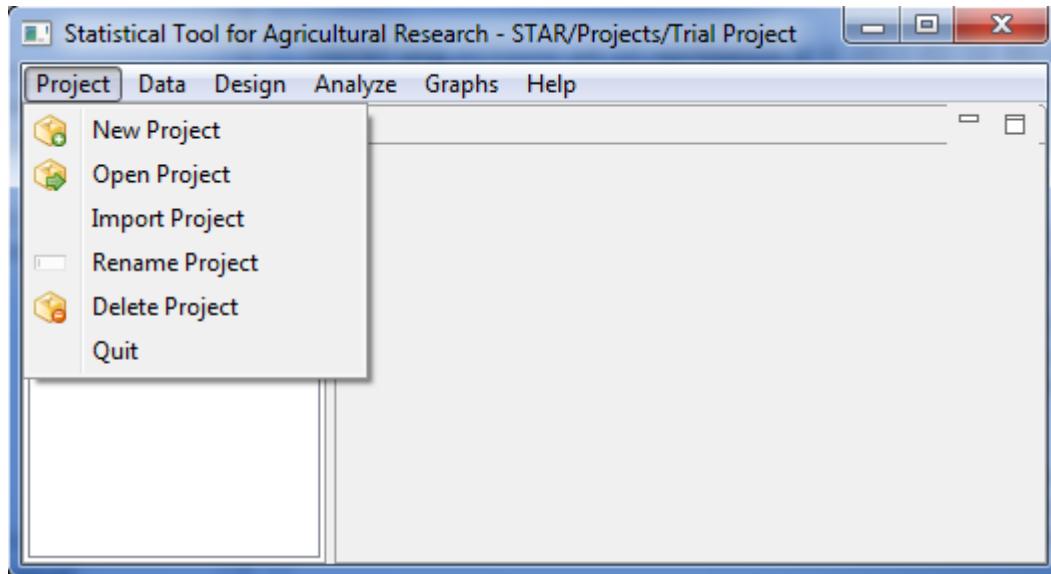
The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

- Click **Project | Import Project** from the main menu.



- Select the project folder that will be imported. For the example, select *Trial Project* folder on the desktop. Click the **OK** button.

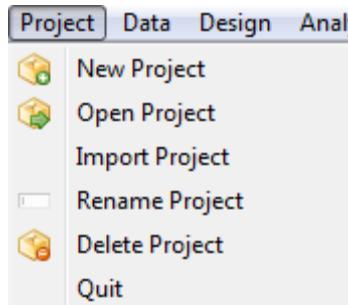
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#### Project and File Management

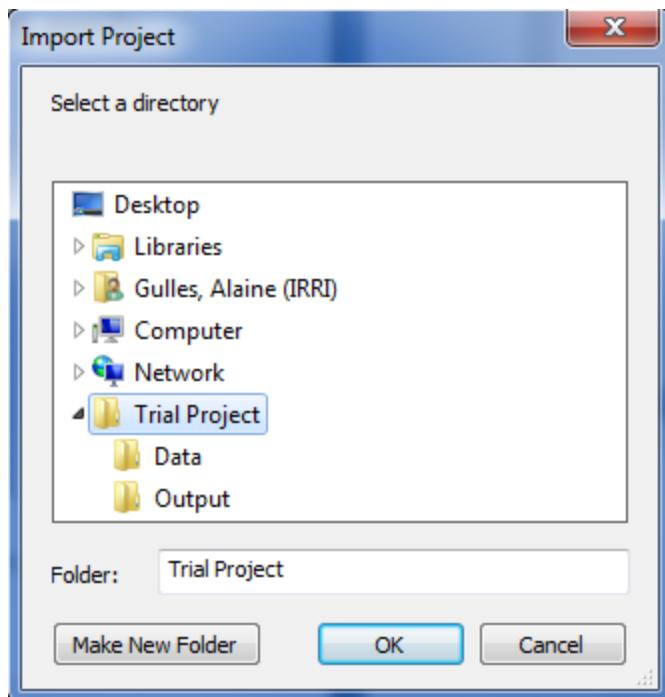
## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.



- The *Trial Project* is now the active project in the **Project Explorer**.

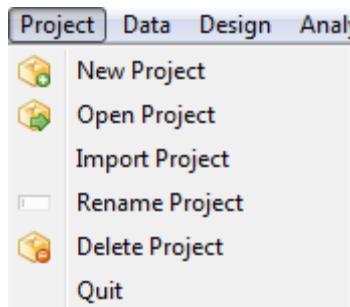
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## Project and File Management

### Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

## Importing Data from External Source

There are three file formats that STAR accepts to import from external source namely:

- (i) R datasets. These are datasets that were saved in the R environment and have an extension *.rda*, *.Rda*, *.RDA*, or *.Rdata*;
- (ii) text files. These are datasets with extension *.txt* whose file delimiter can be a tab, space, comma or a semi-colon; and
- (iii) comma-separated value files. These are datasets with extension *.csv*.

The general steps for importing data from external source are listed below:

- On the **Project Explorer** panel, right-click the *Data* folder of the project named *Trial Project*. A pop-up menu will appear. Choose **Import Data**.

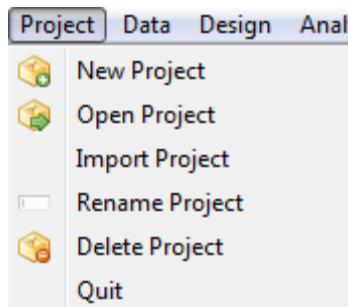
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### Project and File Management

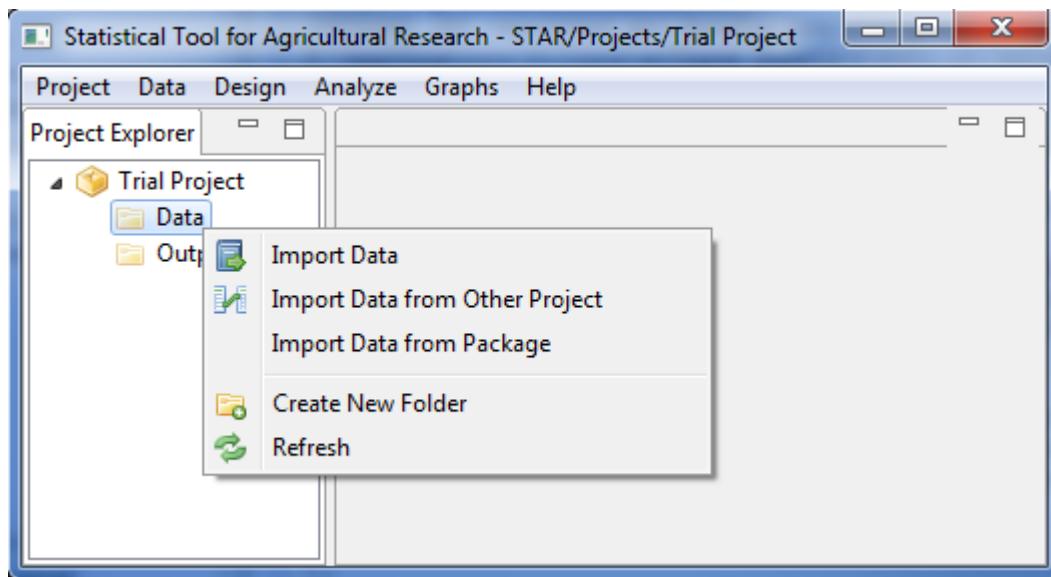
## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.



- The **Import** dialog box will appear. Choose the appropriate file type to be imported in the File of Types drop-down box. The default file type is **\*.csv**. Go to the directory where the file to be imported is located. Select the file or type the file name on the **File name** text box.

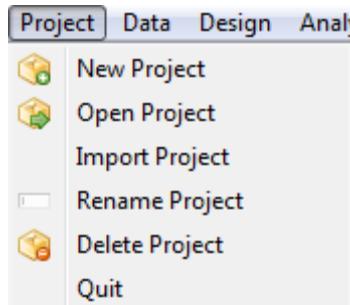
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#### *Project and File Management*

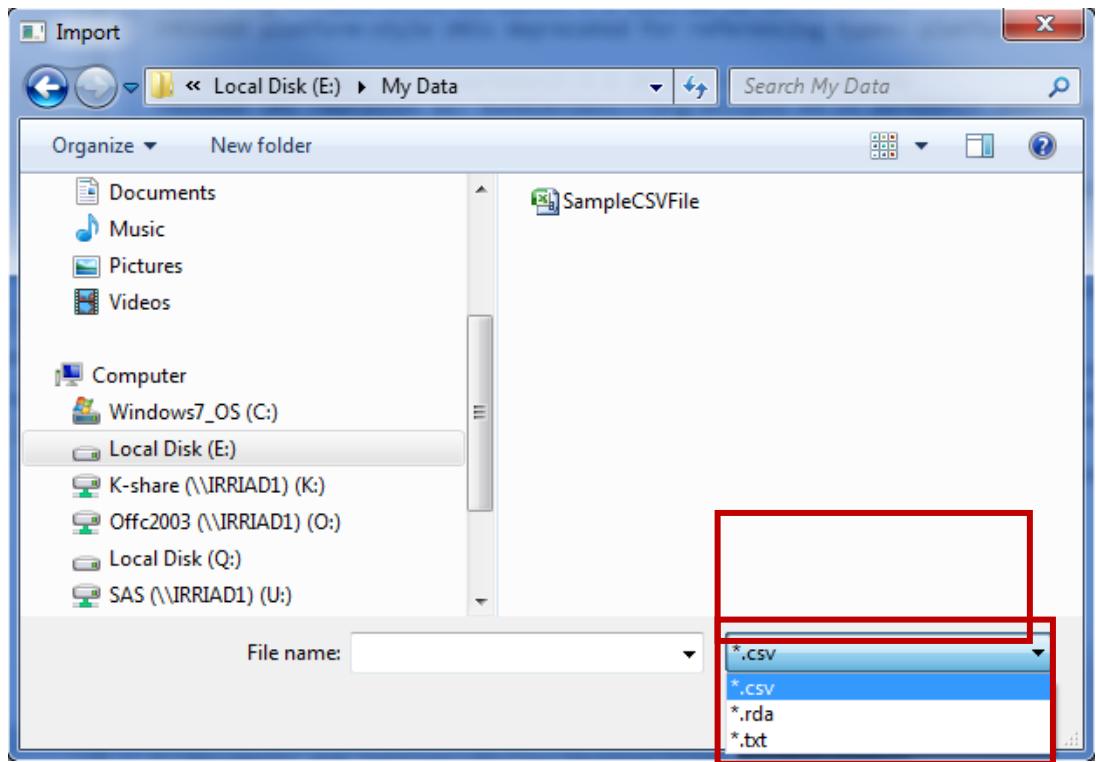
## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.



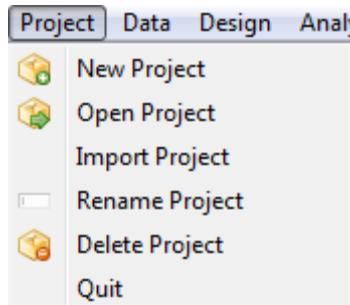
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#### Project and File Management

## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

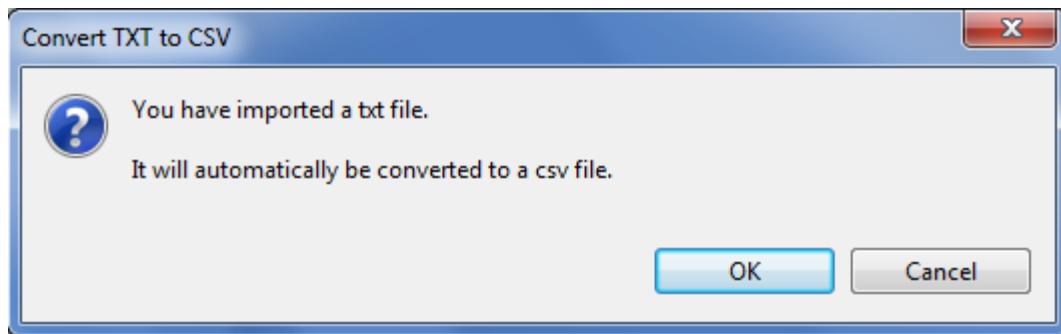
- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

- Click the **Open** button.

If the **\*.txt** or the **\*.rda** file type is chosen, a message dialog box will appear that will prompt the user that the text or r data files will be automatically converted to a csv file. Click the **OK** button.



Further, if the **\*.txt** file type is chosen, the **Specify Delimiter** dialog box will appear. Choose the appropriate delimiter of the text file to be open then click the **OK** button.

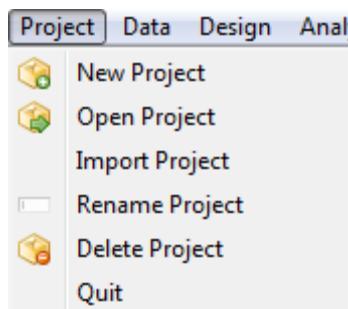
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## *Project and File Management*

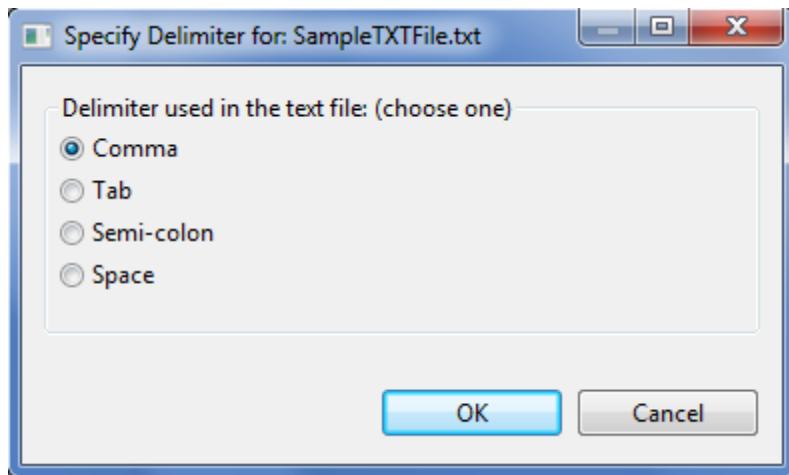
### **Creating New Project**

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.



- The newly imported data will now be displayed inside the *Data* folder of the active project in the **Project Explorer**. To view the data in a spreadsheet format, double-click the icon of the data file.

## Importing Data from Other Project

The steps for importing data from other project are listed below:

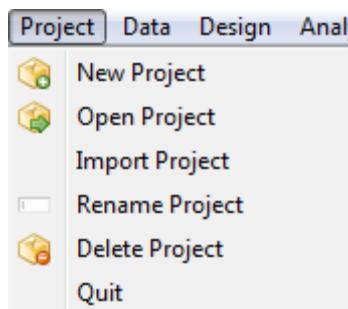
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### *Project and File Management*

## Creating New Project

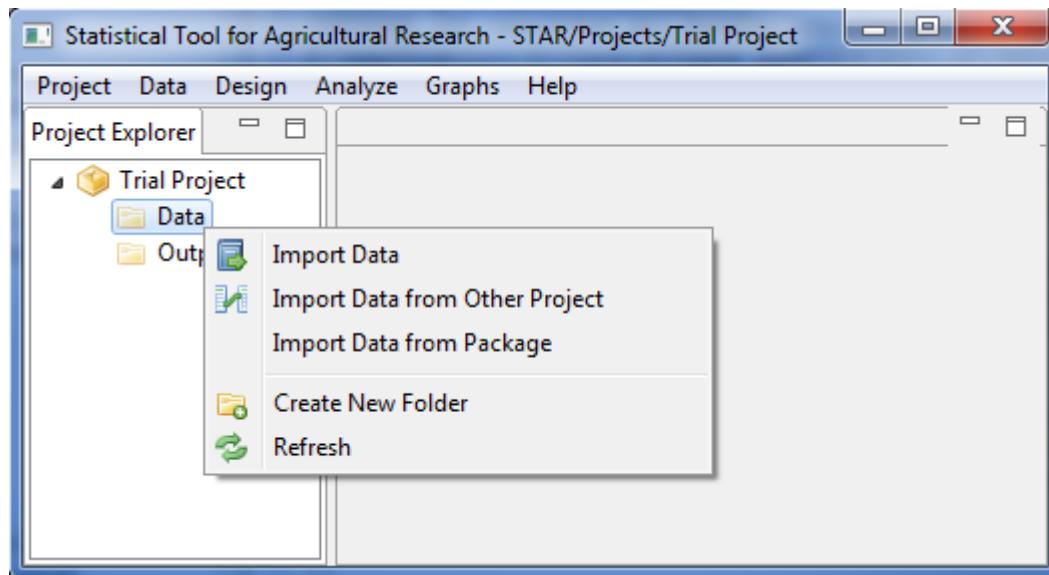
The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

- On the **Project Explorer** panel, right-click the *Data* folder of the project named *Trial Project*. A pop-up menu will appear. Choose **Import Data from Other Project**.



- The **Import from Other Project** dialog box will appear. This dialog box contains all projects created in STAR. The user can select one or several project folders, one or

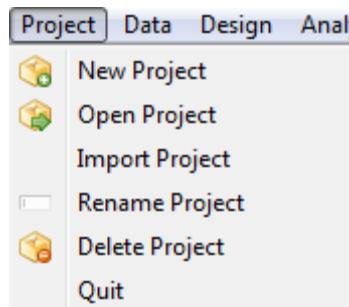
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#### Project and File Management

## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

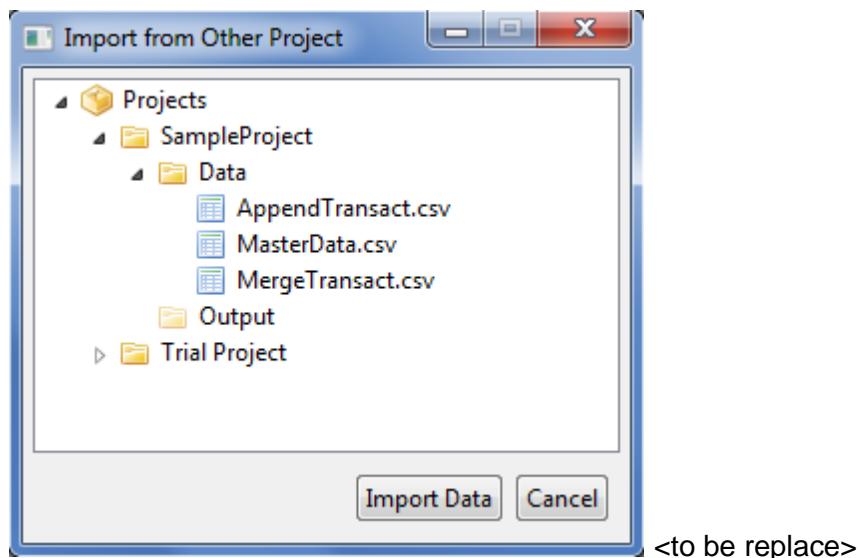
- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

several folders within projects or one or several data files. Choose the data files to be imported.

For the example, choose *MasterData.csv* from *Projects | SampleProject | Data*.



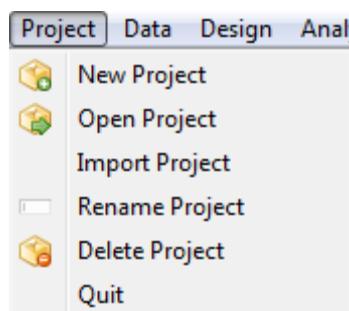
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#### Project and File Management

## Creating New Project

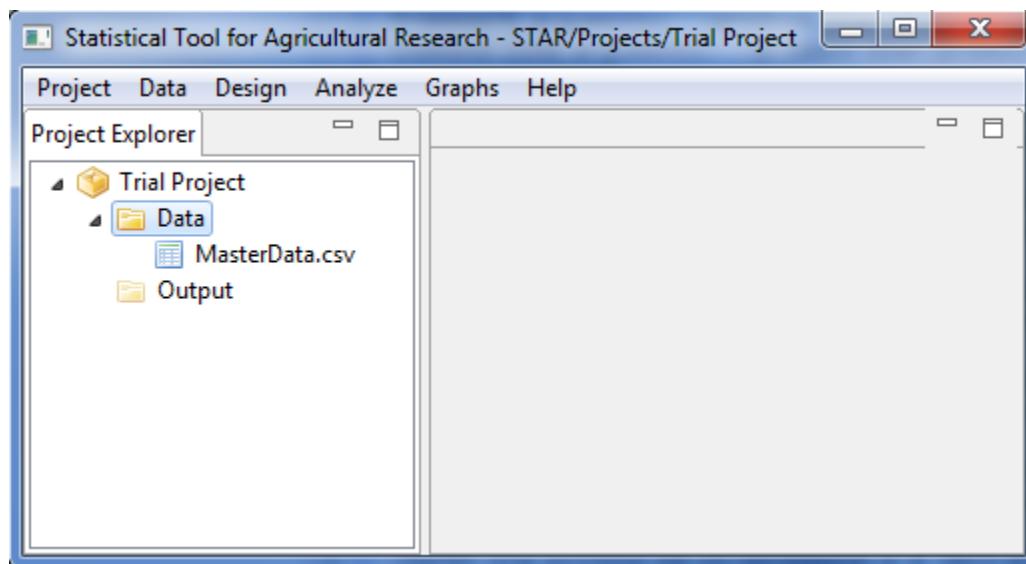
The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

- Click the **Import Data** button. The new imported data file will now be displayed inside the *Data* folder of the active project in the **Project Explorer** panel. To view the data in a spreadsheet format, double-click the icon of the data file.



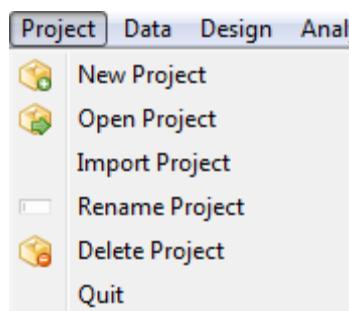
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#### Project and File Management

## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

## Importing Data from Package

Datasets in STAR package of R can be imported. The steps to import data from R package are listed below:

- On the **Project Explorer** panel, right-click the *Data* folder of the project named *Trial Project*. A pop-up menu will appear. Choose **Import Data from Package**.

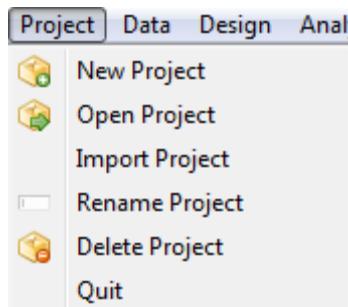
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### Project and File Management

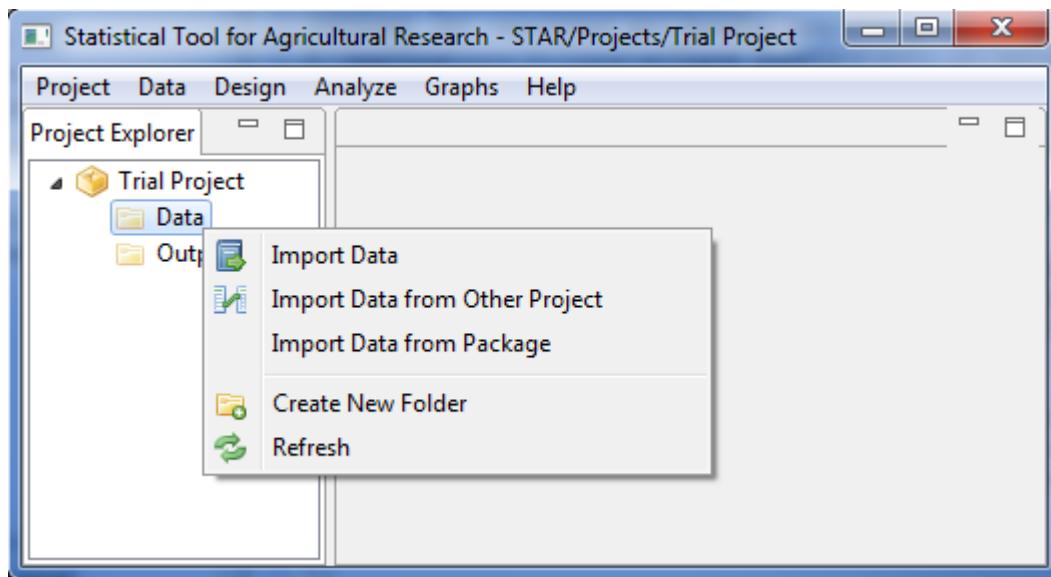
## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.



- The **Import Data from R** dialog box will appear. Choose one dataset to be imported. Only one data set can be imported at a time.

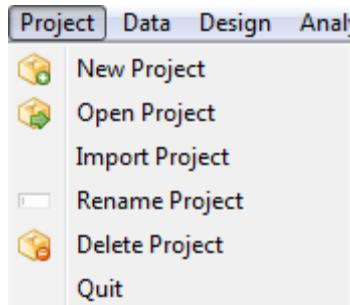
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#### *Project and File Management*

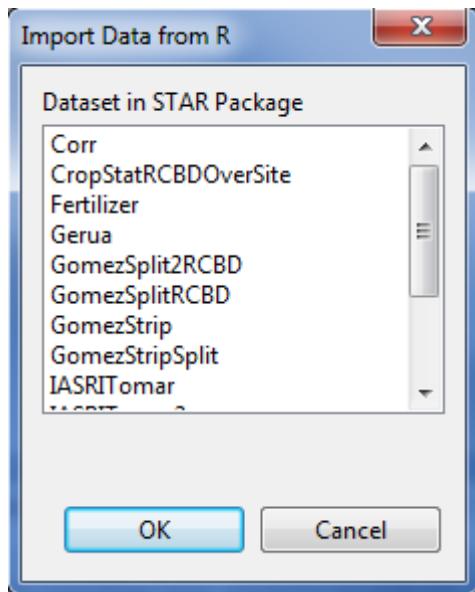
## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.



For the example, choose *SeedingRate*.

- Click the **OK** button. The new imported data file will now be displayed inside the **Data** folder of the active project in the **Project Explorer** panel. To view the data in a spreadsheet format, double-click the icon of the data file

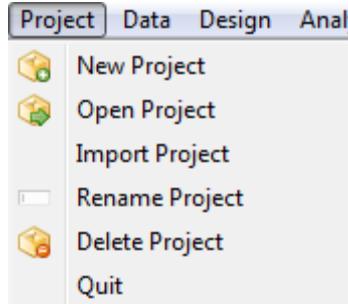
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#### *Project and File Management*

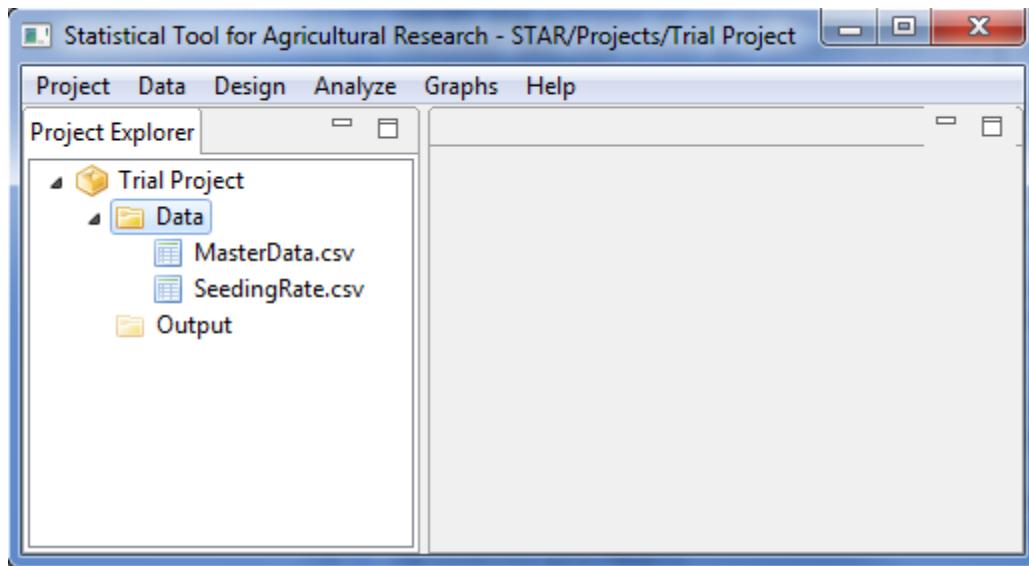
## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.



## Creating New Folder

To organize the data files imported in a project or results of an analysis, user may want to create a sub folder inside the *Data* folder or inside the *Output* folder.

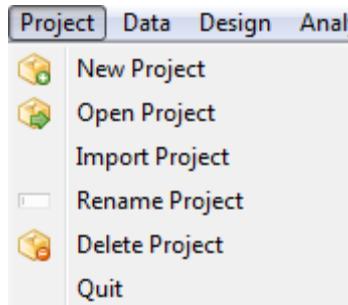
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### Project and File Management

## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.

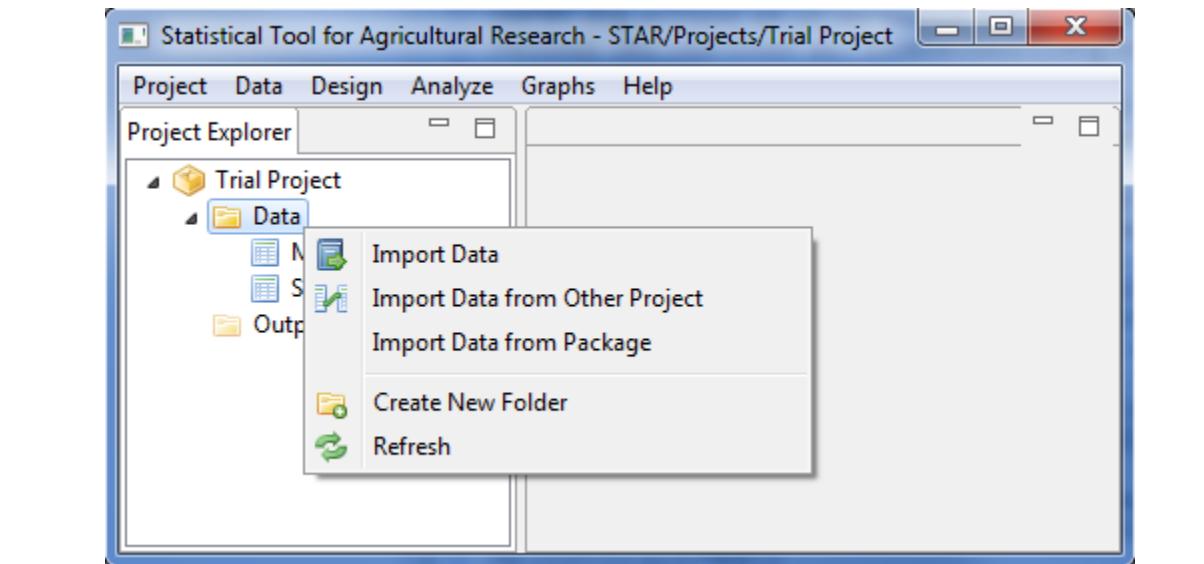


- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

The steps in creating a sub folder are listed below:

- On the **Project Explorer** panel, right-click the folder where you want to create the subfolder.

For the example, right-click the *Data* folder of the project named *Trial Project*. A pop-up menu will appear. Choose **Create New Folder**.



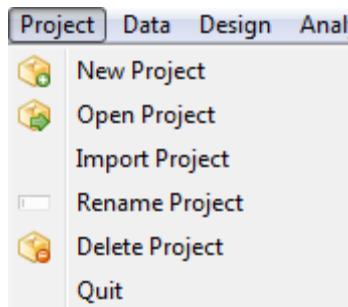
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#### Project and File Management

## Creating New Project

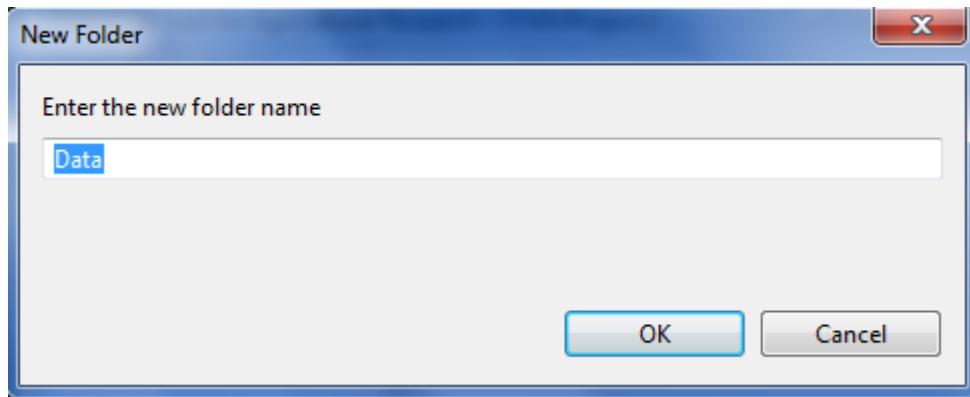
The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

- The **New Folder** dialog box will appear. In the **Enter the new folder name** field, user can specify other name for the new folder. If the sub folder will be created within the *Data* folder, the default folder name is *Data*. If the sub folder will be created within the *Output* folder, the default folder name is *Output*.



In naming a folder, the following rules apply:

- The name must start with a letter. The remaining characters can be any letter, any digit, a period, underscore, blank or dash.
- Folder names cannot end with a period, underscore, blank or dash.

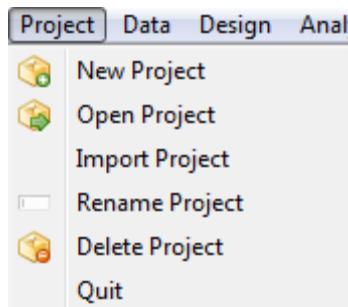
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#### Project and File Management

## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

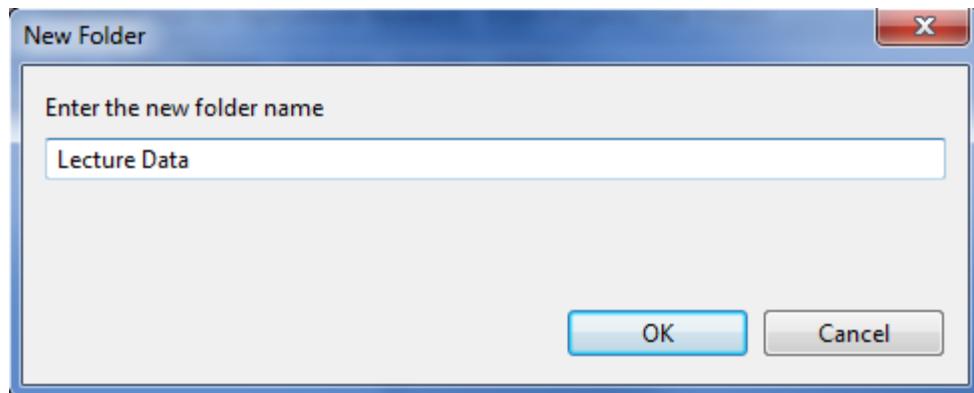
- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

- The length of the folder name should not be less than 4 characters.
- Each folder name must be unique with a specific folder; duplication is not allowed.
- Folder name is not case sensitive.

For the example, type *Lecture Data* as the new folder name.



- A new sub-folder inside *Data* folder is now created and can be seen in the Project Explorer.

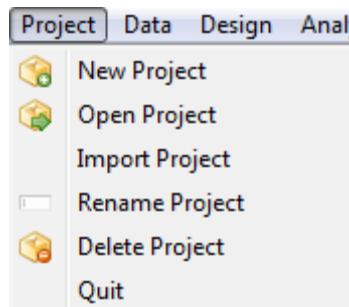
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## Project and File Management

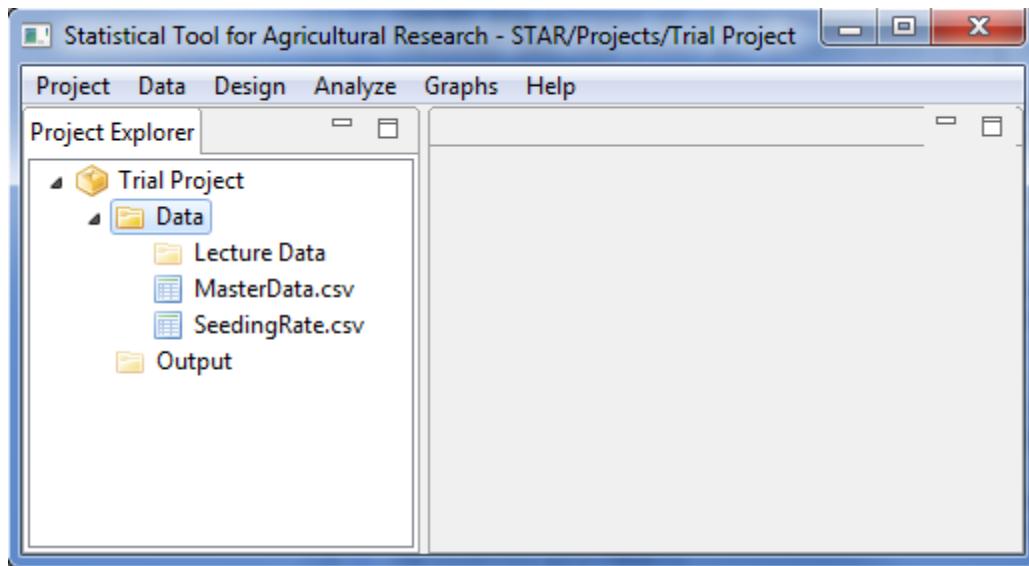
### Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.



The user can create several sub folders within the *Data* folder or *Output* folder. If the sub folders are created within the *Data* folder, user can import data set to the sub folder, rename, copy, delete and move the sub folder.

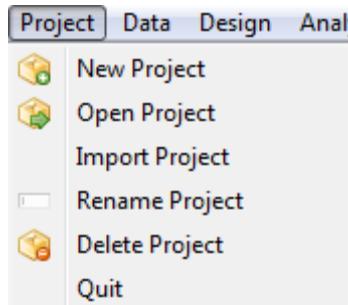
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#### Project and File Management

## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

## Copying File/Folder

The steps to copy data files to other location are listed below:

- On the **Project Explorer** panel, right-click the file you want to copy.

For the example, right-click *SeedingRate.csv* inside the *Data* folder of the project named *Trial Project*. Choose **Copy**.

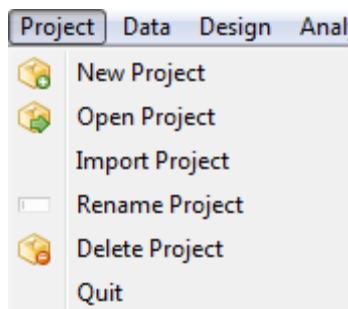
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### *Project and File Management*

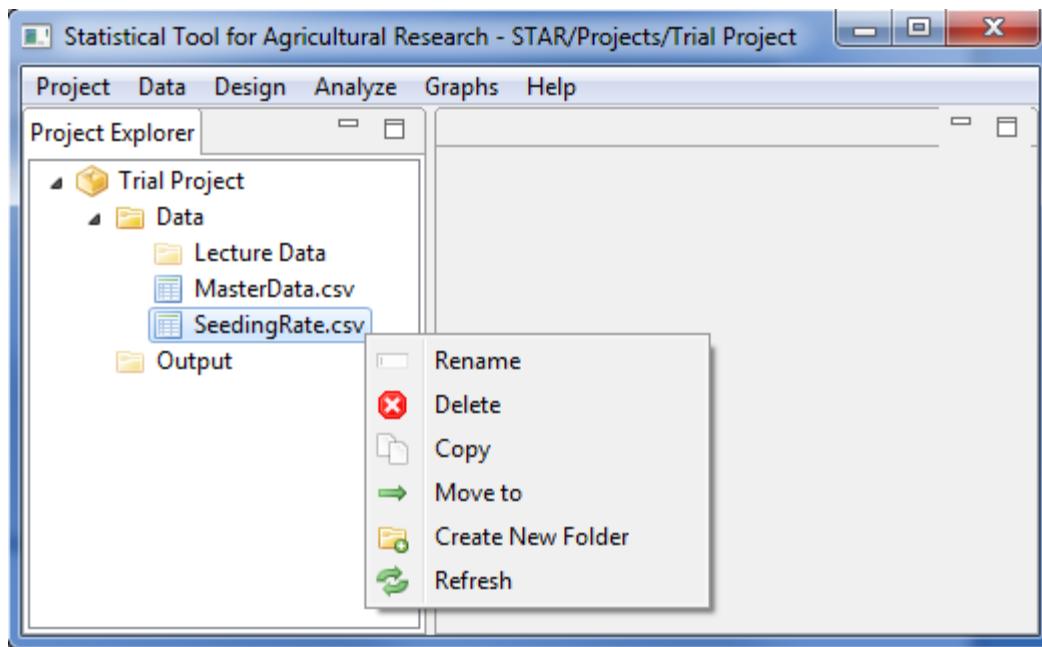
## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.



- Go to the desired destination folder, which can be within or outside STAR workspace, then right-click then choose **Paste**.

For the example, right-click on the *Lecture Data* folder then choose **Paste**.

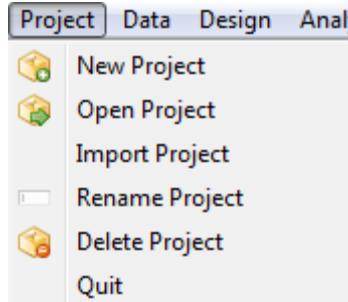
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#### *Project and File Management*

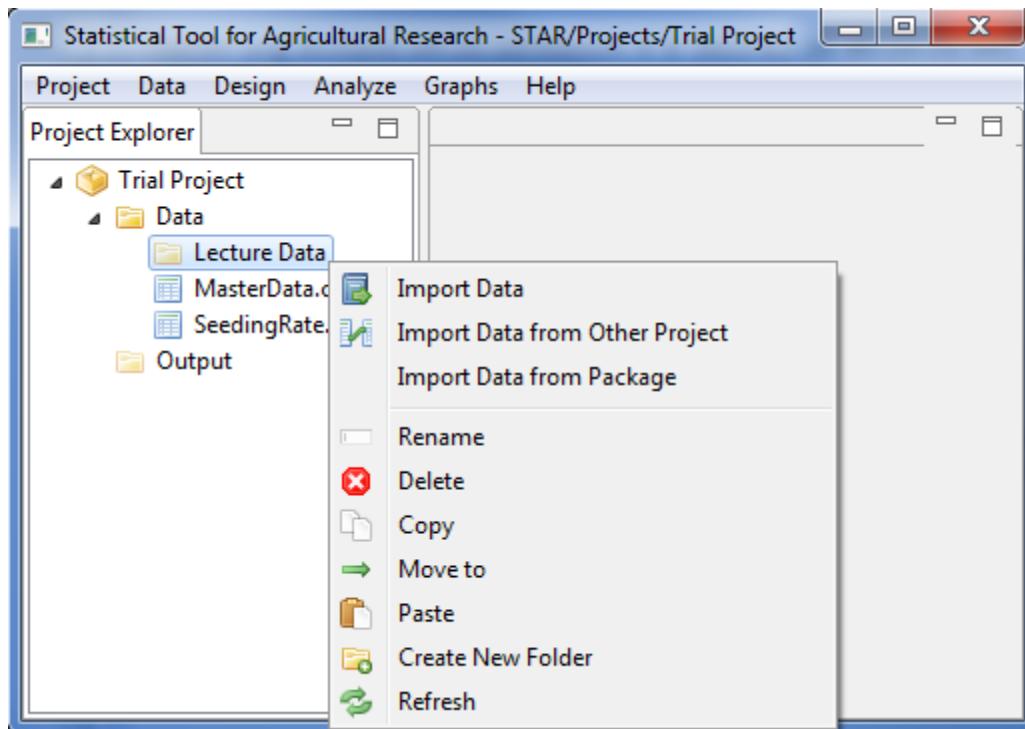
## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.



- The file is now copied inside the destination folder.

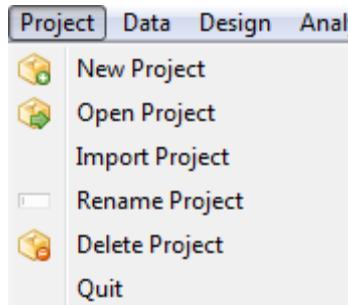
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#### Project and File Management

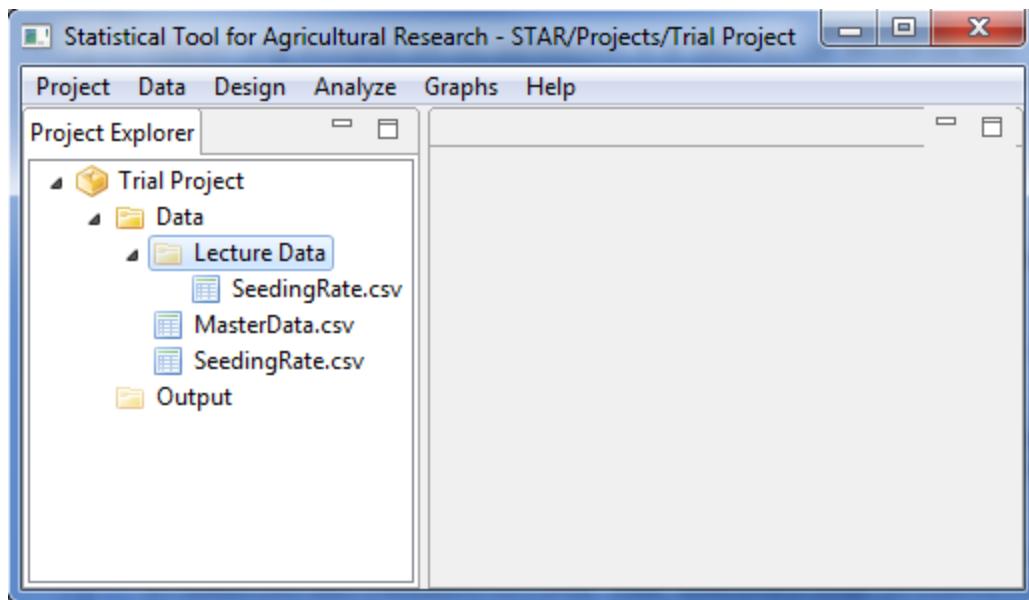
## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.



These steps also apply when copying the sub- folders within the *Data* and *Output* folders.

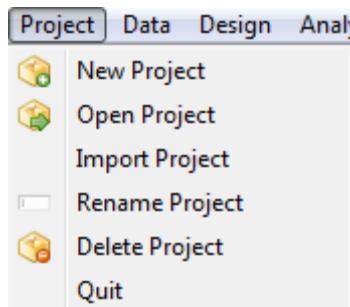
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#### Project and File Management

## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

## **Renaming File/Folder**

The steps to rename files are listed below:

- On the **Project Explorer** panel, right click the file to rename.

For the example, right-click *SeedingRate.csv* inside the *Data* folder of the project named *Trial Project*. Choose **Rename**.

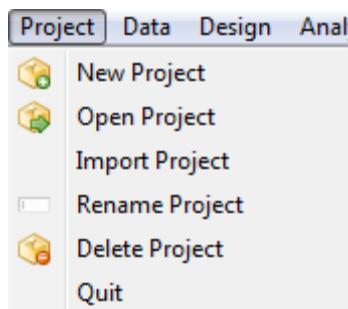
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### *Project and File Management*

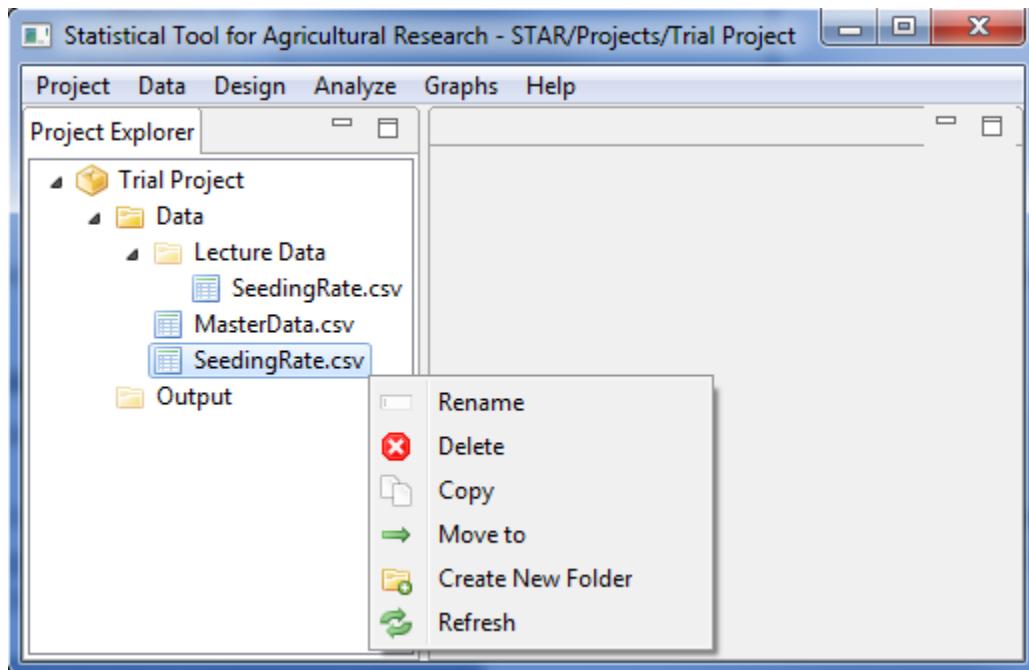
## **Creating New Project**

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.



- The **Rename File** dialog box will appear. In the **Enter the new file name** field, user can specify the new filename.

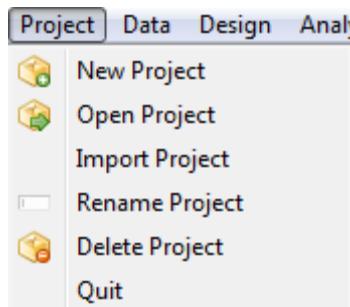
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#### Project and File Management

## Creating New Project

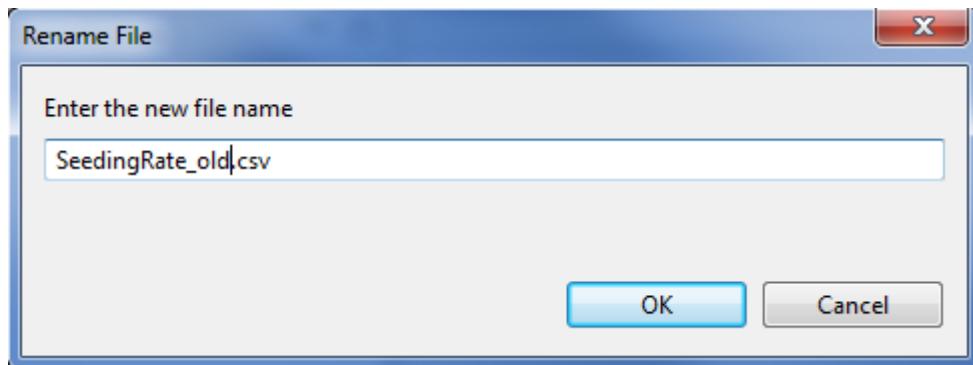
The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

For the example, set the new filename to *SeedingRate\_old.csv*. The completed dialog box should appear as shown below:



- Click the **OK** button. The renamed data file should appear in the **Project Explorer** panel.

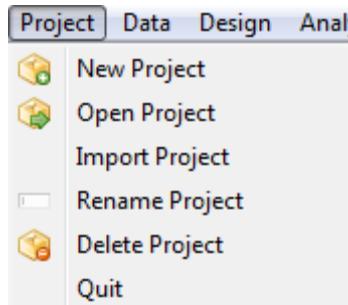
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## *Project and File Management*

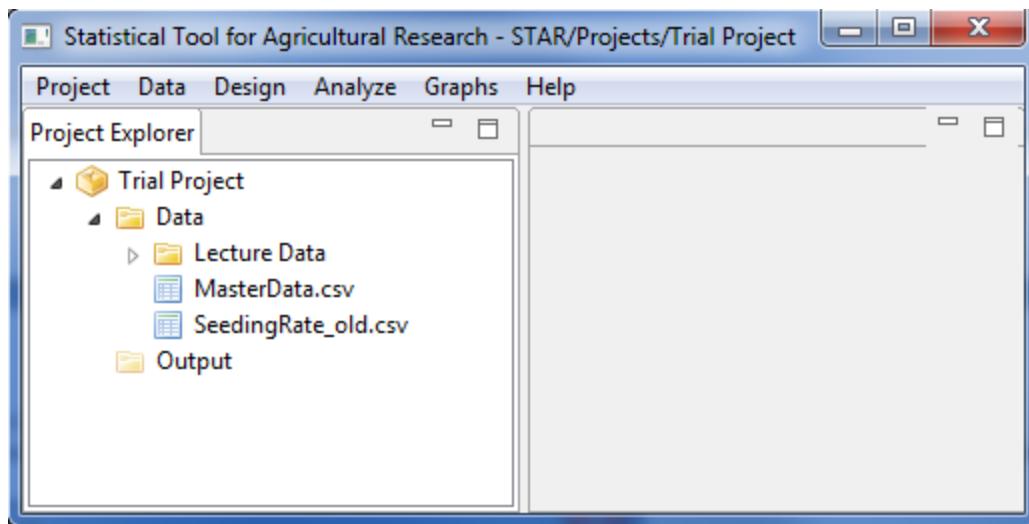
### **Creating New Project**

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.



These steps also apply when renaming the sub- folders within the *Data* and *Output* folders.

## Moving File/Folder

The steps to move data files to other location in the STAR workspace are listed below:

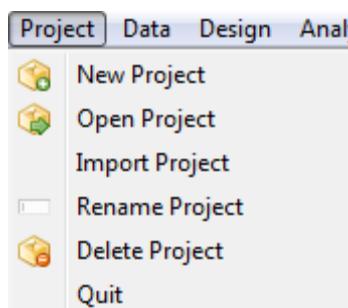
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### *Project and File Management*

## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

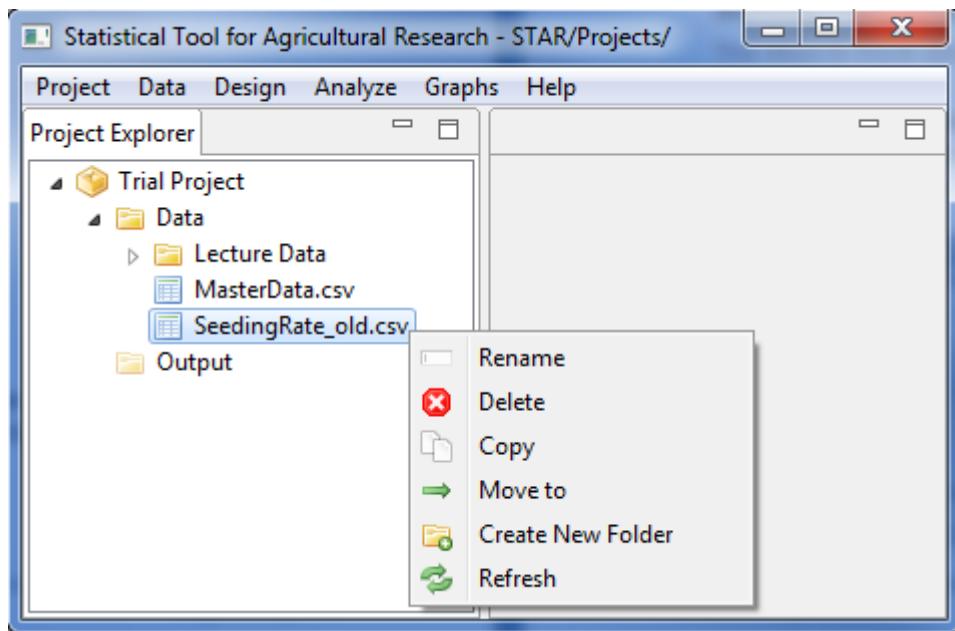
- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

- On the **Project Explorer** panel, right click the file to you want to move.

For the example, right-click *SeedingRate\_old.csv* inside the *Data* folder of the project named *Trial Project*. Choose **Rename**.



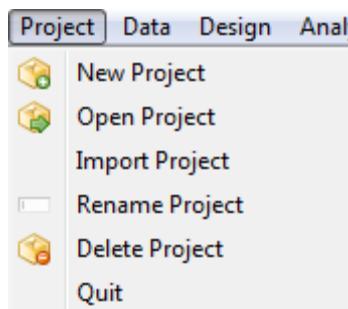
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#### Project and File Management

## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

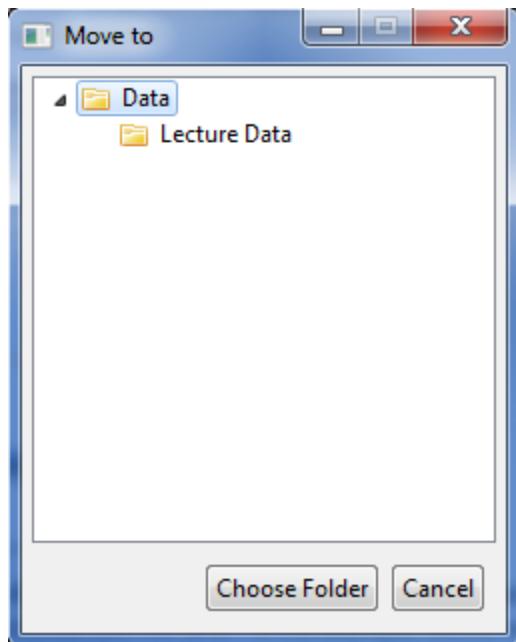
- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

- The **Move to** dialog box will appear. Select the destination folder.

For the example, choose the *Lecture Data* folder inside the *Data* folder.



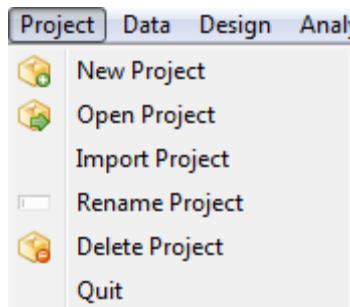
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#### Project and File Management

## Creating New Project

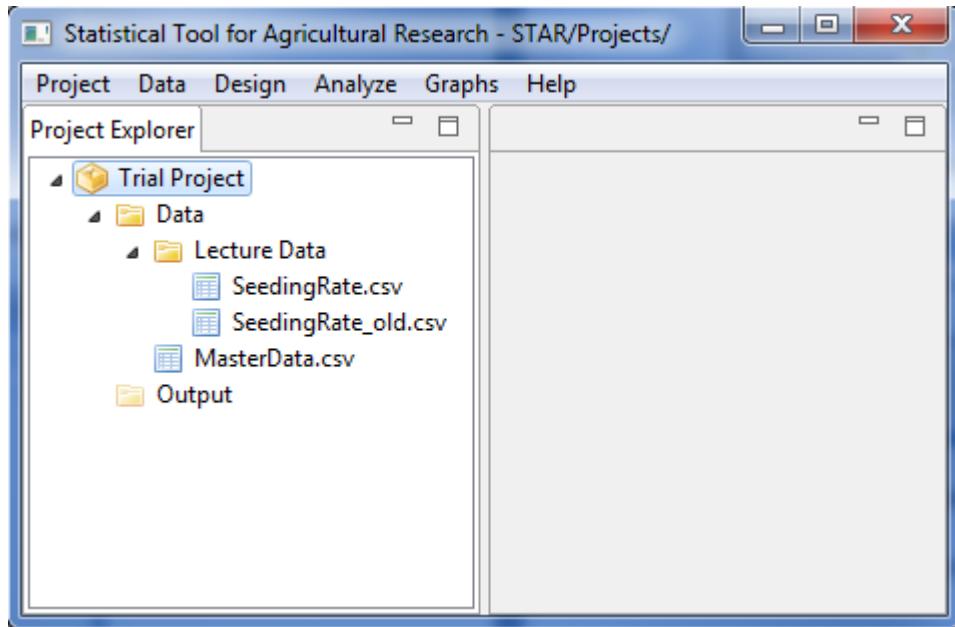
The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

- Click the **Choose Folder** button. The file is now moved to the destination folder.



These steps also apply when moving the sub-folders within the *Data* and *Output* folder.

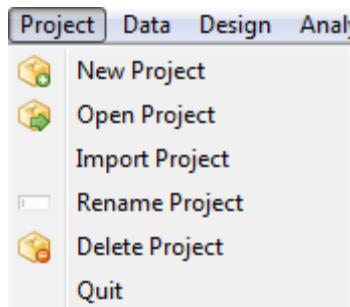
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### *Project and File Management*

## **Creating New Project**

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

## **Deleting File/Folder**

The steps to delete data files are listed below:

- On the **Project Explorer** panel, right click the file to you want to delete.

For the example, right-click *SeedingRate\_old.csv* inside the *Lecture Data* of the *Data* folder of the project named *Trial Project*. Choose **Delete**.

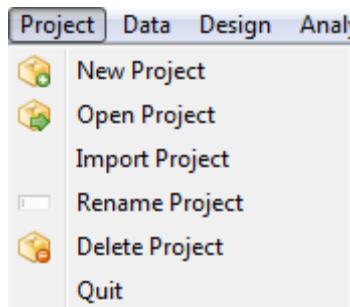
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## *Project and File Management*

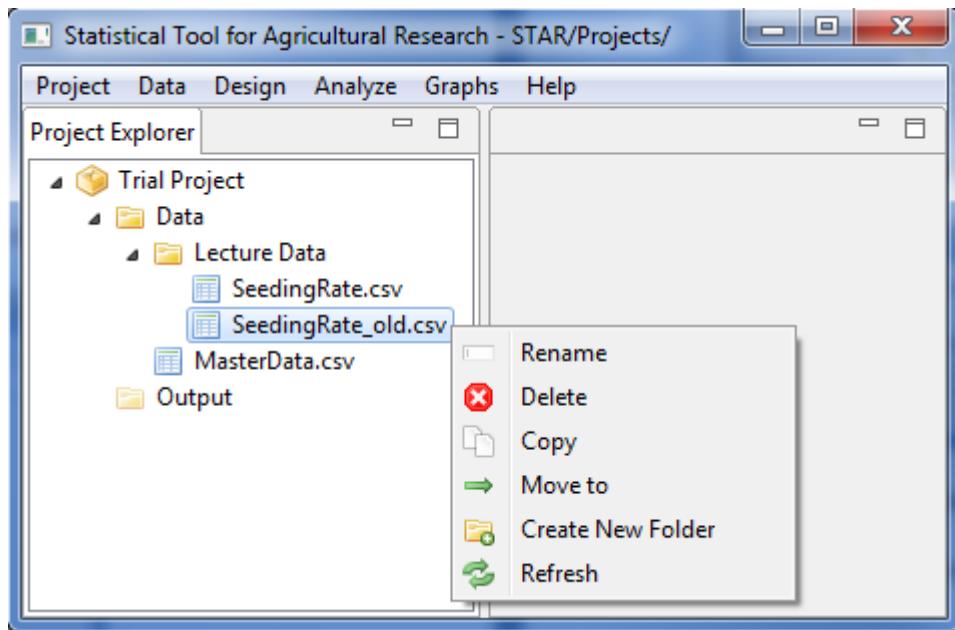
### **Creating New Project**

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.



- The **Confirm Delete** message box will appear.

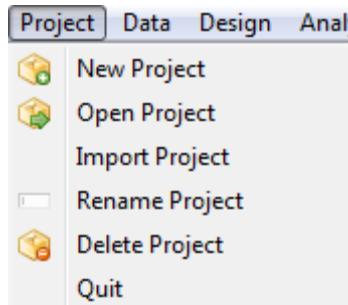
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#### Project and File Management

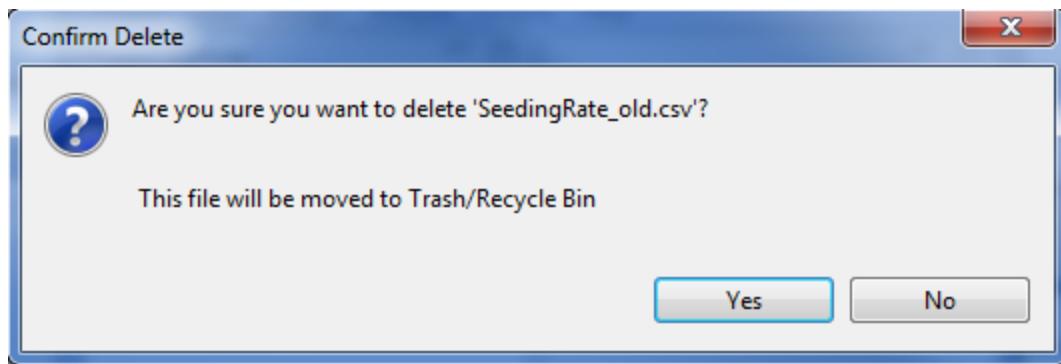
## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.



- Click the **Yes** button to delete.

These steps also apply when deleting the sub-folders within the *Data* and *Output* folder.

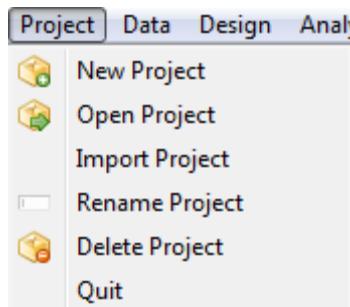
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## Project and File Management

### Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

# Data Manipulation

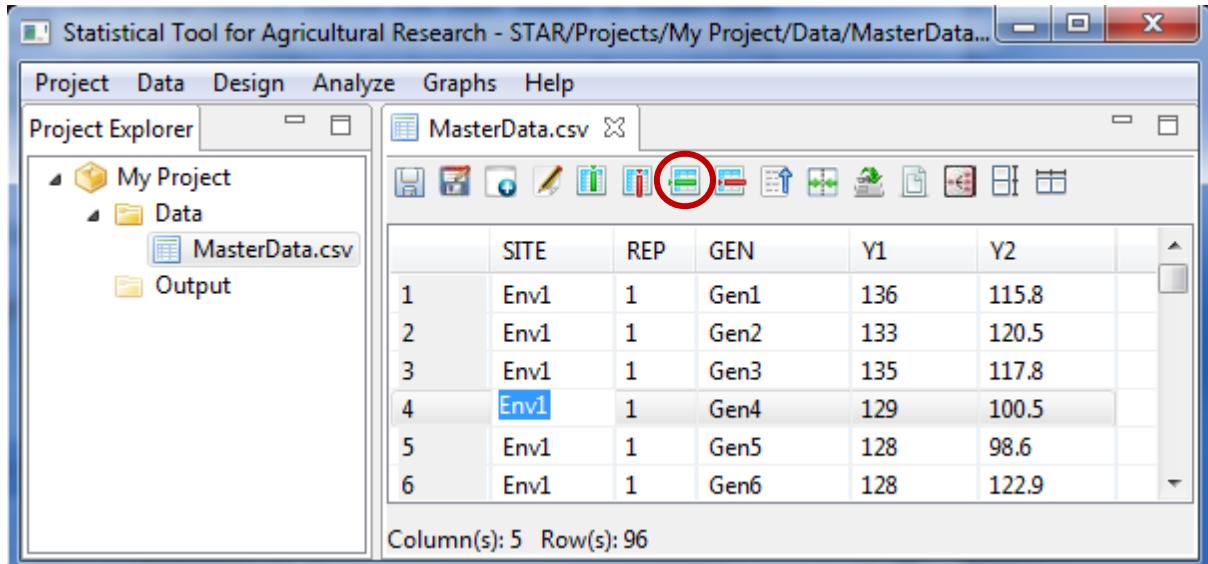
## Insert Row(s)

The steps to insert row(s) are listed below:

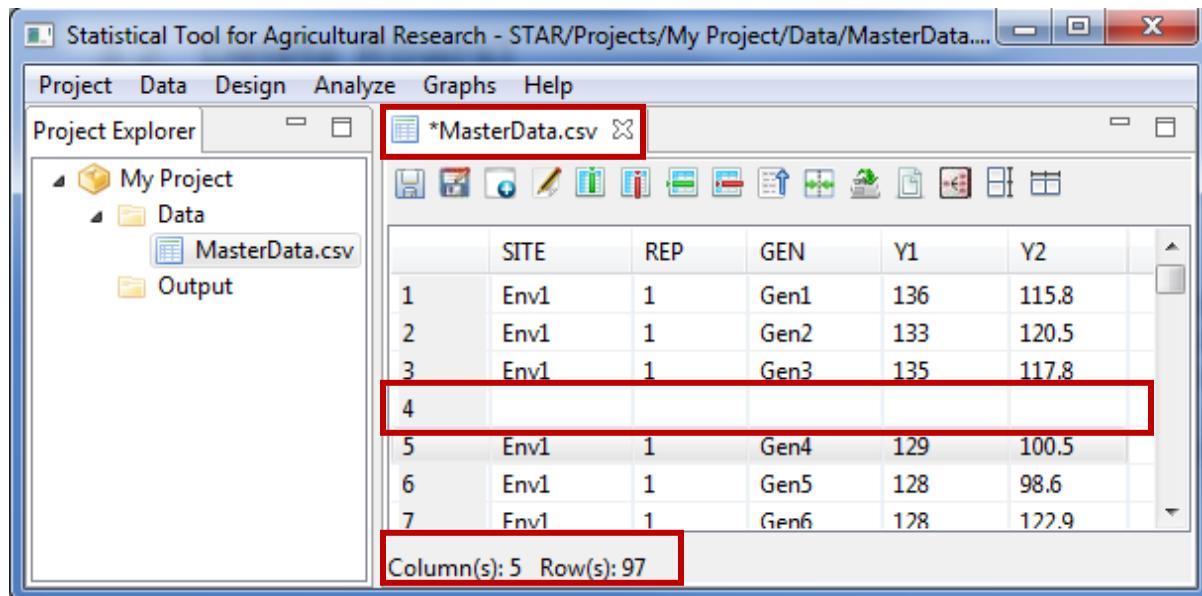
- On the **Project Explorer** panel, using the project named *My Project*, import the data *MasterData.csv* from the *Data* folder of the project named *SampleProject*. Double-click the file to open it and view it in the Data Viewer.
- Select any row(s) or any cell in the row(s) where the user wants to insert new row(s) above it. To select several cells/rows, click any cell/row, then hold the **Ctrl** key and click on another cell/row. The number of selected rows is the number of row that will be inserted.

For the example, select the 4<sup>th</sup> row.

- To insert row, click **Data | Insert Row...** from the main window or click on the Insert Row icon  in the **Data Viewer** toolbar.



- The new row is displayed in the Data Viewer tab.



- If there is no row selected before executing the Insert Row function, the user will be prompted if the user wants to insert a row after the last row of the data or not.

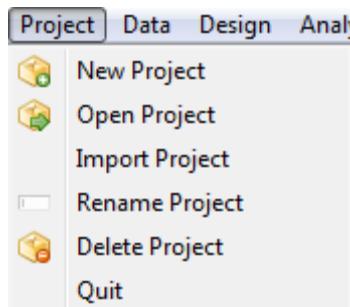
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### Project and File Management

## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

## Delete Row(s)

The steps to delete row(s) are listed below:

- On the **Project Explorer** panel, using the project named *My Project*, import the data *MasterData.csv* from the *Data* folder of the project named *SampleProject*. Double-click the file to open it and view it in the Data Viewer.
- Select any row(s) or any cell in the row(s) that the user wants to delete. To select several cells/rows, click any cell/row, then hold the Ctrl key and click on another cell/row. The number of selected rows is the number of row that will be deleted.
- To delete row(s), click **Data | Delete Row** from the main window or click on the  Delete Row icon in the Data Viewer tool bar.

## Inserting Column(s)

The steps to delete row(s) are listed below:

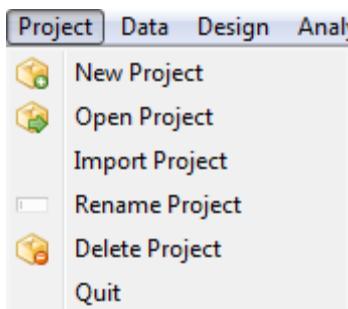
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### Project and File Management

## Creating New Project

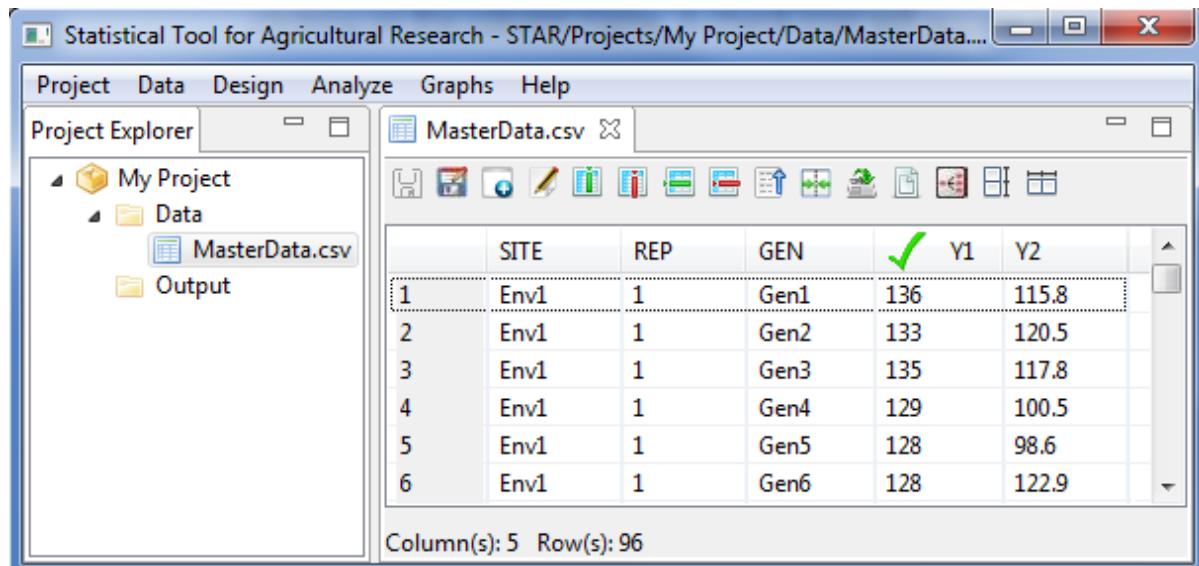
The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

- On the **Project Explorer** panel, using the project named *My Project*, import the data *MasterData.csv* from the *Data* folder of the project named *SampleProject*. Double-click the file to open it and view it in the Data Viewer.
- Select a column where the user wants a new column to be inserted before it by clicking on the column name. A check icon will appear on the column header.



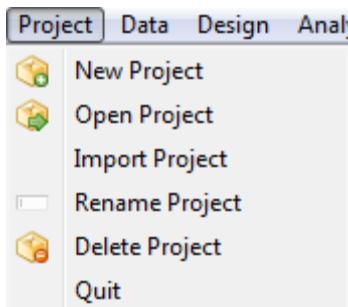
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### Project and File Management

## Creating New Project

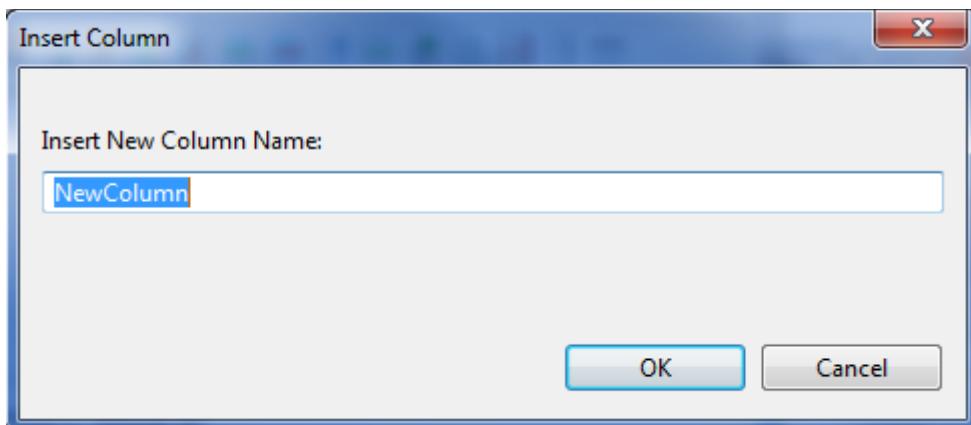
The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

- To insert column(s), click **Data | Insert Column...** from the main window or click on the Insert Column icon  in the Data Viewer tool bar.
- The **Insert Column** dialog box will appear. In the **Insert New Column Name** field, user can specify a new name for the inserted column. The default new column name is *NewColumn*.



In naming the column, the following rules apply:

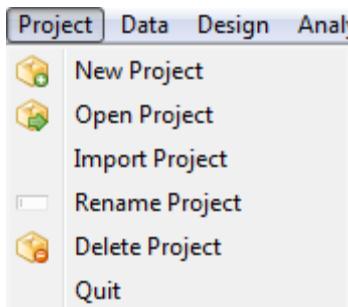
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*Project and File Management*

## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

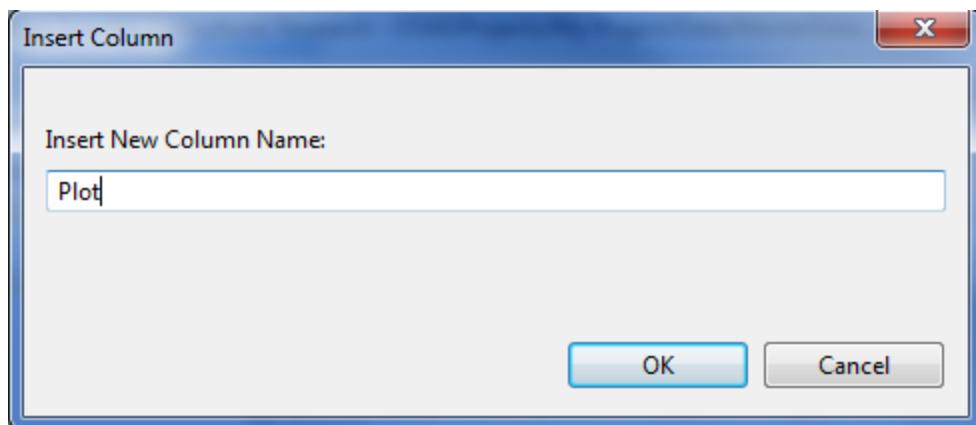
- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

- The name must start with a letter. The remaining characters can be any letter, any digit, a period or underscore.
- Each column name must be unique; duplication is not allowed.
- Column name is case sensitive.

For the example, type *Plot*. The completed dialog box will appear as shown below:



- Click **OK** button.

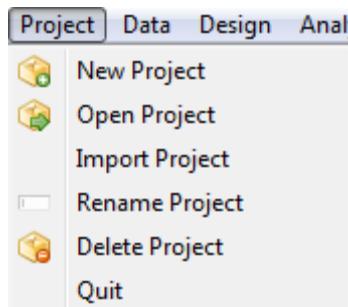
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## Project and File Management

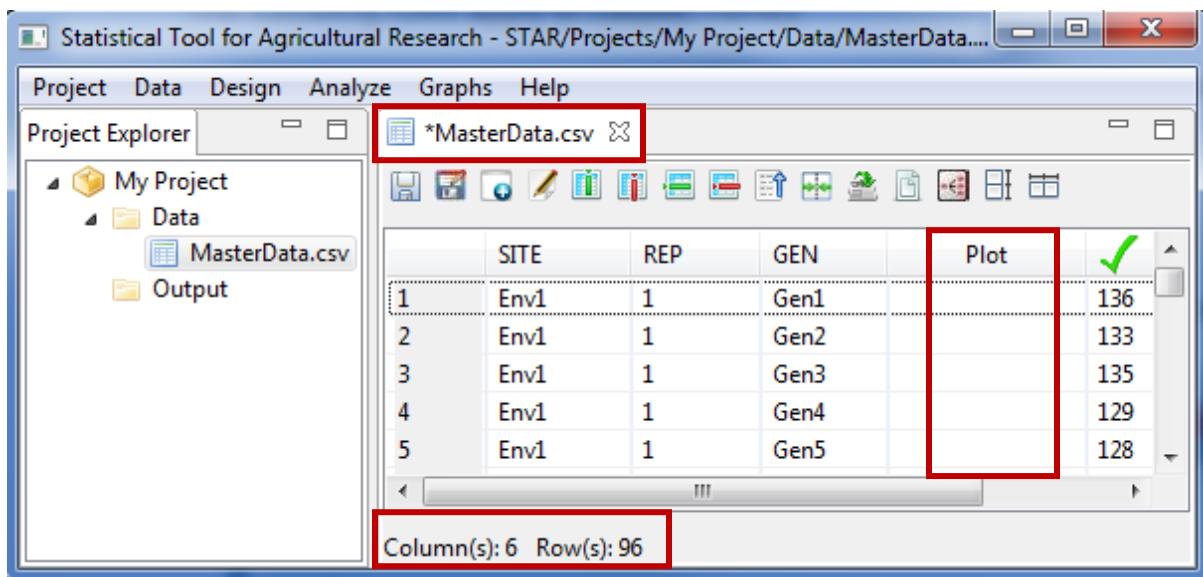
### Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.



## Deleting Column(s)

The steps to delete row(s) are listed below:

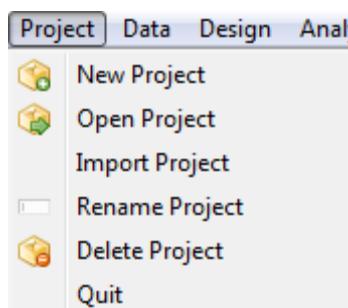
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### Project and File Management

## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

- On the **Project Explorer** panel, using the project named *My Project*, import the data *MasterData.csv* from the *Data* folder of the project named *SampleProject*. Double-click the file to open it and view it in the Data Viewer.
- Select the column or one of the columns to be deleted by clicking on the column name. A check icon will appear on the column header.
- To delete column(s), click **Data | Delete Column** from the main window or click on the  Insert Column icon in the Data Viewer tool bar.
- Click the **OK** button.

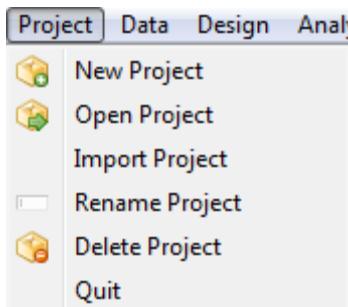
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## Project and File Management

### Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

## Create New Variables

The user can create new variables in the active data set by transforming existing variables or collapsing categories of two or more existing variables.

For transformations, there are six available functions, namely: logarithm, natural logarithm, square root, power, exponential and standardized. For logarithm, natural logarithm, square root and power transformation, the variables to be transformed should not contain negative values. For logarithm and natural logarithm transformation, values of the variable to be transformed will be incremented by 1 if it contains values equal to 0. For square root and power transformation, values of the variable will be incremented by 0.5 if it contains values equal to 0.

The steps to create new variables are listed below:

- On the **Project Explorer** panel, using the project named *My Project*, import the data *MasterData.csv* from the *Data* folder of the project named *SampleProject*. Double-click the file to open it and view it in the Data Viewer.
- To create new variables, click **Data | Create New Variable** from the main window or click on the Create New Variable icon  in the Data Viewer toolbar.

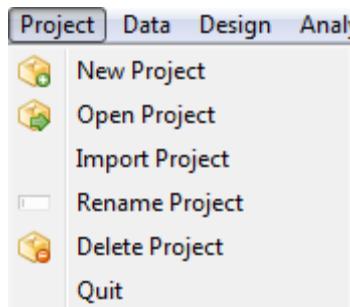
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### Project and File Management

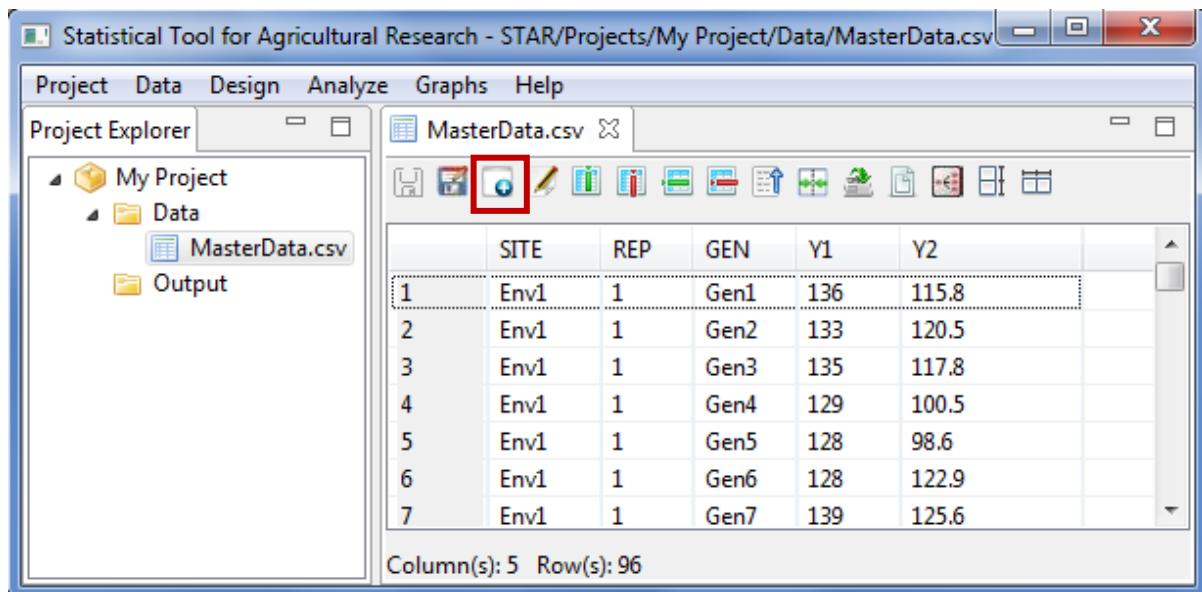
## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.



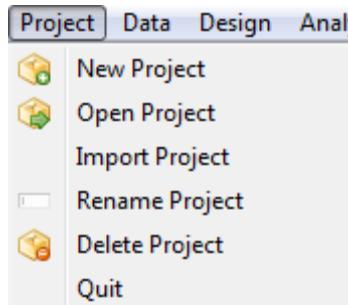
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### Project and File Management

## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

- The **Create New Variable** dialog box will appear.

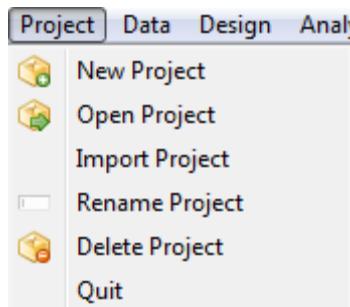
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## *Project and File Management*

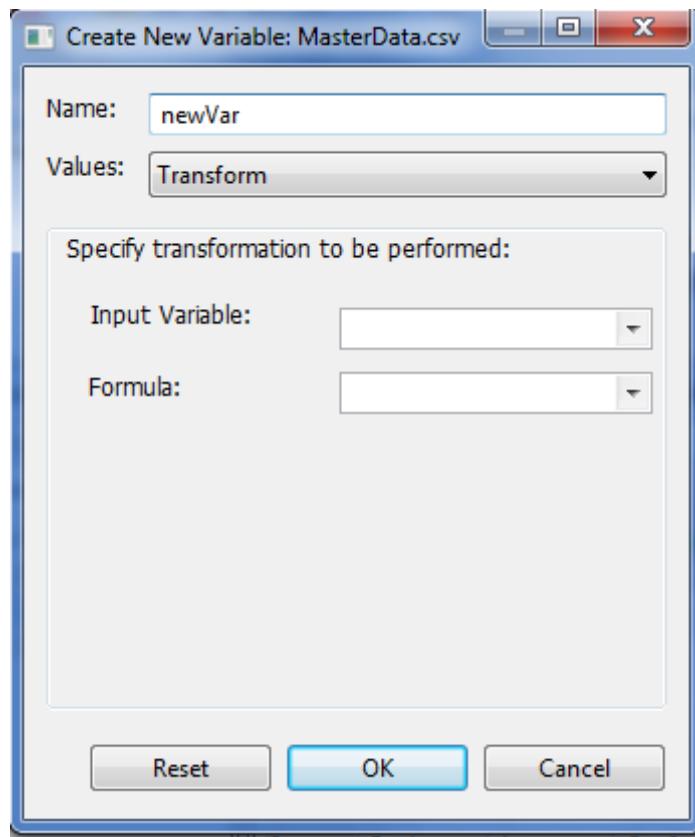
### **Creating New Project**

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.



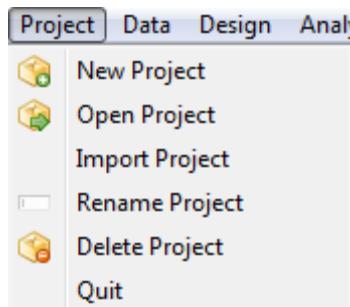
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#### Project and File Management

## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

- Specify the required fields and appropriate options.

### Name

This is the name of the new variable to be created. The default variable name is *newVar*. In naming the column, the following rules apply:

- The name must start with a letter. The remaining characters can be any letter, any digit, a period or underscore.
- Each column name must be unique; duplication is not allowed.
- Column name is case sensitive

### Values

There are two options to determine the values of the new variable. The user can either transform any existing numeric variables or concatenate the values of any variables in the data set. The default is *Transform*.

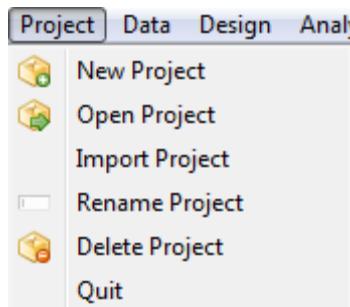
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## *Project and File Management*

### **Creating New Project**

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

### Input Variable

If *transformation* is selected in the **Value** drop-down box, this drop-down box will be visible. This box pertains to the variable where the transformation will be performed. All numeric variables of the active data will be displayed in the drop-down box.

### Formula

If *transformation* is selected in the **Value** drop-down box, this drop-down box will be visible. This box pertains to the formula that will be used when the value in the **Input Variable** is transformed. Transformation options available are logarithm, natural logarithm, square root, power, exponential and standardized.

### Checkbox Table

If *Concatenate Columns* is selected in the **Value** drop-down box, this table will be visible. This table lets the user specify the columns to concatenate by ticking at least two column names. All columns of the active data will be displayed in the table.

For the example, suppose we want to transform the variable Y1. The completed dialog box should appear as shown below:

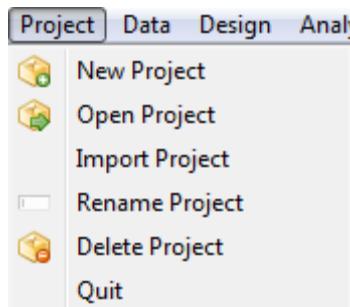
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## Project and File Management

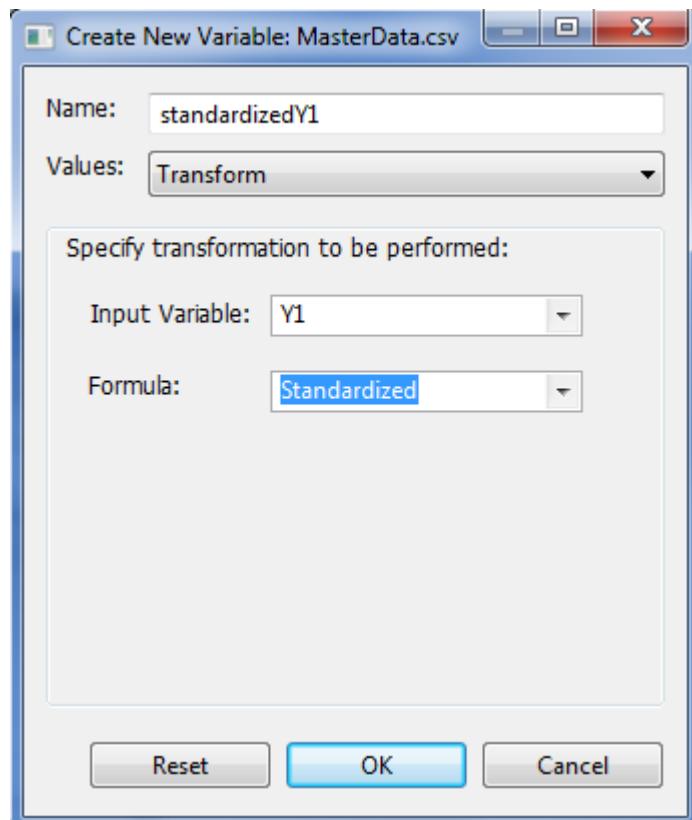
### Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.



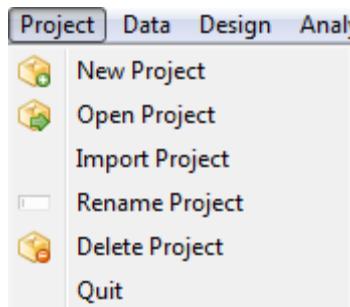
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#### Project and File Management

## Creating New Project

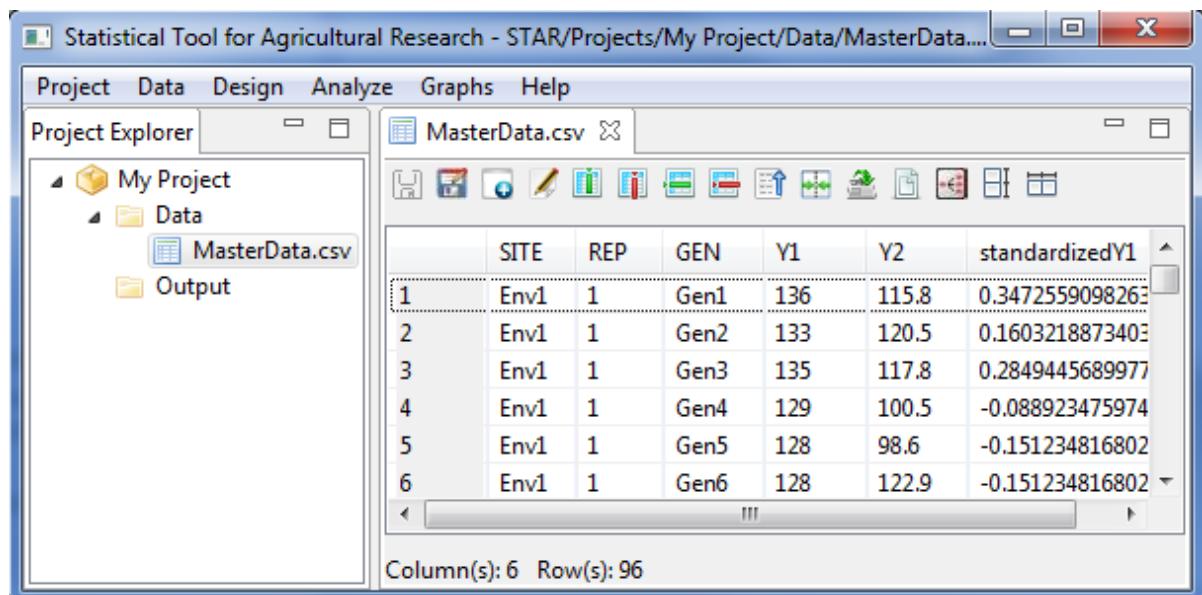
The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

- Click the **OK** button. The data set with the transformed variable is displayed in the Data Viewer tab.



Suppose we want to create a new variable by concatenating the values of two variables. The completed dialog box should appear as shown below:

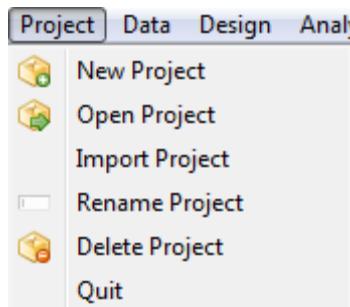
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#### Project and File Management

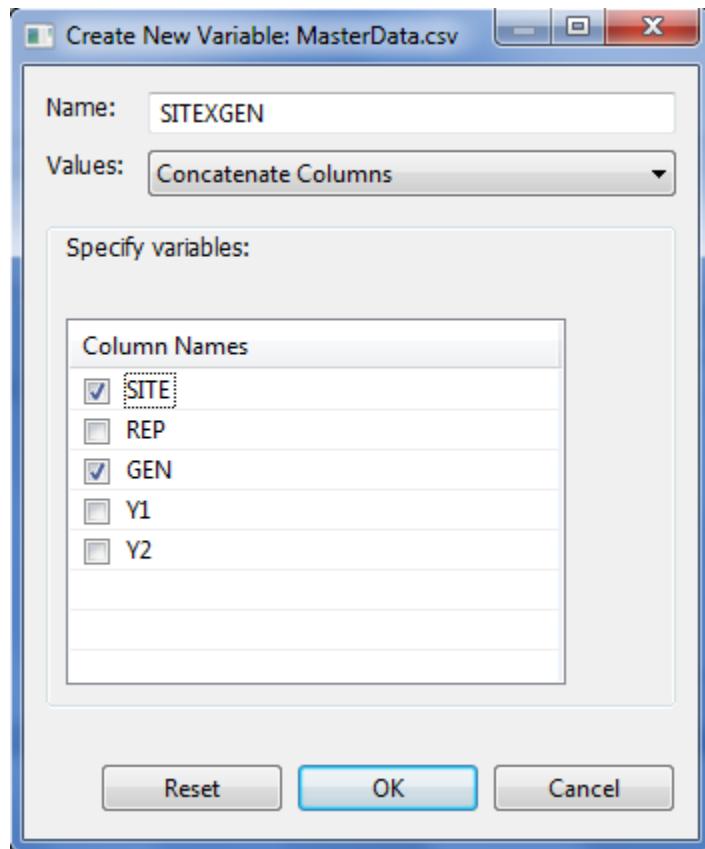
## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.



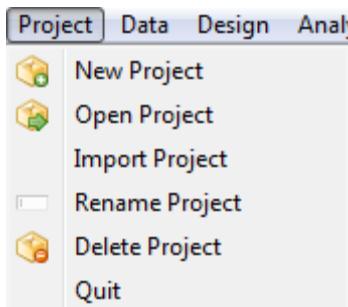
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#### Project and File Management

## Creating New Project

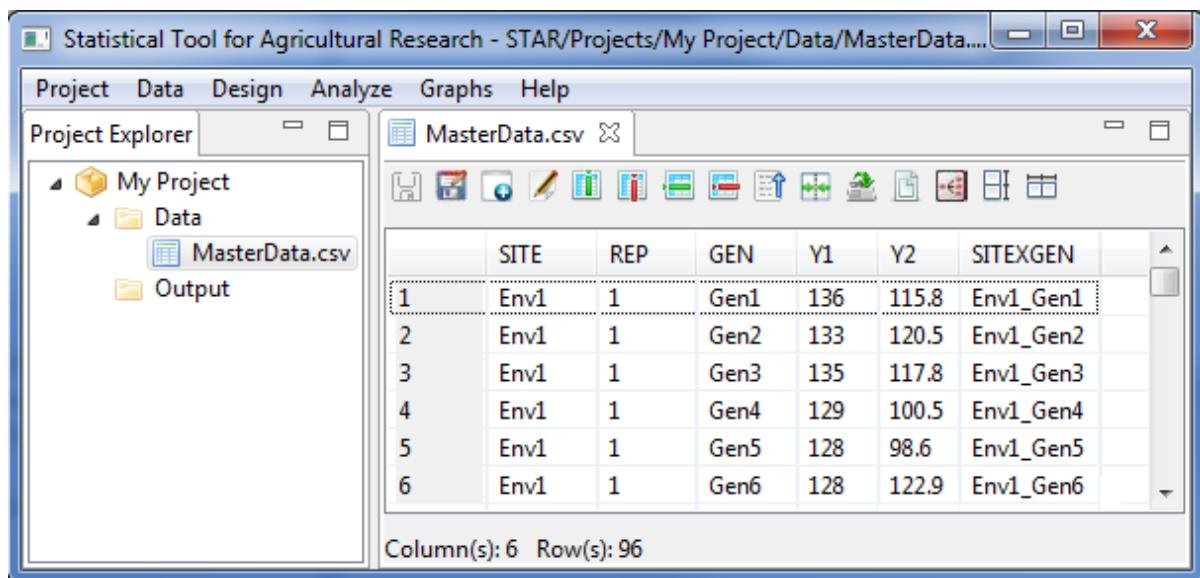
The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

- Click the **OK** button. The transform variable is displayed in the Data Viewer tab.



## Edit Variable Information

The steps to edit the variable information are listed below:

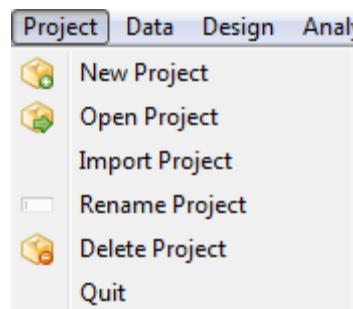
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### Project and File Management

## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

- On the **Project Explorer** panel, using the project named *My Project*, import the data *MasterData.csv* from the *Data* folder of the project named *SampleProject*. Double-click the file to open it and view it in the Data Viewer.
- To edit variable information, click **Data | Edit Variable Information** from the main window of STAR or click on the Edit Variable Information icon  in the Data Viewer toolbar.

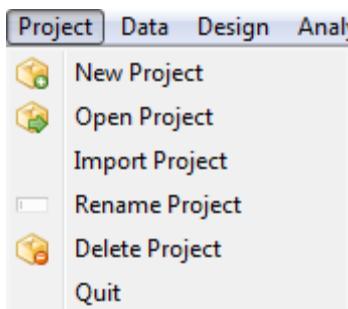
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## *Project and File Management*

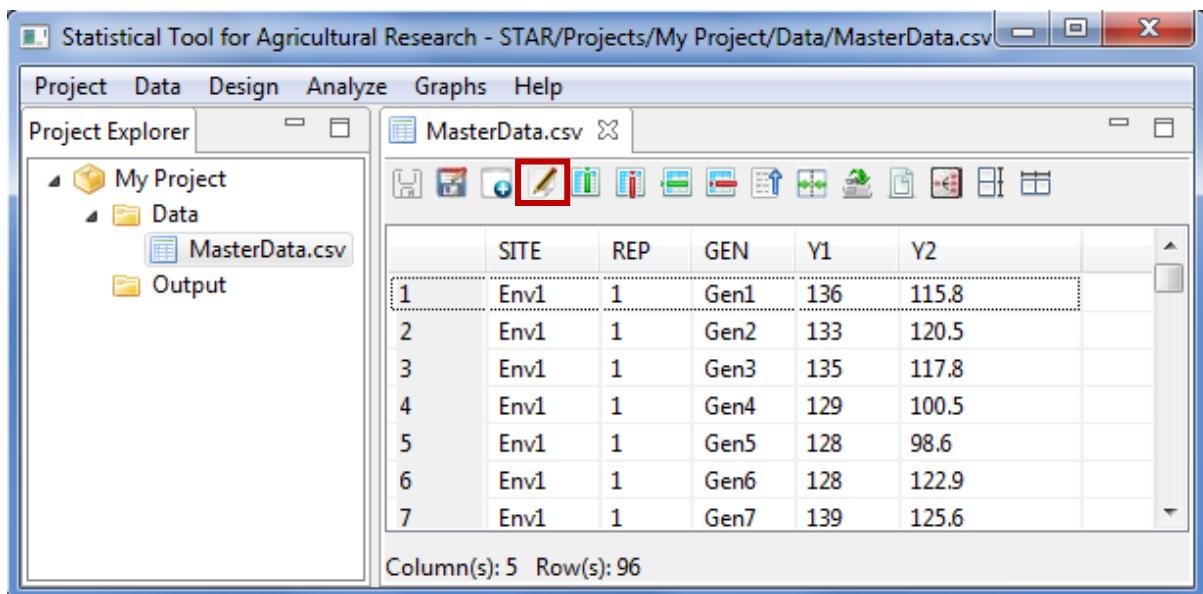
### **Creating New Project**

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.



- The **Edit Variable Information** dialog box will appear. The variables in the active data set are classified as either a factor or numeric variable. The user can modify the variable type of the variables in the data set.

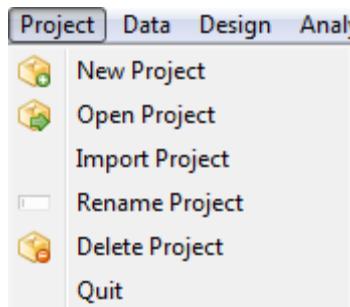
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#### Project and File Management

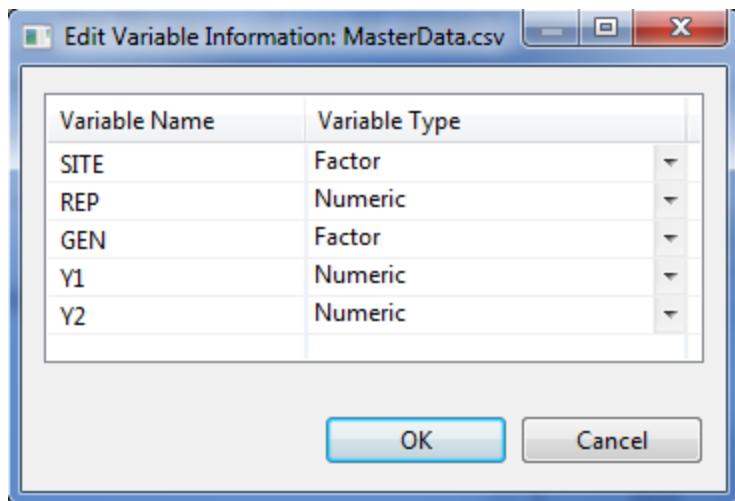
## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.



For the example, change the Variable Type of *REP* from Numeric to Factor. The complete dialog box should appear as shown below:

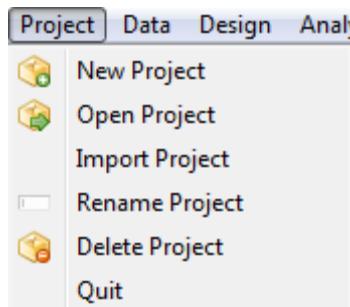
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#### Project and File Management

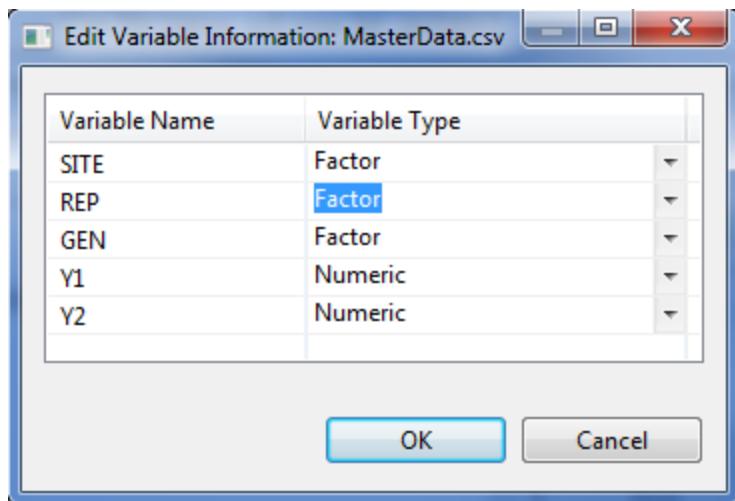
## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.



- Click the **OK** button.

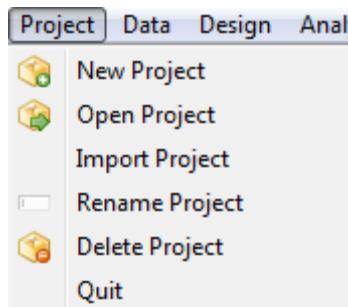
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## Project and File Management

### Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

## Sorting

Re-arranging or sorting the rows or cases of the data file is often useful and sometimes necessary for certain types of analysis. The **Sort Cases Menu** can be used to sort rows based on the value of one or more sorting variables.

The steps to re-arrange the data set based on the value of one or more sorting variable are listed below:

- On the **Project Explorer** panel, using the project named *My Project*, import the data *MasterData.csv* from the *Data* folder of the project named *SampleProject*. Double-click the file to open it and view it in the Data Viewer. The data file is arranged by *SITE, REP* then by *GEN*.

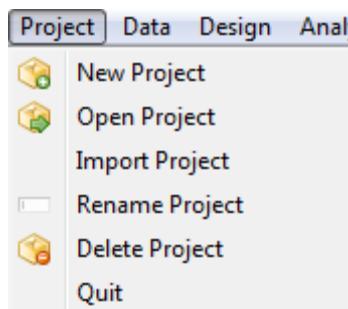
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## *Project and File Management*

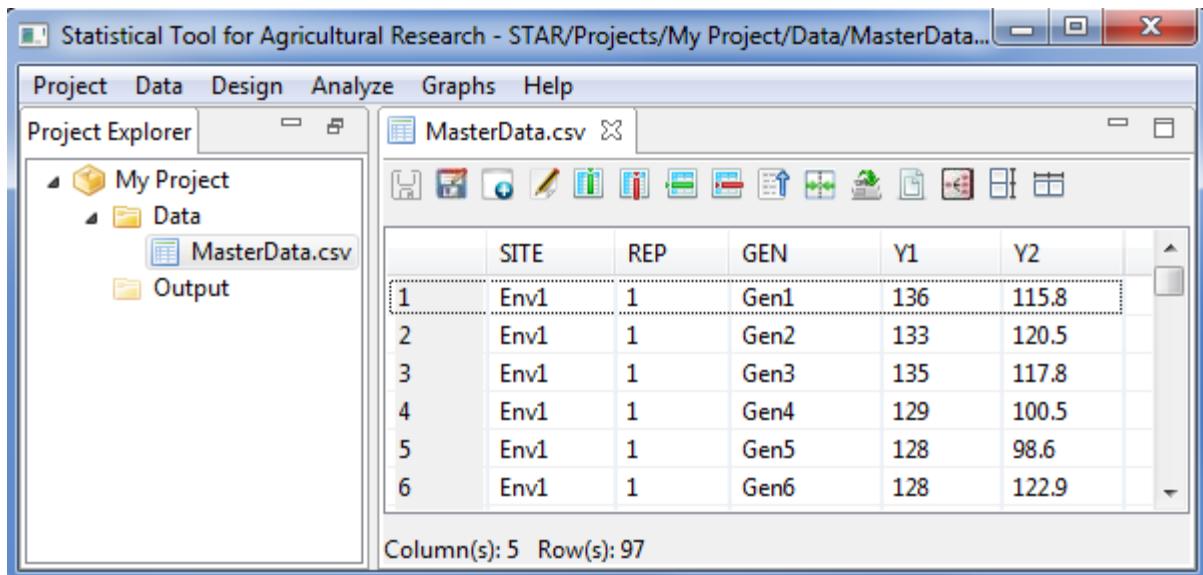
## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.



- Choose **Data | Sort...** from the main window or click on the Sort icon  in the Data Viewer tool bar. The **Sort** dialog box will appear.

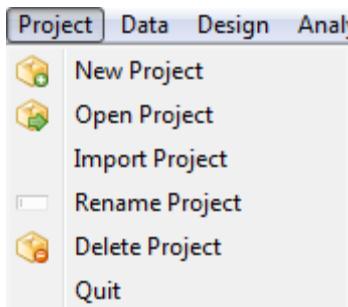
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#### Project and File Management

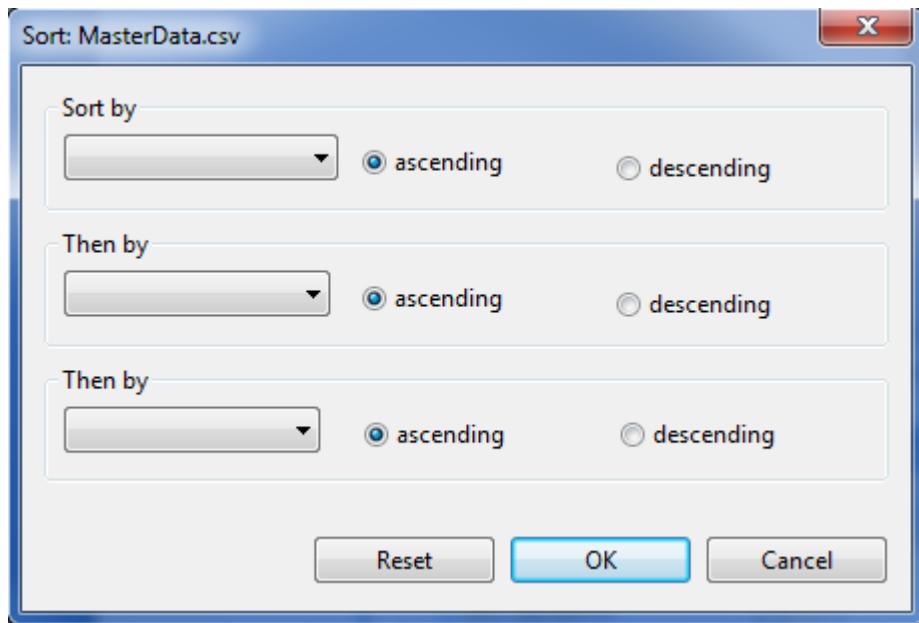
## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.



- The user can specify up to three variables as the basis for sorting and the order of sorting. Click the drop-down list box to identify the sorting variables. The rows can be re-arranged or sorted in ascending or descending order, with ascending order as the default option. If two or three variables are selected, rows are sorted for each

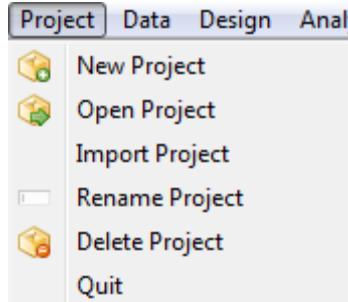
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#### *Project and File Management*

## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

variable within categories of the preceding variables. For character variables, uppercase letters precede their lowercase counterparts.

For the example, suppose we want to re-arrange the content of the data *MasterData.csv*, by ascending order of the variable *GEN* then by descending order of the variable *SITE*. The completed dialog box should appear as illustrated below:

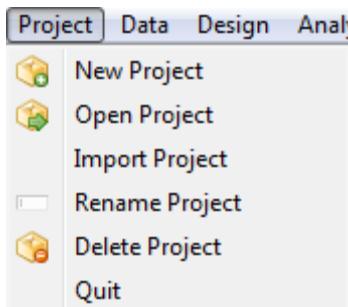
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*Project and File Management*

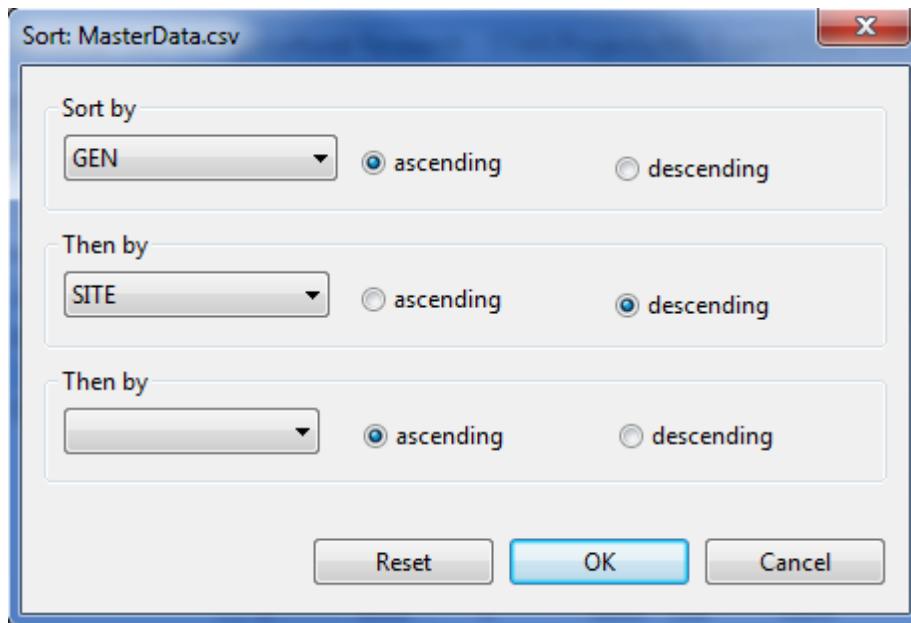
## **Creating New Project**

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.



- Click the **OK** button to sort the active data. The **Sort** dialog box is closed and the sorted data is saved in the parent folder of the active data and displayed in the Data Viewer tab.

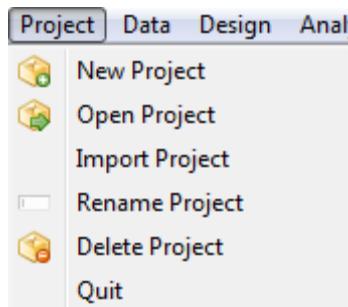
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## Project and File Management

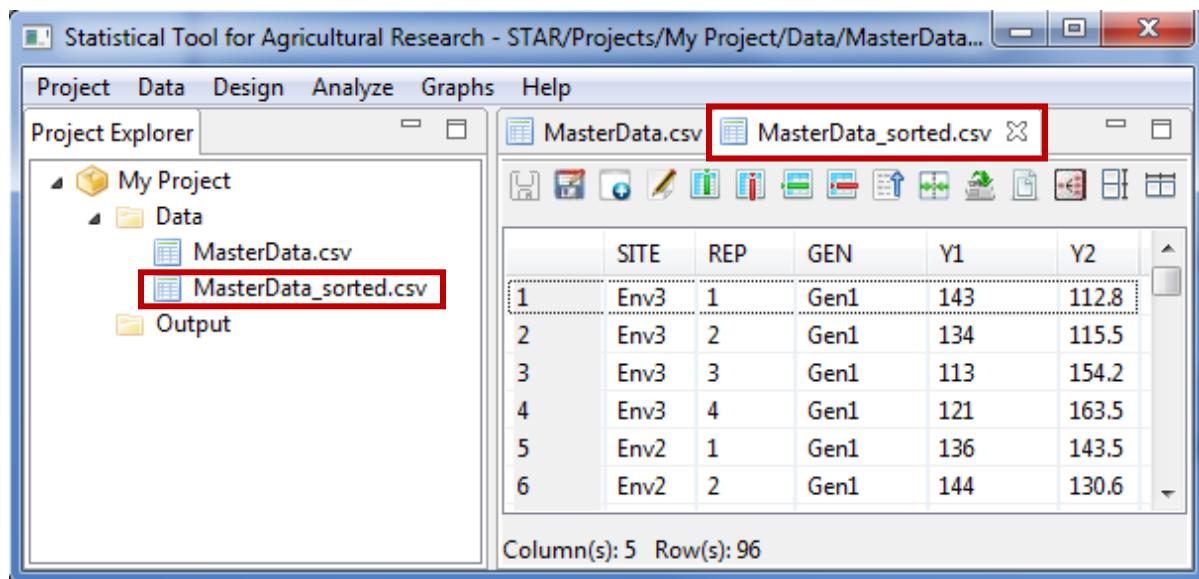
### Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.



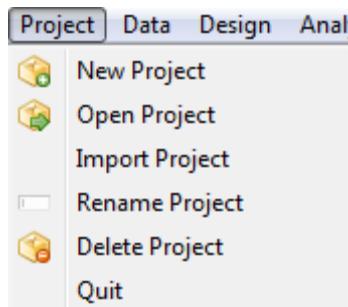
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### Project and File Management

## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

## Merge Datasets

The **Merge submenu** can be used to combine the active data file (known as the master data) with another data file (referred as the transaction data) that contains the same cases or rows but different variables.

The steps to merge datasets are listed below:

- On the **Project Explorer** panel, using the project named *My Project*, import the data files *MasterData.csv* and *MergeTransact.csv* from the *Data* folder of the project named *SampleProject*. Double-click the file *MasterData.csv* to open it and view it in the Data Viewer.
- Choose **Data | Merge Datasets...** or click on the Merge Datasets icon  in the Data Viewer toolbar. The **Merge Data** dialog box will appear.

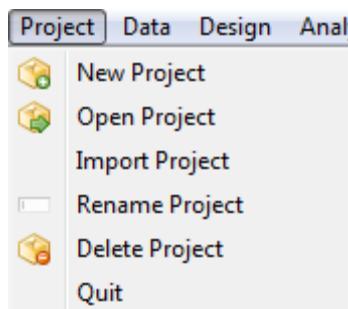
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## *Project and File Management*

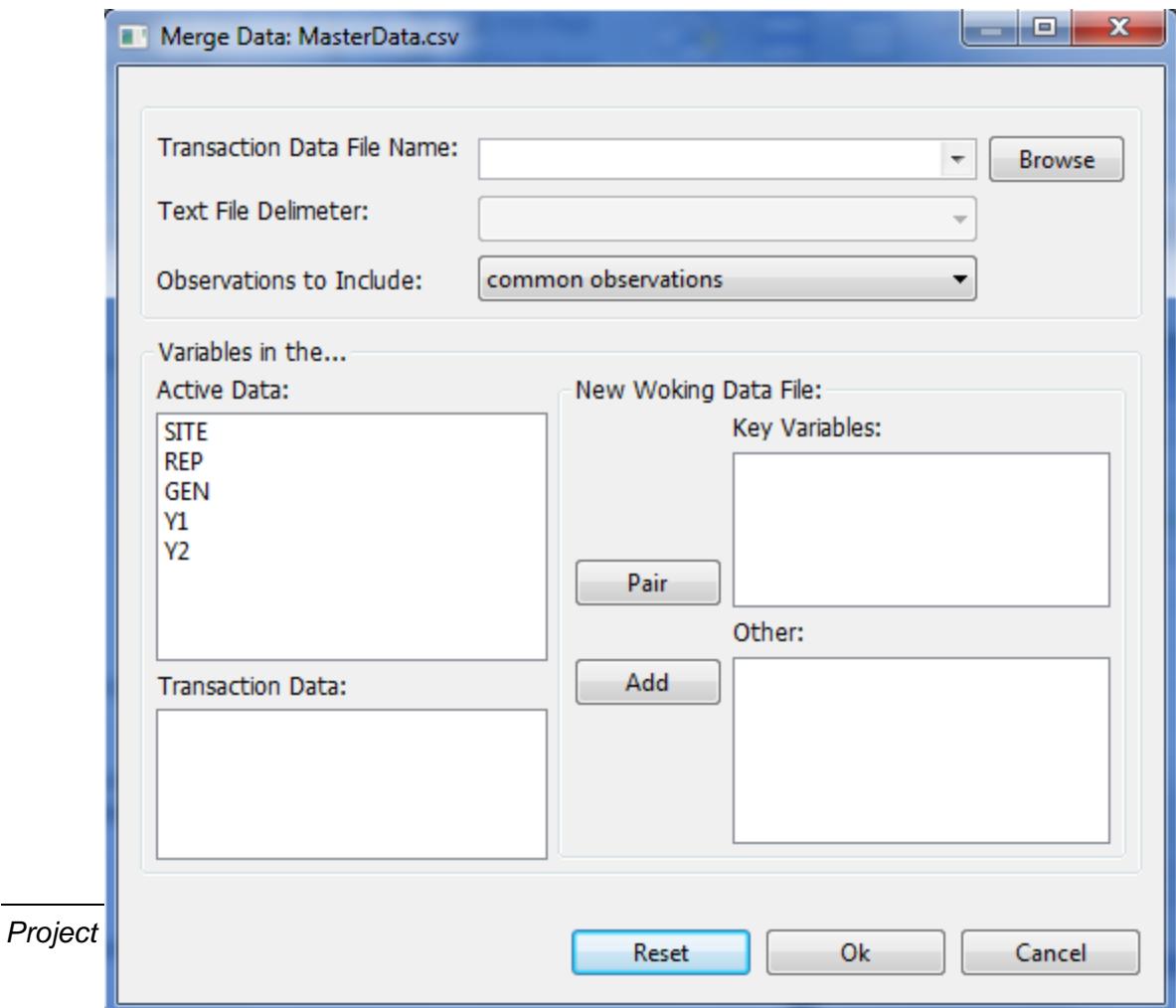
### Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



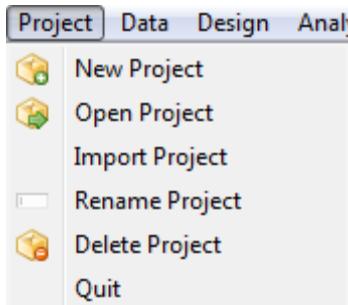
- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.



## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

- Specify the required fields and appropriate options.

#### **Transaction File Name**

Specify this file by selecting a file using the drop-down combo box or by locating it using the **Browse** button. The files included in the drop-down combo box are files inside the *Data* folder not in its sub-folder. Only *.txt* and *.csv* data file format can be selected as the transaction file.

#### **Text File Delimeter**

If the transaction file selected is a text file, the delimiter should be specified. Four delimiters are available, namely: comma, space, tab and semi-colon.

#### **Observations to Include**

This option pertains to how rows or cases will be included in the new merged data file. The options available are to include common observations (default value), all observations in the active data, all observations in the transaction data and all observations.

#### **Key Variables**

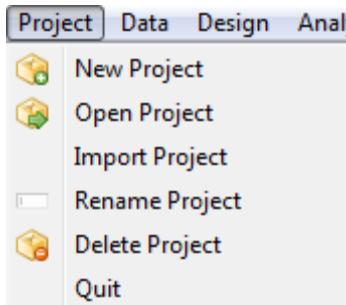
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### *Project and File Management*

## **Creating New Project**

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

These are pair(s) of variables that are present in the active and transaction files and will be the basis for the merging. Variables can be paired by clicking one variable in the active data and clicking one variable in the transaction data then clicking the **Pair** button. If the pair of variables have different column names, the merged data file that will be created will use the column name of the active data.

#### **Other**

These are the other variables the user wants to include in the merged data file. If columns in this list have the same name, **.1** will be appended to the column name coming from the active data and **.2** to the one from the transaction data.

For the example, select *MergeTransact.csv* file as the transaction data file from the drop-down combo box. The completed dialog box should appear as illustrated below:

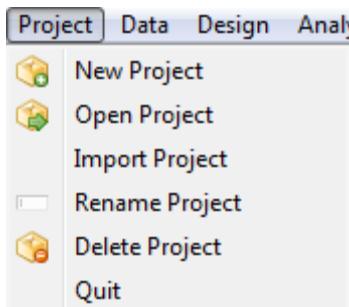
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#### *Project and File Management*

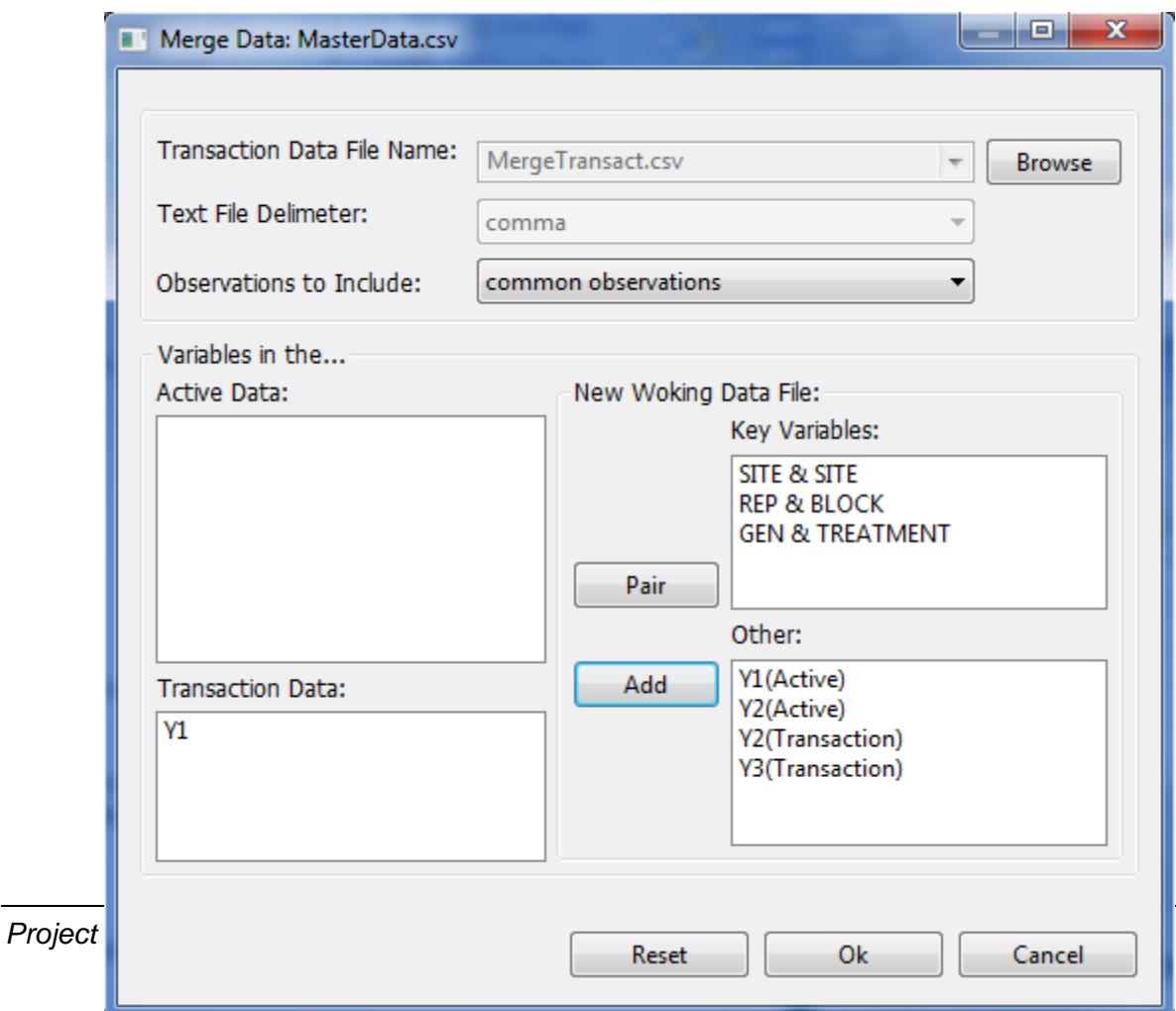
## **Creating New Project**

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



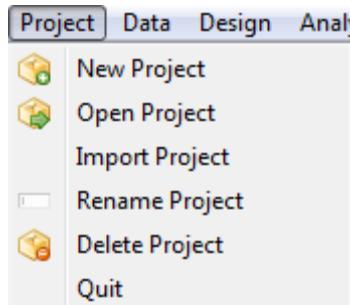
- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.



## Creating New Project

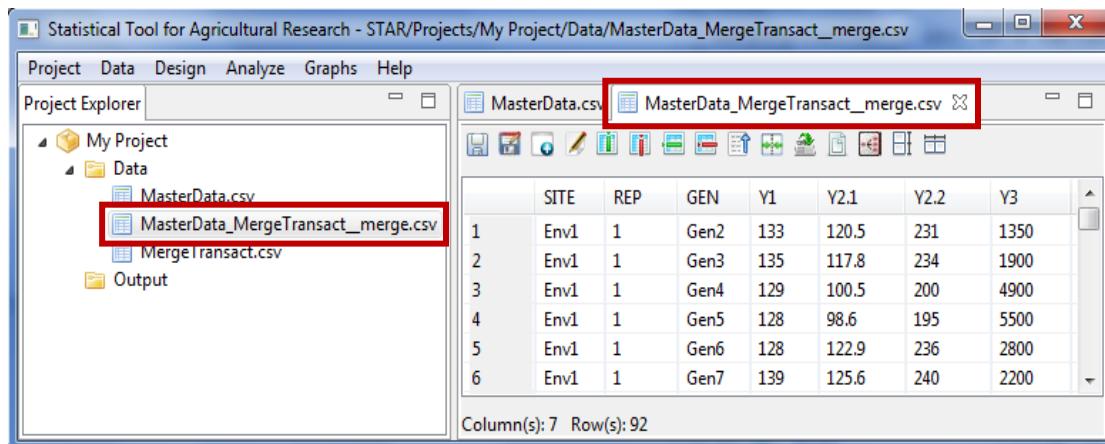
The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

- Click the **OK** button. The merged data is saved in the parent folder of the active data and displayed in the Data Viewer tab. The default filename of the merged data set follows the format <activeDataFilename>\_<TransactionDataFilename>\_merge.csv.



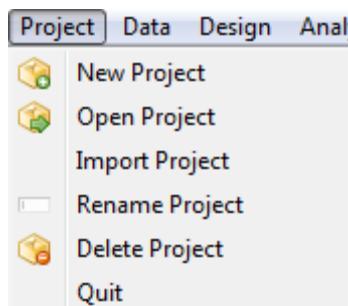
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## Project and File Management

### Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

## Append Datasets

The Append submenu can be used combine two data files with the same variables but different cases.

- On the **Project Explorer** panel, using the project named *My Project*, import the data files *MasterData.csv* and *AppendTransact.csv* from the *Data* folder of the project named *SampleProject*. Double-click the file *MasterData.csv* to open it and view it in the Data Viewer.
  
- Choose **Data | Append Datasets...** or click on the Append Datasets icon  in the Data Viewer toolbar. The Append Data dialog box will appear.

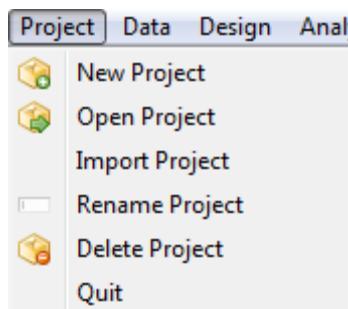
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### Project and File Management

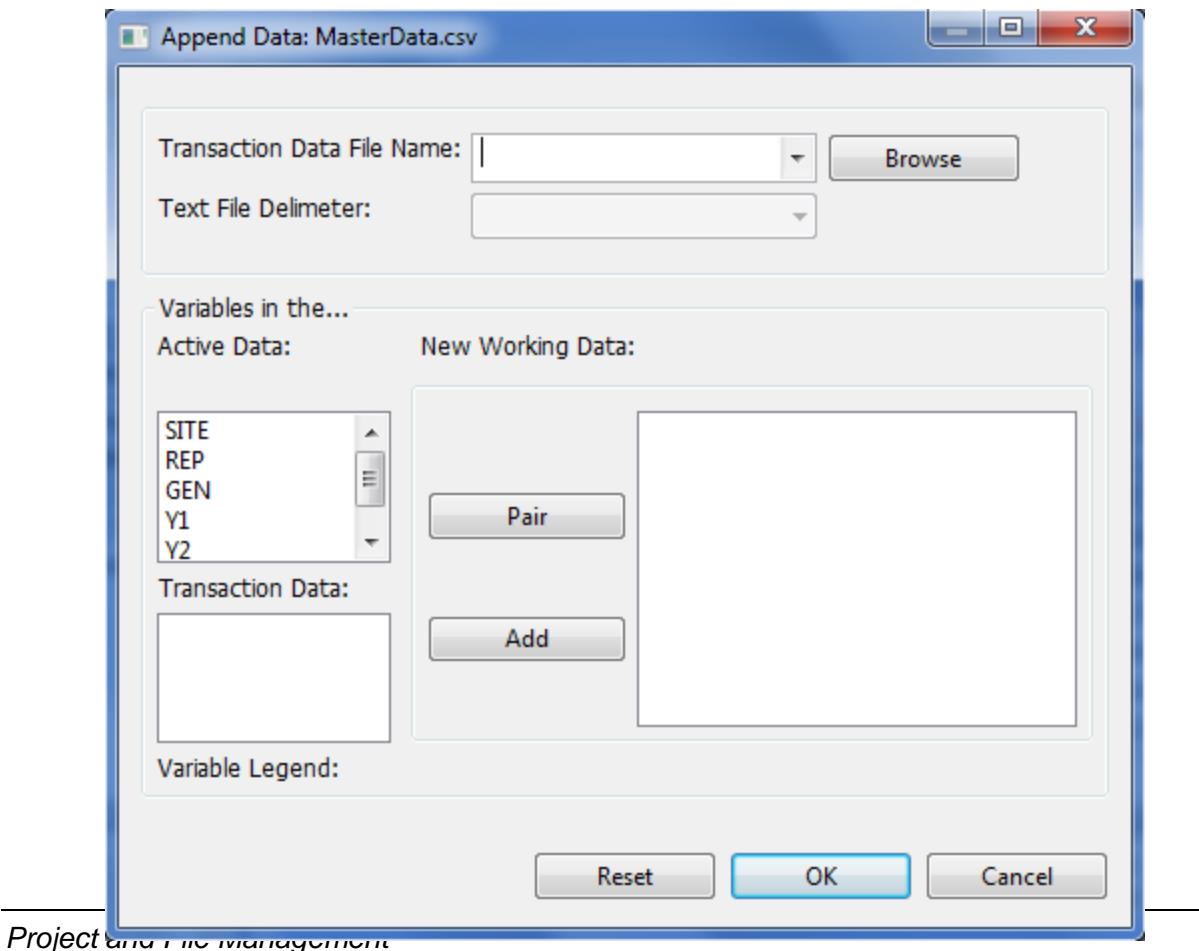
## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

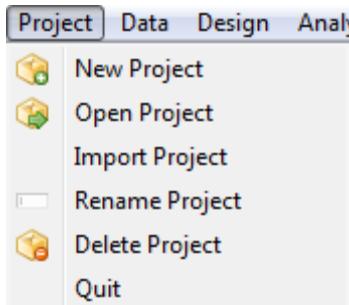


Project and Data management

## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

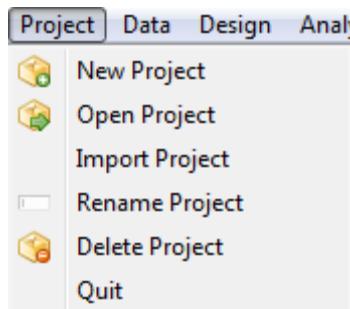
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*Project and File Management*

## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

- Specify the required fields and appropriate options.

#### **Transaction File Name**

Specify this file by selecting a file using the drop-down combo box or by locating it using the **Browse** button. The files included in the drop-down combo box are files inside the *Data* folder not in its sub-folder. Only *.txt* and *.csv* data file format can be selected as the transaction file.

#### **Text File Delimeter**

If the transaction file selected is a text file, the delimiter should be specified. Four delimiters are available, namely: comma, space, tab and semi-colon

#### **New Working Data**

This is the list of variables or paired variables that will be included in the new data set. Variables can be paired by clicking one variable in the active data and clicking one variable in the transaction data then clicking the **Pair** button. Other variables can be added to this list by clicking the variable then clicking the **Add** button. For paired variables in this list, the appended data file that will be created will use the column name of the active data. For non-paired variables, **.1** will be appended to the column name coming from the active data and **.2** to the one from the transaction data.

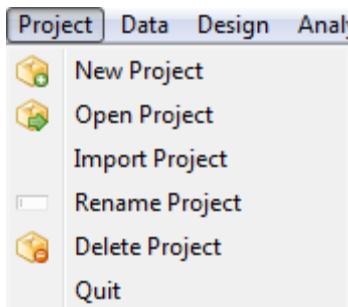
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### *Project and File Management*

## **Creating New Project**

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

For the example, select *AppendTransact.csv* file as the transaction data file from the drop-down combo box. The completed dialog box should appear as illustrated below:

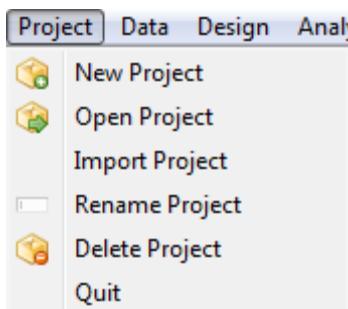
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*Project and File Management*

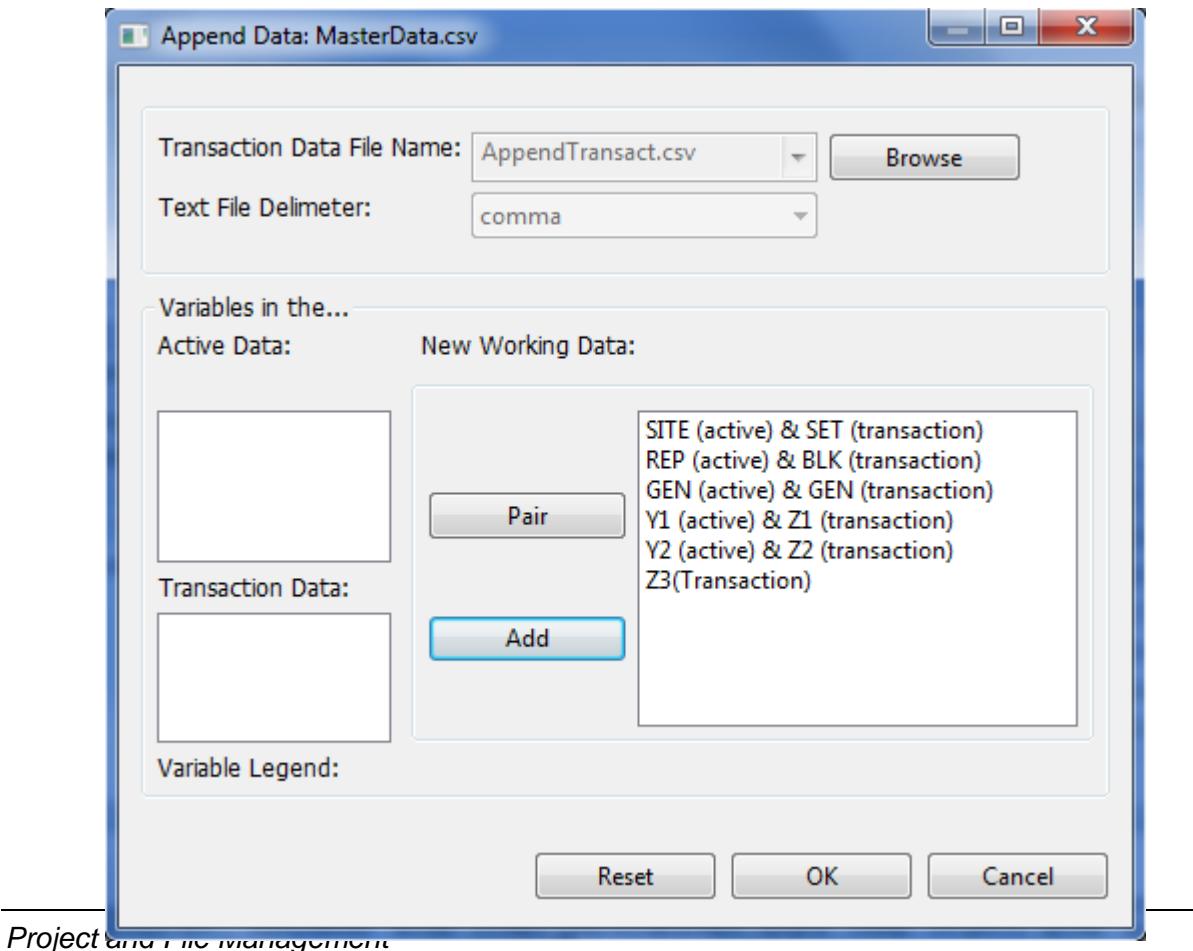
## **Creating New Project**

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

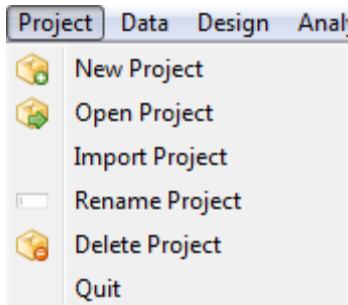


Project and Data management

## Creating New Project

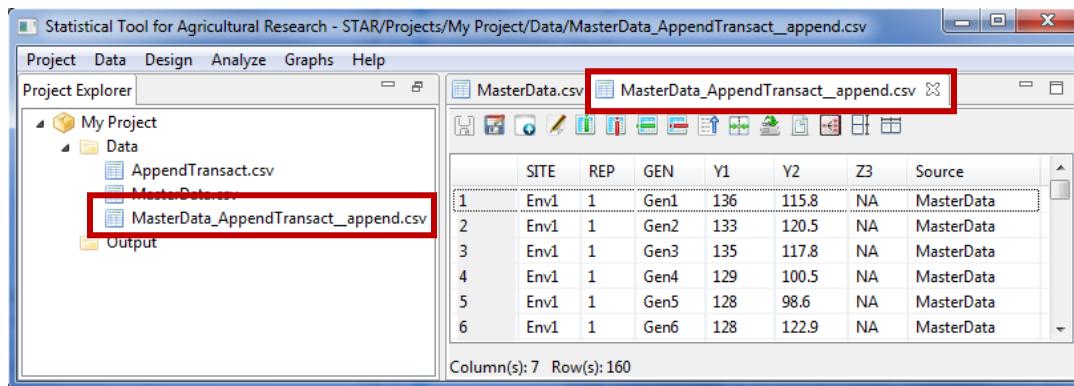
The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

- Click the **OK** button. The appended data is saved in the parent folder of the active data and displayed in the Data Viewer tab. The appended data will contain an additional column named Source which indicates where the data came from. The default filename of the appended data set follows the format <activeDataFilename>\_<TransactionDataFilename>\_merge.csv.



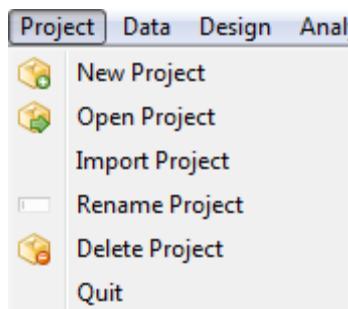
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## Project and File Management

### Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

## Creating Data Subset

The steps in creating a subset of a dataset are listed below:

- On the **Project Explorer** panel, using the project named *My Project*, import the data file *MasterData.csv* from the *Data* folder of the project named *SampleProject*. Double-click the file to open it and view it in the Data Viewer.
  
- Choose **Data | Create Data Subset...** or click on the Create Data Subset icon  in the Data Viewer toolbar. The Create Data Subset dialog box will appear.

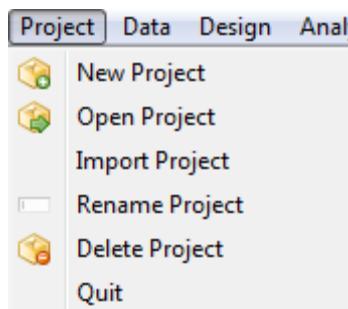
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## Project and File Management

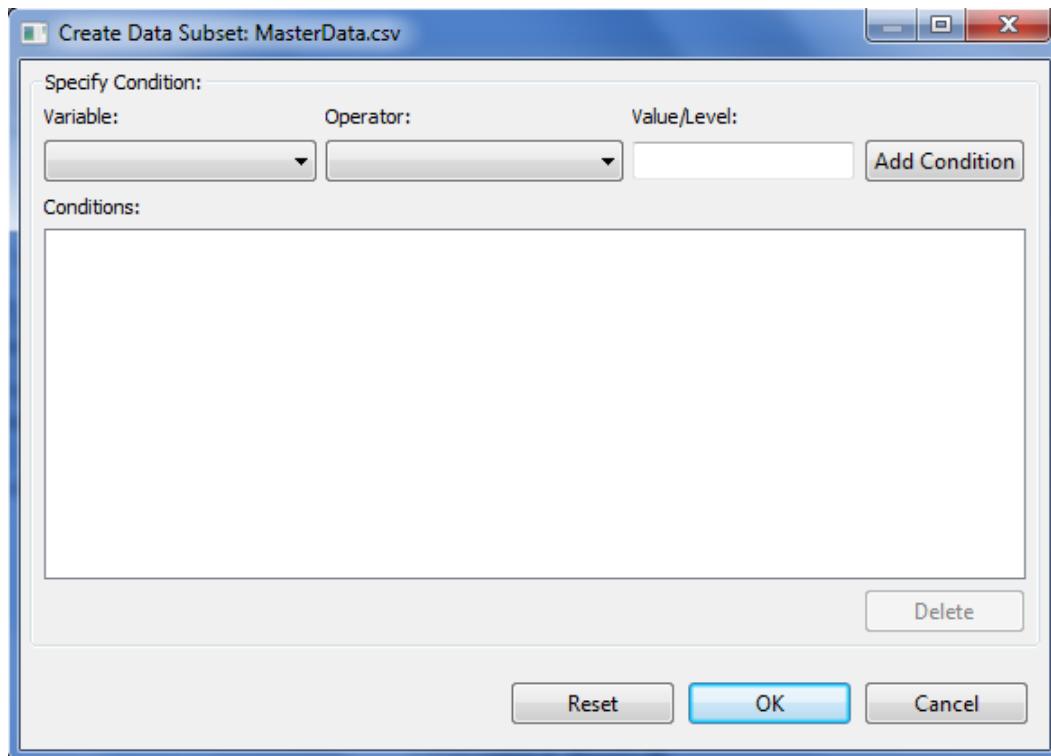
### Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.



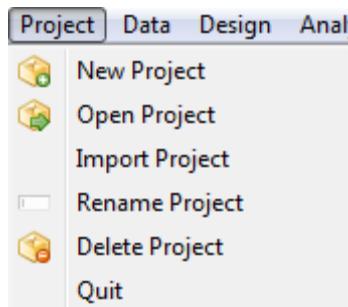
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### Project and File Management

## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

- Suppose the user wants to select only the observations from Env2. This can be done by selecting variable Site, operator equals (==), typing Env2 under Value/Level and clicking the Add Condition button. Do the same for the condition “Gen not equal to 8”.

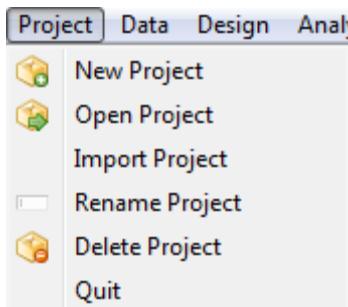
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#### *Project and File Management*

## **Creating New Project**

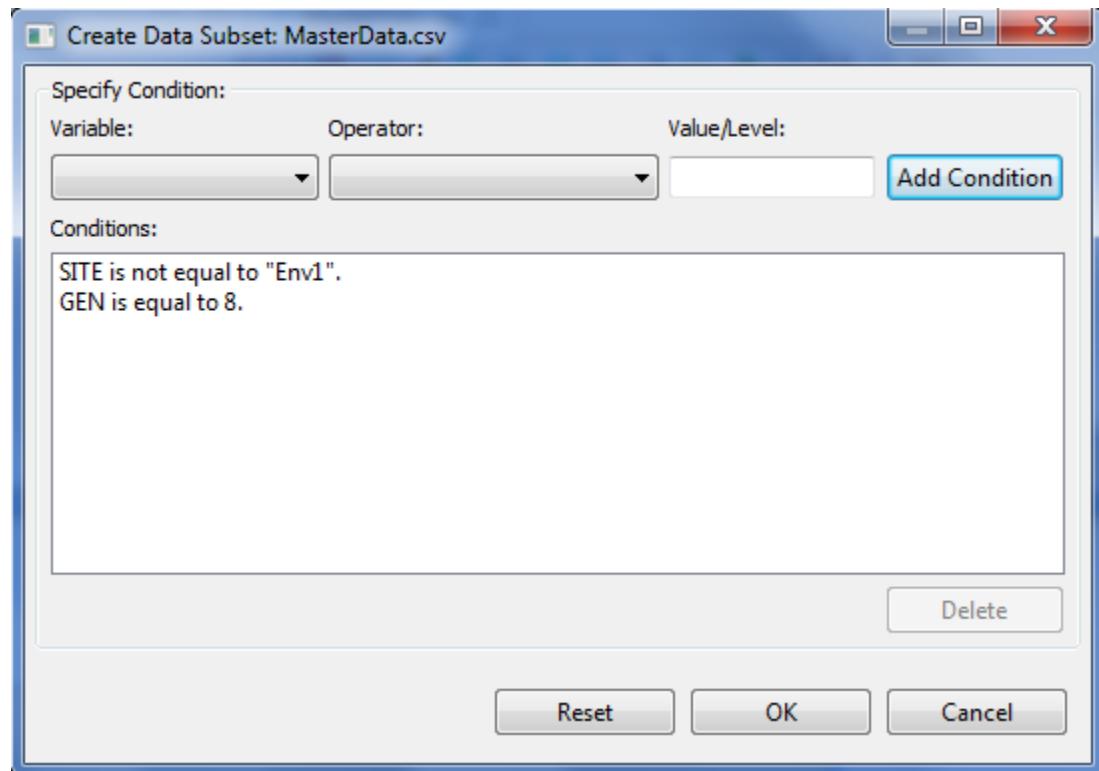
The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

For the example, the completed dialog box should appear as illustrated below:



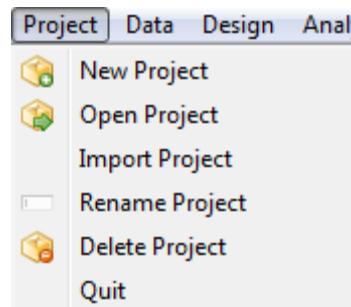
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#### *Project and File Management*

## **Creating New Project**

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

- Click OK. The new data is saved in the *Data* folder and displayed in the Data Viewer.

## Reshaping

The **Reshape submenu** can be used to restructure or reshape your active data set to follow the structure of the data set appropriate for the STAR procedure you want to use.

### ***Reshaping Data from Long (Serial) to Wide (Parallel) Format***

Reshaping data from long (serial) to wide (parallel) involves re-arranging a data file, such that, repeated measurements are in separate columns.

The steps for reshaping the data from long to wide format are listed below:

- On the **Project Explorer** panel, using the project named *My Project*, import the data files *Year* from package. Double-click the file to open it and view it in the Data Viewer.

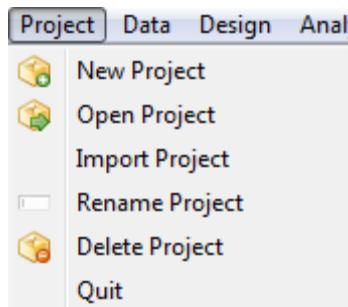
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## *Project and File Management*

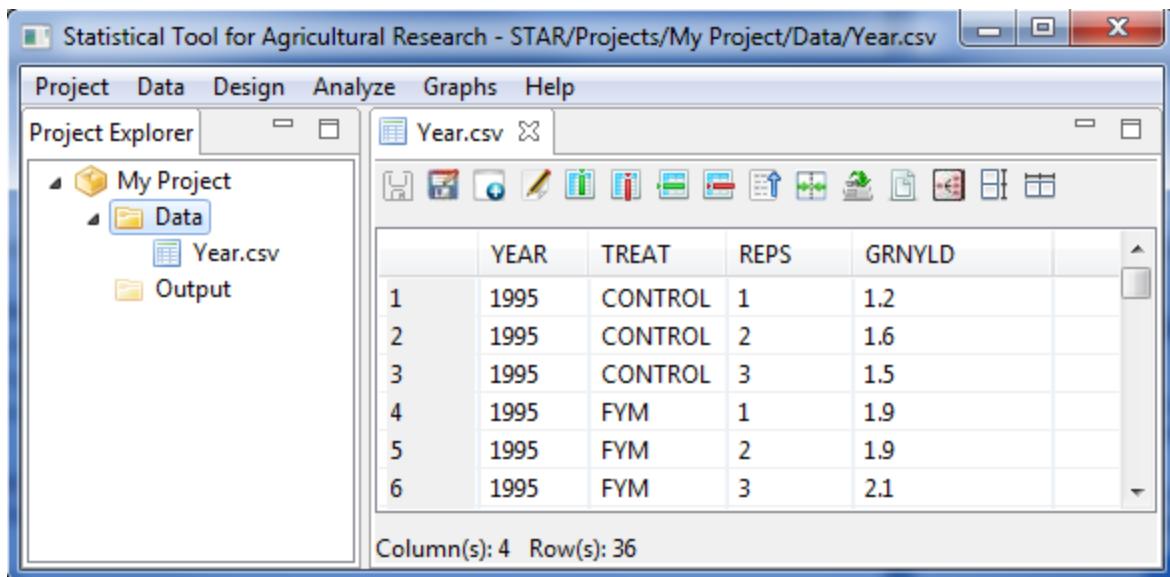
## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.



- Click **Data | Reshape | Long (Serial) to Wide (Parallel)** ... from the main window or click on the Reshape to Wide icon  in the Data Viewer tool bar. The **Reshape Data (Long to Wide)** dialog box will automatically appear as shown below.

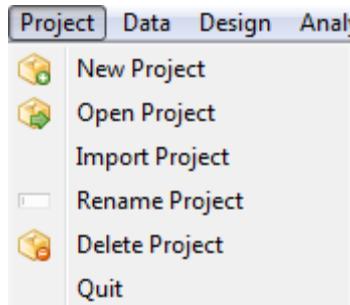
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#### Project and File Management

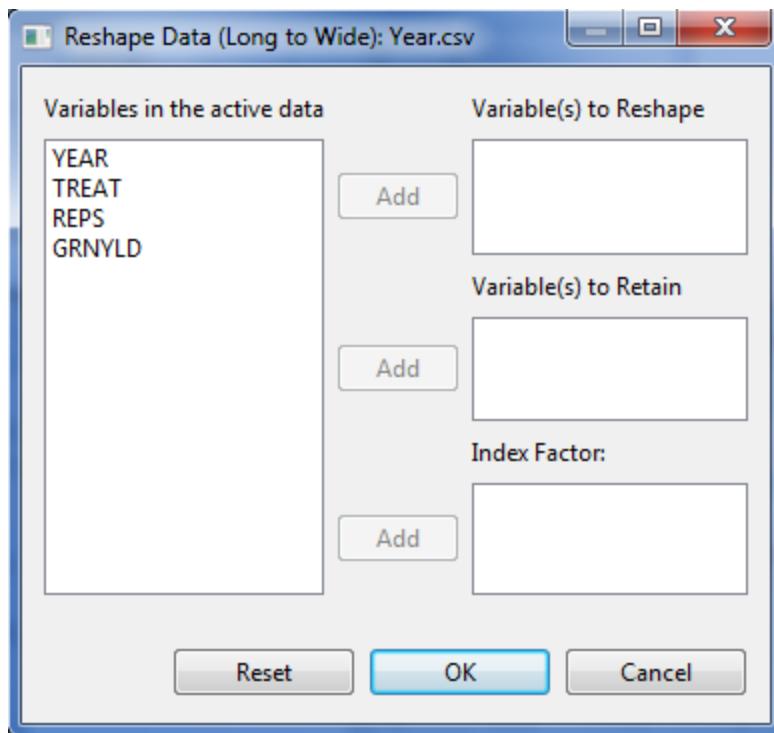
## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.



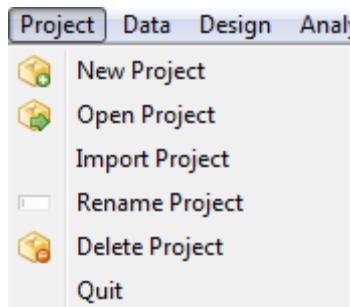
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## Project and File Management

### Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

- Specify the required fields and appropriate options.

#### **Variables to be Reshape**

This pertains to the list of variable(s) which is to be divided into two or more columns and saved to different variables in terms of the levels of the index factor.

#### **Variables to be Retained**

This pertains to variable(s) to be retained to describe the individual cases or observations.

#### **Index Factor**

This pertains to variable(s) which will determine the groupings of the values of the variable(s) to be transposed

For the example, the completed **Reshape Data (Long to Wide)** dialog box should now look like this:

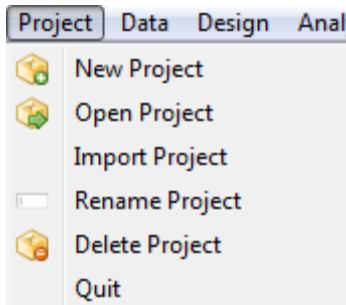
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## *Project and File Management*

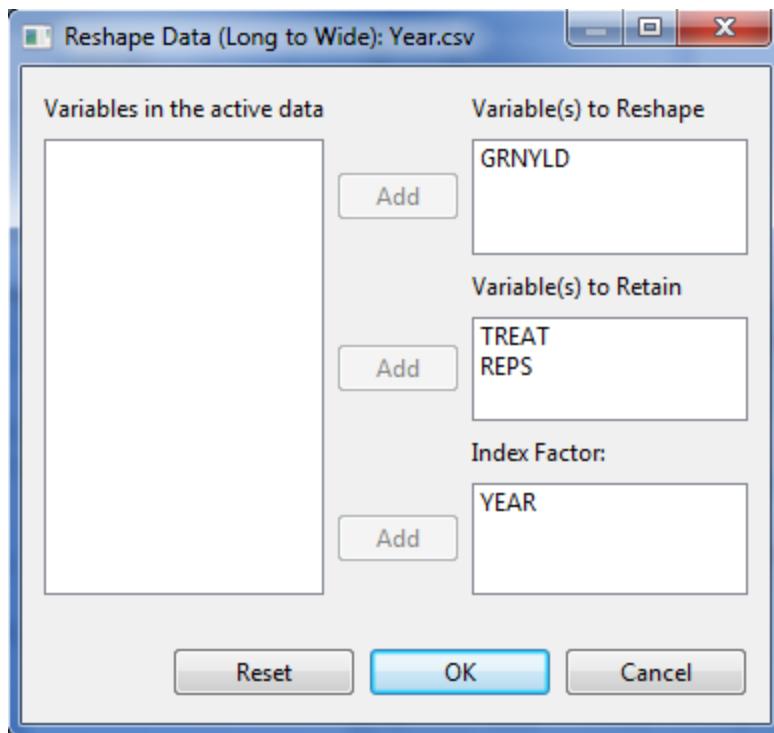
### **Creating New Project**

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.



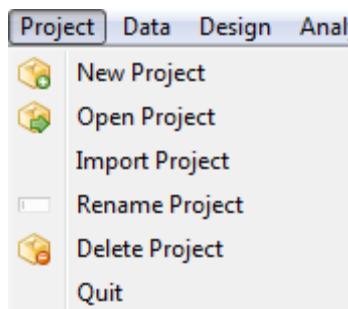
- Click the **Ok** button. The restructured data set is saved in the parent folder of the active data and displayed in the Data Viewer tab. The default filename of the restructured data set follows the format <activeDataFilename>\_ReshapeToWide.csv.

#### Project and File Management

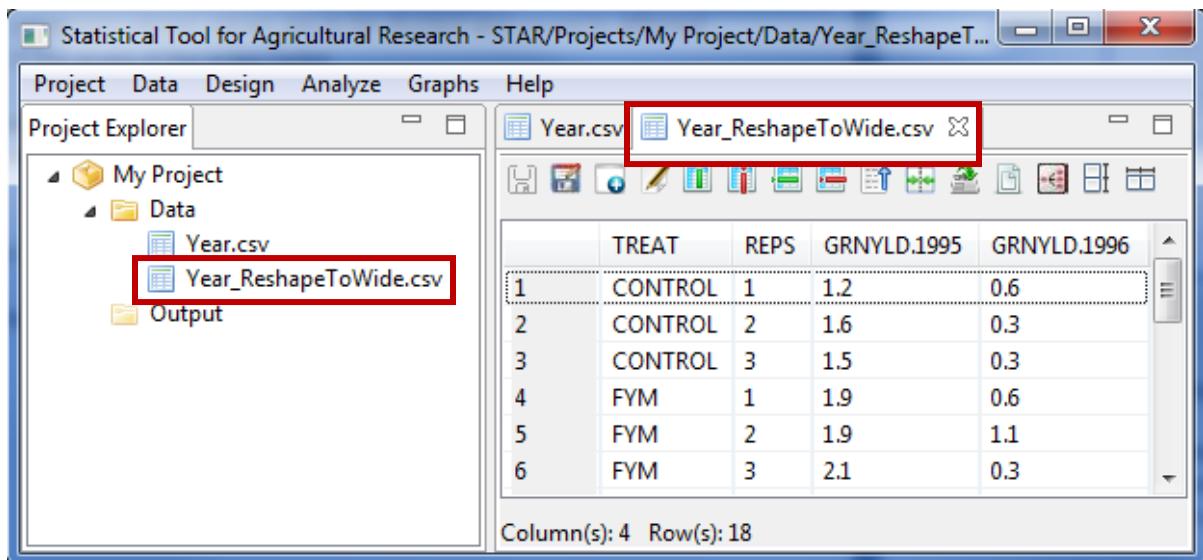
## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.



## Reshape Data from Wide to Long Format

Manipulating data from wide (parallel) to long (serial) refers to re-arranging a multivariate into a univariate data. For instance, different columns representing measurements taken

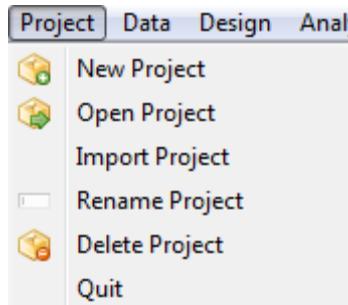
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### Project and File Management

## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

for a response variable over a period of time can be combined to form a single column, with the time variable used as an additional identifier variable.

The steps for reshaping the data from wide to long format are listed below:

- On the **Project Explorer**, locate the *Year\_ReshapeToWide.csv* file (the generated file from section *Reshape Data from Long to Wide Format*) from the *Data* folder of the project named *My Project*. Double-click the file to view it in the Data Viewer.
- Click **Data | Reshape | From Wide (Parallel) to Long (Serial) ...** from the main window or click on the Reshape to Long icon  in the Data Viewer tool bar. The **Reshape Data (Wide to Long)** dialog box will appear.

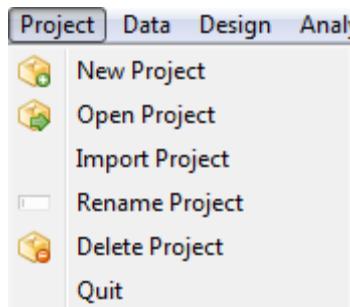
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#### *Project and File Management*

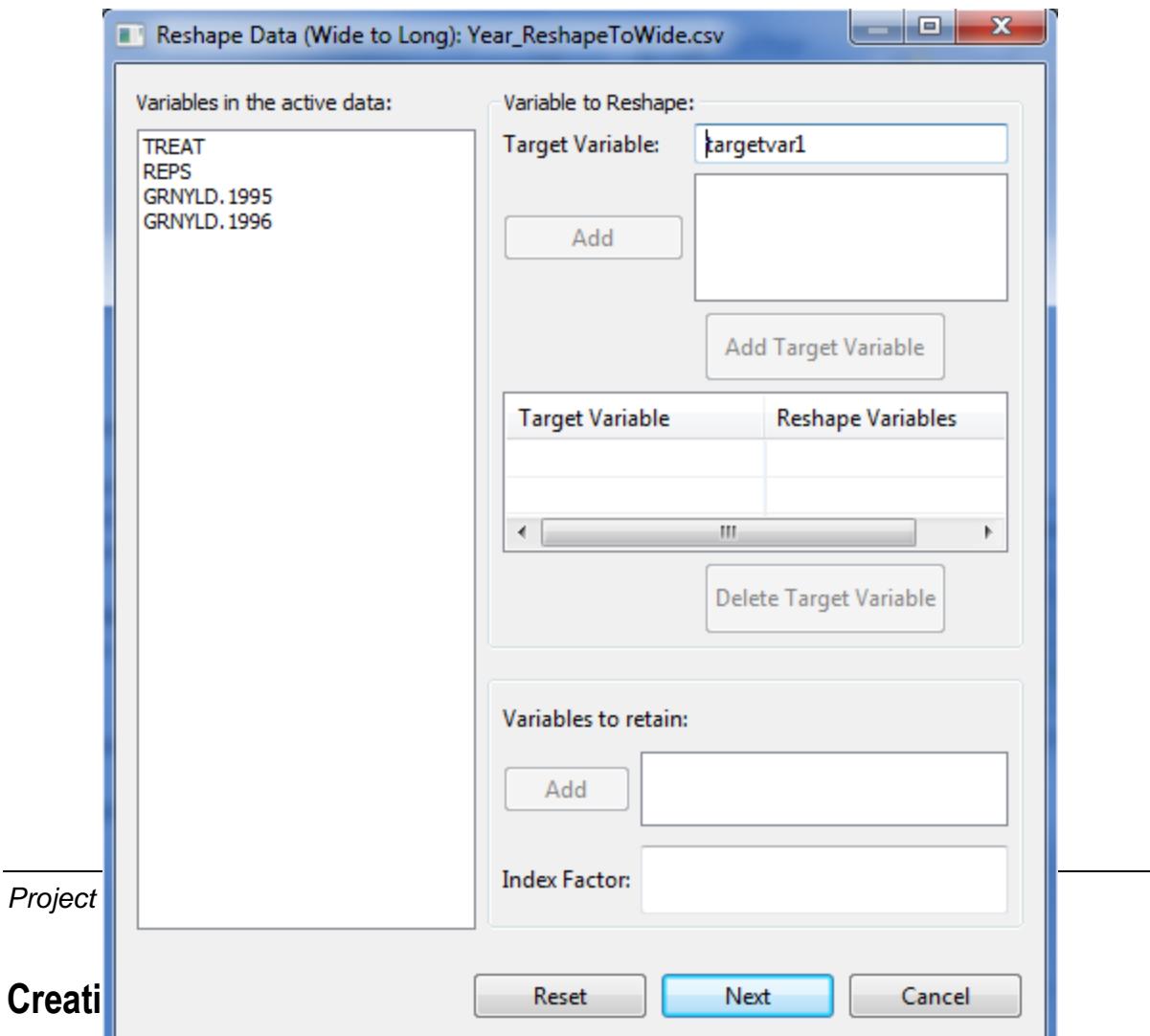
## **Creating New Project**

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.

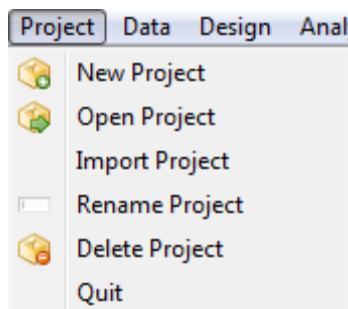


- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.



The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

- Specify the required fields and appropriate options:

### Variable to be Reshape

These are the variables that will be combined to form one variable. Click the variables in the list of variables in the active data while holding the Ctrl key then click the **Add** button. Moreover, the user should specify as the target variable the name of the variable to be created. The default target variable name is *targetvar1*. Then click the **Add Target Variable**. In specifying the name of the target variable, the following rules apply:

- The name must start with a letter. The remaining characters can be any letter, any digit, a period or underscore.
- Each column name must be unique; duplication is not allowed.
- Column name is case sensitive

User can create at least one target variable. This target variable should be unique and the length of the *Reshape Variables* should be the equal for all target variables to be created.

### Variables to be Retained

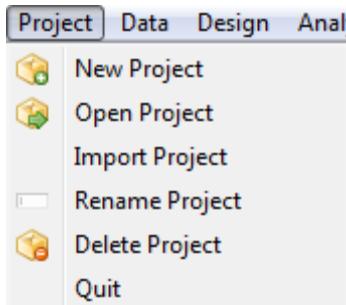
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## Project and File Management

### Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

These are the variables that will be included in the restructured data set and pertains to variables that describe the individual cases.

### **Index Factor**

This is the name of the grouping variables that will be created.

For the *example*, the completed dialog box should appear as illustrated below:

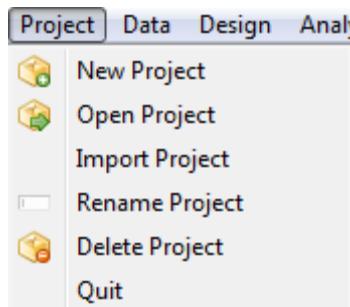
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## *Project and File Management*

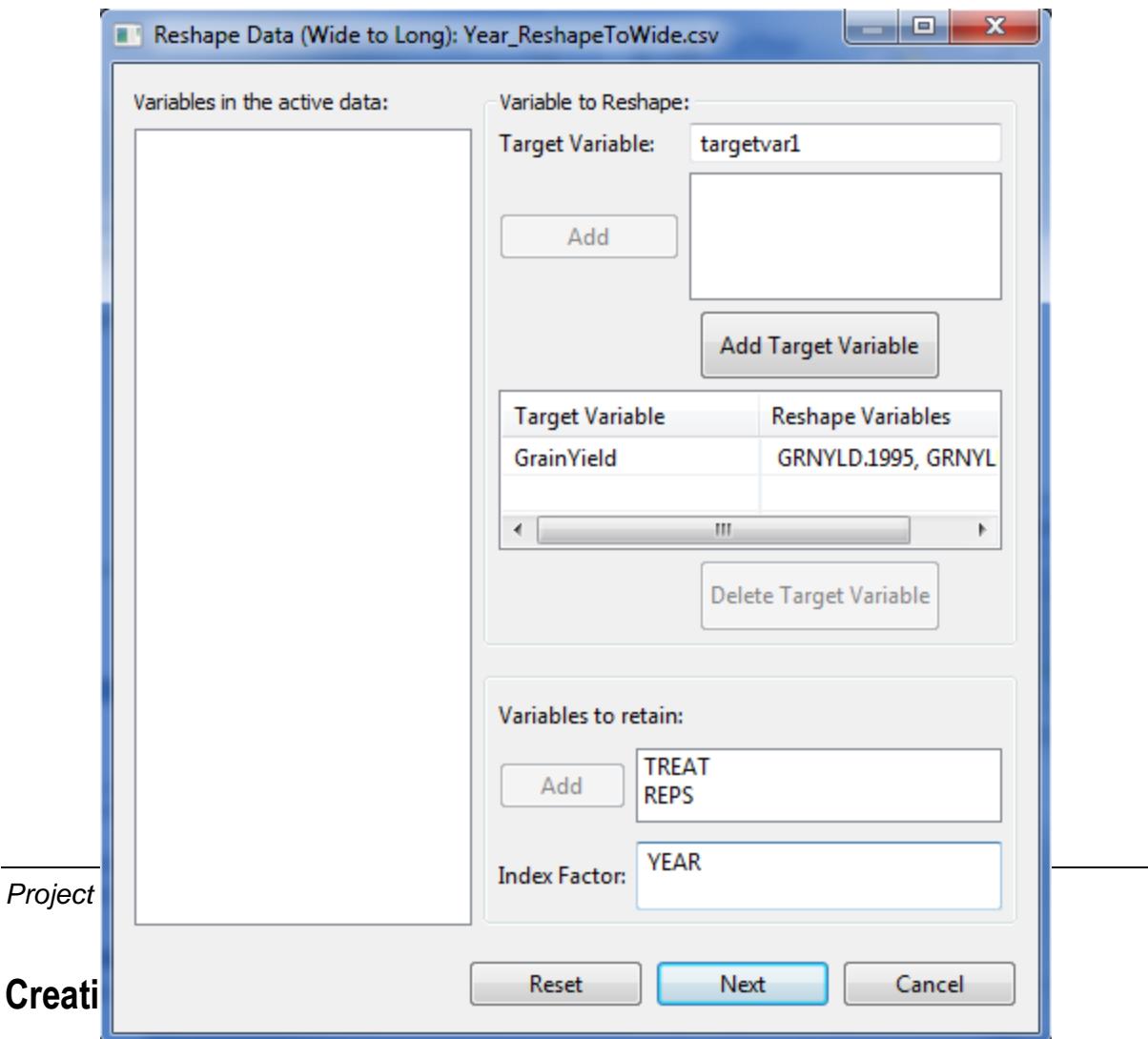
### **Creating New Project**

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.

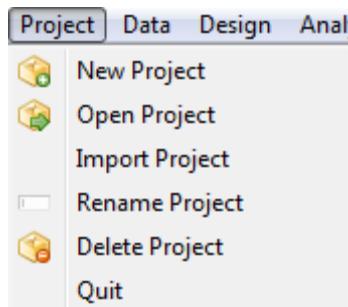


- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.



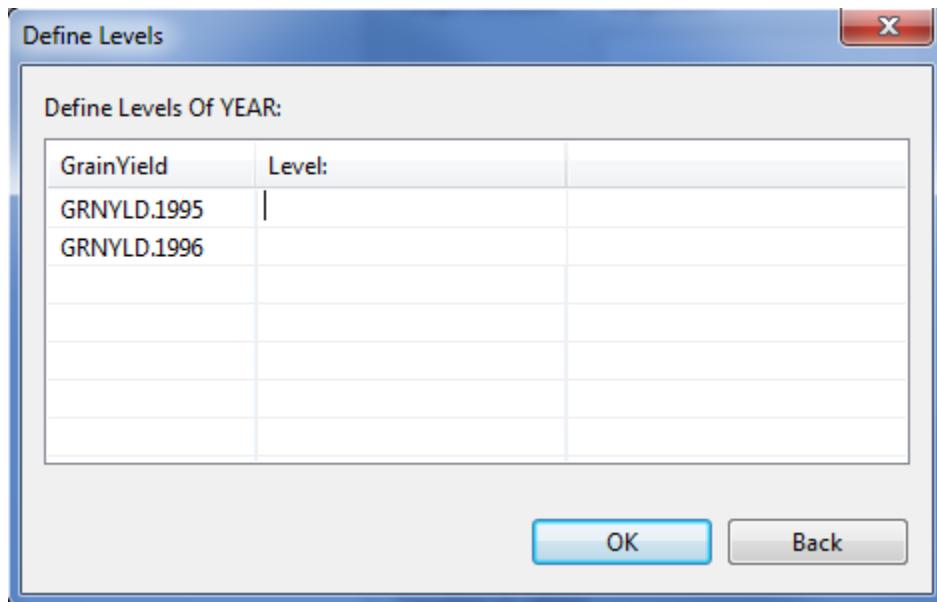
The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

- Click the **Next** button to proceed. The **Define Levels** dialog box will appear.



- Specify the required fields.

For the example, the complete dialog box should appear as shown below:

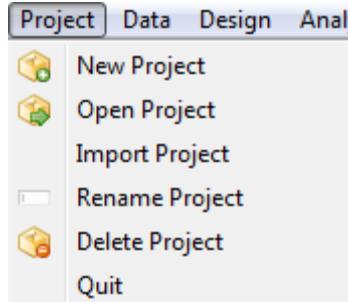
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#### *Project and File Management*

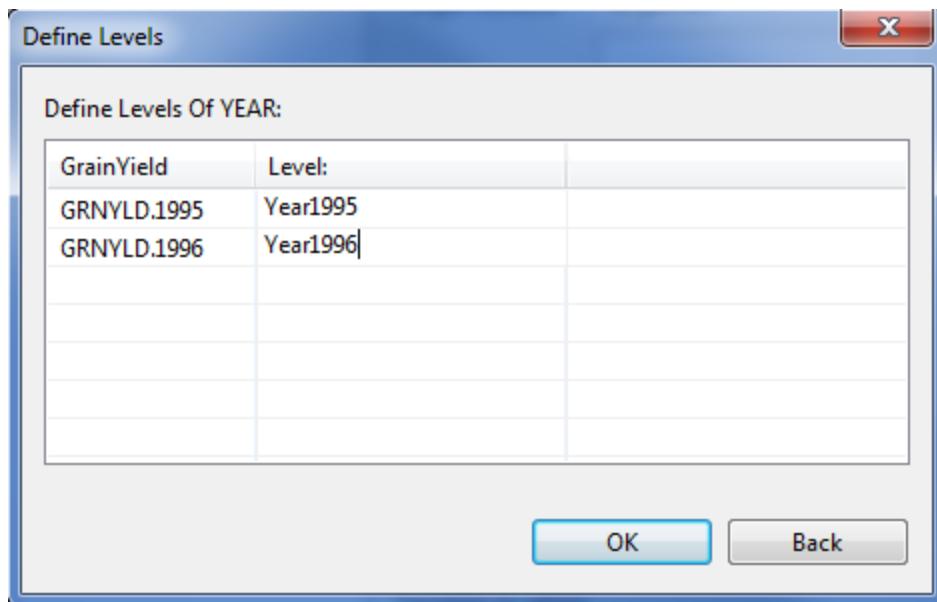
## **Creating New Project**

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.



- Click the **OK** button. The restructured data set is saved in the parent folder of the active data and displayed in the Data Viewer tab. The default filename of the restructured data set follows the format <activeDataFilename>\_ReshapeToLong.csv.

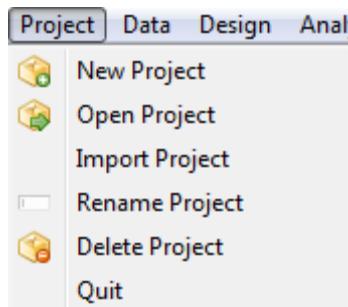
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## Project and File Management

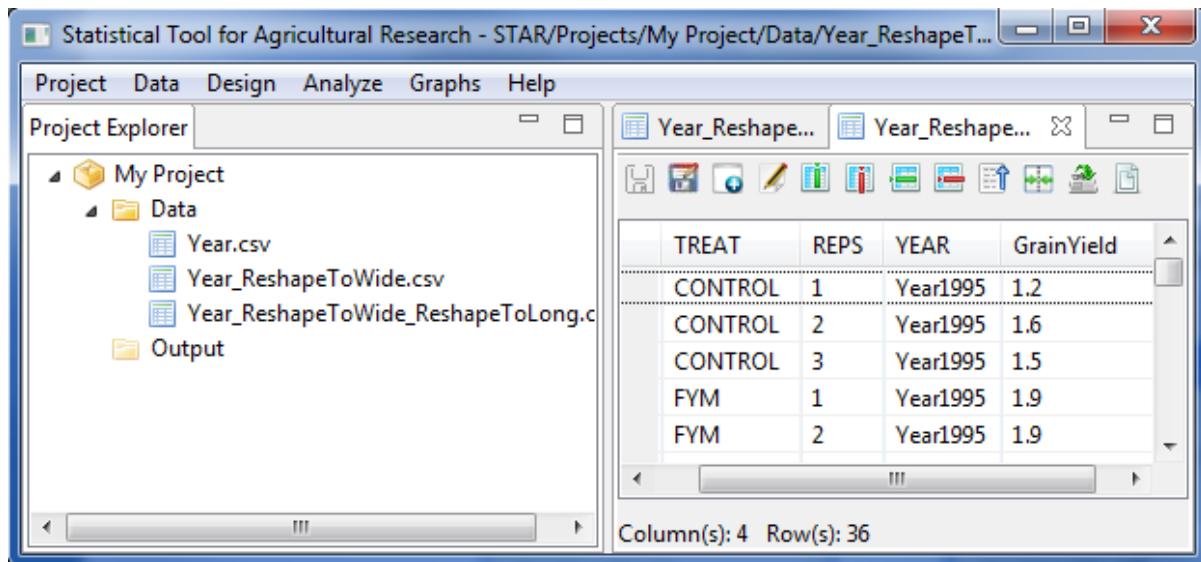
### Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.



## Aggregate

The **Aggregate submenu** aggregates group of observations into single observation and creates a new, aggregated data file or creates new columns in the active data file that

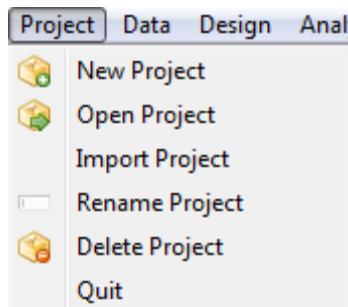
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### Project and File Management

## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

contain the aggregated data. Observations are aggregated based on the value of one or more grouping variables.

The steps for aggregating the data are listed below:

- On the **Project Explorer** panel, using the project named *My Project*, import the data file *MasterData.csv* from the *Data* folder of the project named *SampleProject*. Double-click the file to open it and view it in the Data Viewer.

Opening the data for the first-time, *REP* field is regarded by STAR as numerical variable; they need to be changed as factors. Go to **Edit Variable Information** and change the *Variable Type* of *REP* from *Numeric* to *Factor*.

- Choose **Data | Aggregate...** or click on the Aggregate Data icon in the Data Viewer tool bar.

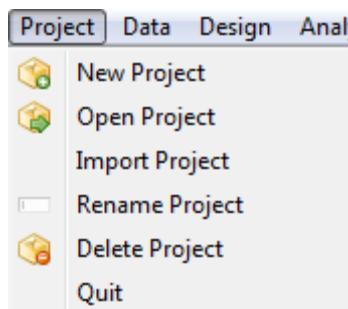
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#### *Project and File Management*

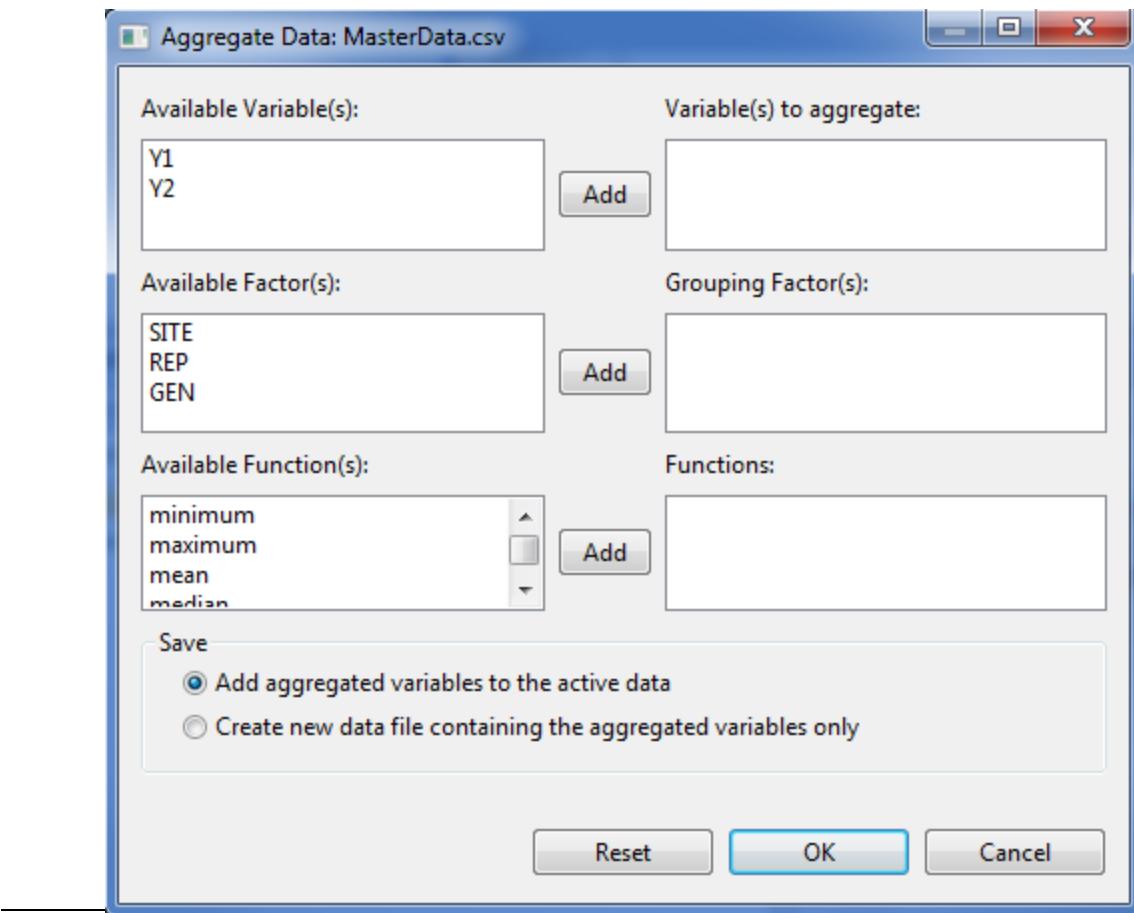
## **Creating New Project**

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- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

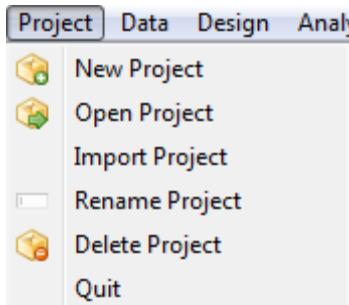


#### Project and File Management

## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

- Specify the required fields and appropriate options.

#### **Variable(s) to Aggregate**

This is the list of variables whose values will be summarized using the selected functions.

#### **Grouping Factor(s)**

Specify this grouping factor, if the user wants to summarize the values per level of a grouping factor.

#### **Functions**

Available functions are minimum, maximum, mean, median, sum, variance and standard deviation.

#### **Save**

Specify how the aggregated data will be saved. User can either add aggregated variables to the active data (default option) or create a new data file containing the aggregated variables only. If user chooses the default option, the resulting data file is not aggregated. Each observations with the save value(s) of the grouping variable(s) will receive the same values of the new aggregated variables. If user chooses the

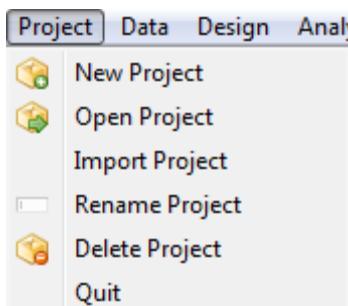
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### *Project and File Management*

## **Creating New Project**

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

option create a new data file containing the aggregated variables only, the new data files contains one observation for each category of the grouping variables.

For the *example*, suppose we want to compute the mean of the variables suppose we want to compute the mean of the variables *Y1* and *Y2* for each level of *REP*. The completed dialog box should appear as illustrated below:

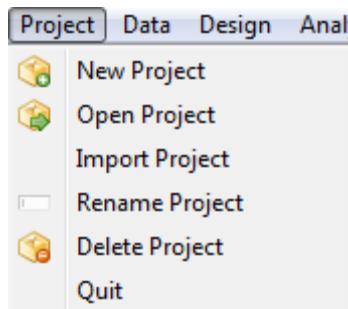
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#### *Project and File Management*

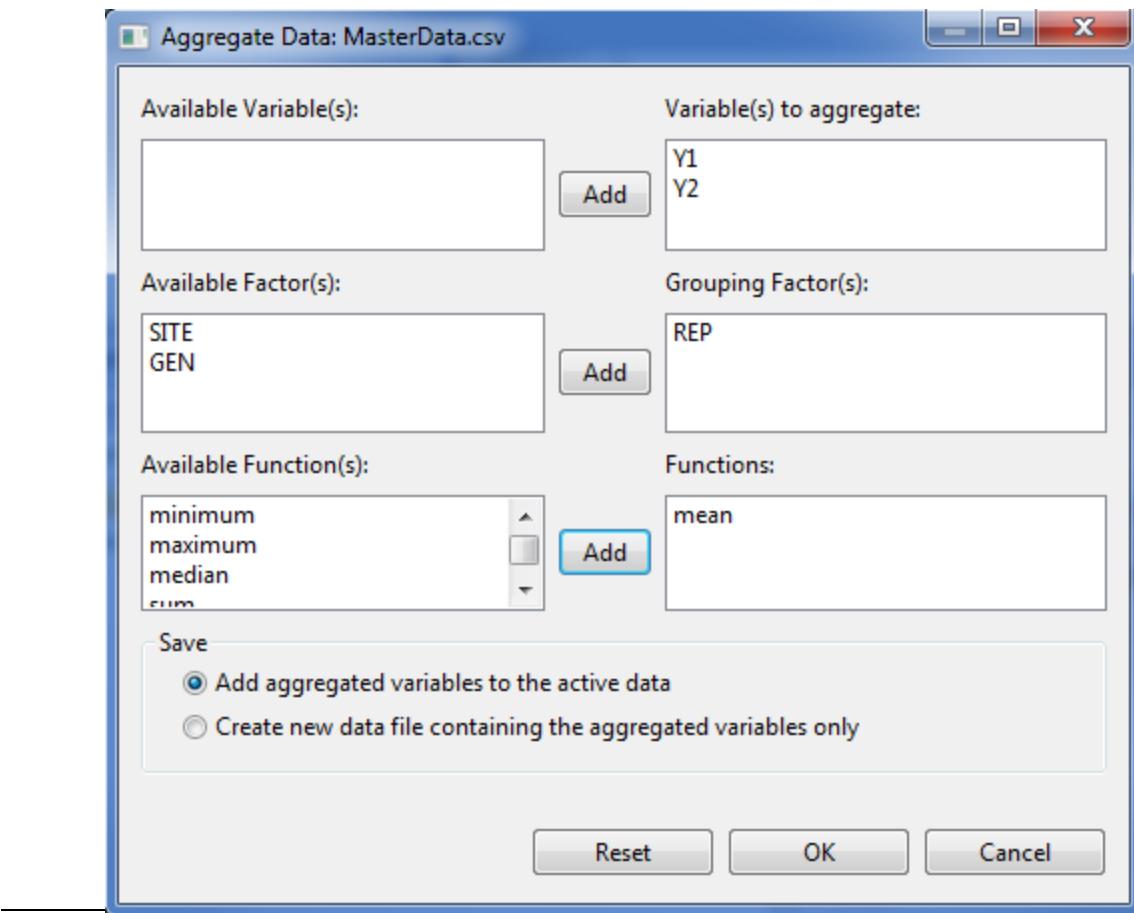
## **Creating New Project**

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- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

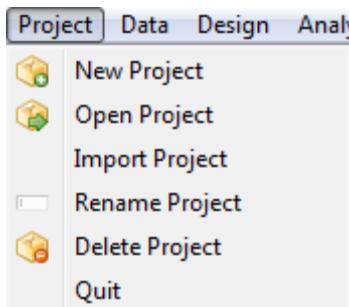


#### Project and File Management

## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

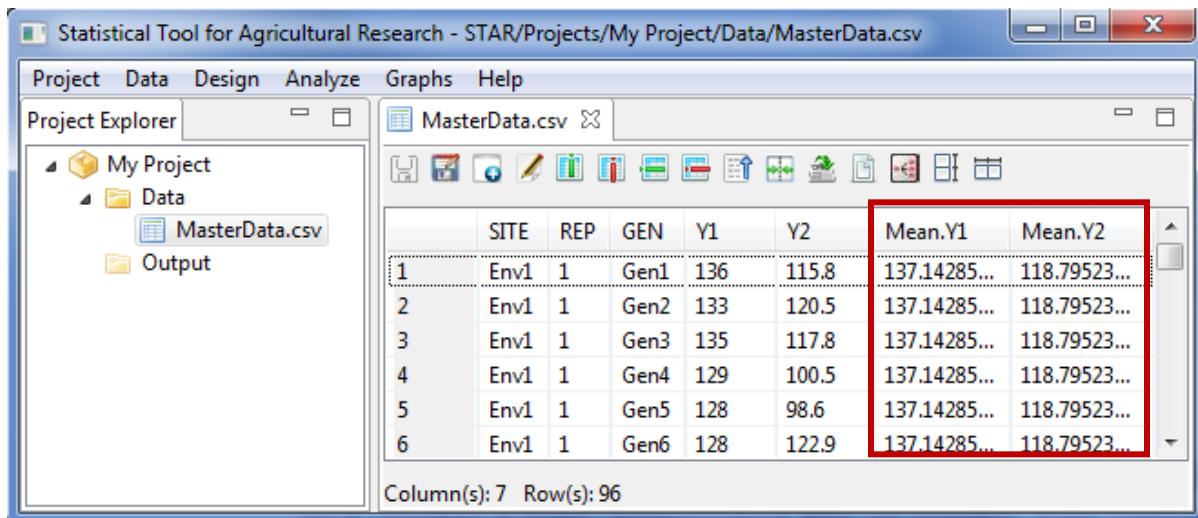
- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

- Click the **OK** button.

If the user chooses the save option: *add aggregated variables to the active data* (default option), the active data is saved with the additional column(s) and displayed in the Data Viewer. The default column name(s) which contain the aggregate data follows the format *<Function>.< Variable to aggregate >*.



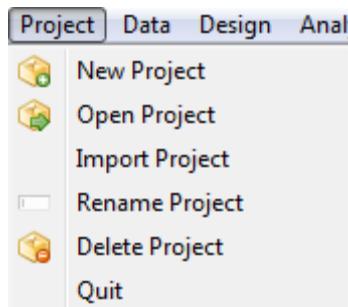
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#### Project and File Management

## Creating New Project

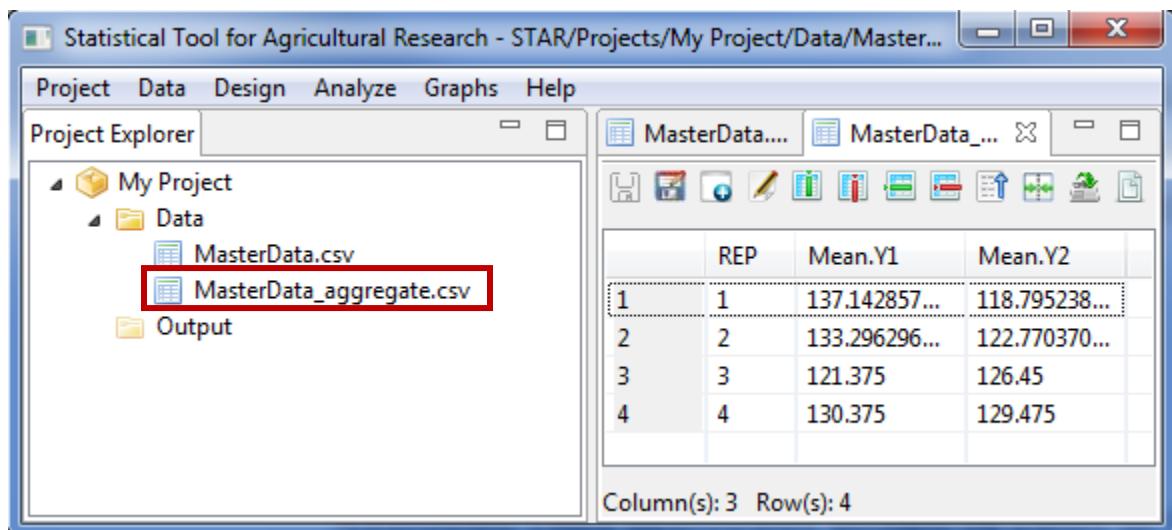
The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

If the user chooses the save option: *create a new data file containing the aggregated variables only*, the aggregated data file is saved in the parent folder of the active data and displayed in the Data Viewer. The default column name(s) which contain the aggregate data follows the format *<Function>.<Variable name to aggregate>* and the default filename of the aggregated data set follows the format *<activeDataFilename>\_aggregate.csv*.



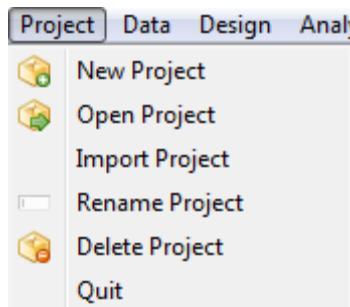
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#### Project and File Management

## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

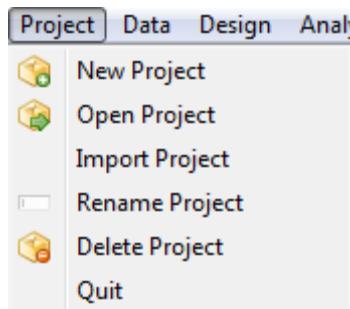
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*Project and File Management*

## Creating New Project

The user can create several projects in STAR. However, only one project can be considered as the active project and is visible in the Project Explorer panel. The steps for creating new project are listed below.

- Select **Project | New Project** from the main menu.



- The **Create New Project** dialog box will appear. In the **Project Name** field, specify a name of the new project.

# Randomization for Basic Experimental Design

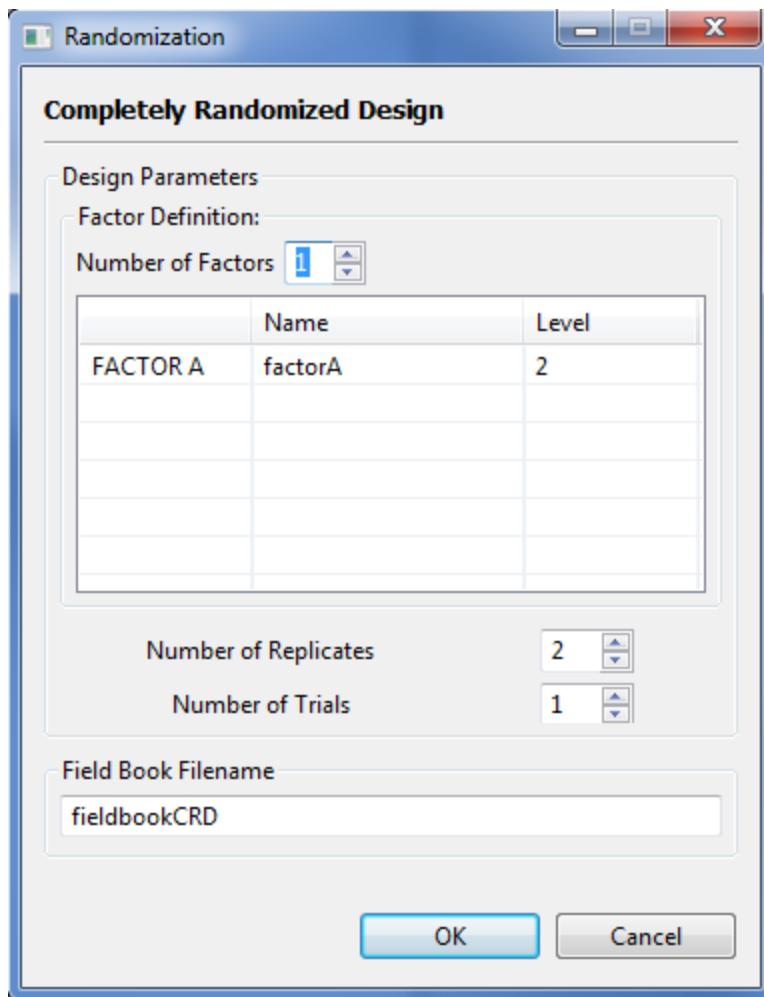
The **Design menu** allows user to generate randomization for single- and multi-factor designs. If the menu is used for the first-time in the active project, a *Randomization* folder will be created inside the *Output* folder. Sub-folders will be created inside the *Randomization* folder which will save the field book saved in csv format and a text file. The default sub-folder name follows the format *<design>\_<time stamp>*.

## Completely Randomized Design

The randomization that will be generated is for balanced design. Equal number of replicates will be generated for each level of the factor or treatment combination.

The steps to generate randomization in Completely Randomized Design are listed below:

- To perform randomization, click **Design | Completely Randomized Design....** The **Randomization** dialog box will appear.



- Specify the required fields and appropriate options.

### Number of Factors

Define the number of factors to be generated with default and minimum value accepted value is 1. The number of factors specified will define the number of rows of the table inside the **Factor Definition** frame. To change the default value, user can either type a value inside the spin box or click the up-arrow key of the spin box to increase the value, down-arrow key, otherwise.

### Factor Definition Frame

This table is required. It lets the user define the name of the factor(s), under the *Name* column, and its levels, under the *Level* column.

The *Name* column contains the default name for the factor. User can change the factor name by typing the desired factor name. In specifying the factor name, the following rules apply: factor name should not contain any space; must begin with a

letter or a period (.); succeeding characters can be a combination of letters, numbers, period(.) and underscore(\_); and factor names should be unique.

The *Level* column contains the level of the factor. User can change the level of the factor by either typing a value inside the spin box or clicking the up-arrow key of the spin box to increase the value, down-arrow key, otherwise. The default value and minimum value of the levels is equal to 2.

### **Number of Replicates**

Define the number of replicates to be generated for each level of the factor or for each treatment combination. The default value and minimum value is equal to 2.

### **Number of Trial**

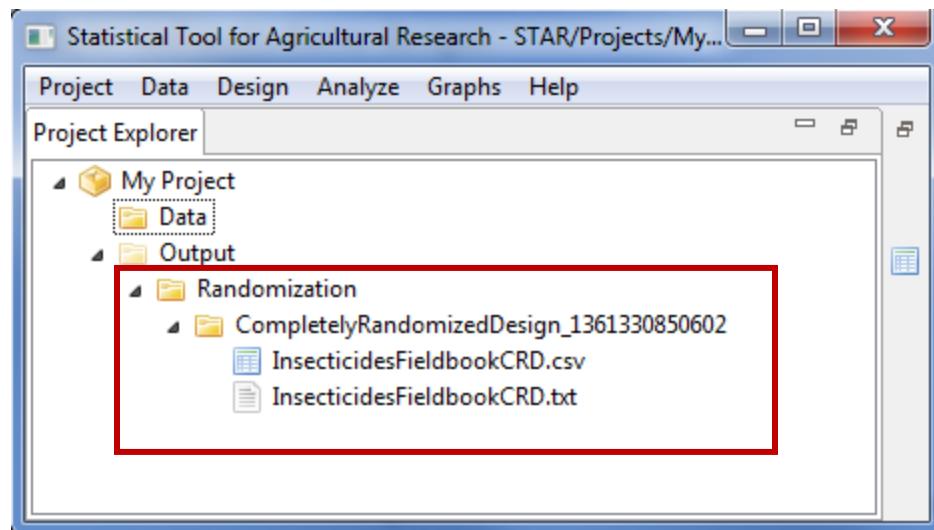
Define the number of trials to be generated. The default value and minimum value is equal to one.

### **Field Book Filename Textbox**

This field is required and it specifies the file name where the result of the randomization will be saved. The default filename is *fieldbookCRD*.

For the example, suppose we want to generate a randomization for an experiment whose aim is to compare the effects of seven different foliar and granular insecticides on the grain yield which will be conducted in Completely Randomized Design with four replicates. The completed dialog box should appear as illustrated below:

- Click the **OK** button to generate the randomization. The **Randomization** dialog box will be minimized and STAR will automatically display the csv data file created in the Data Viewer.

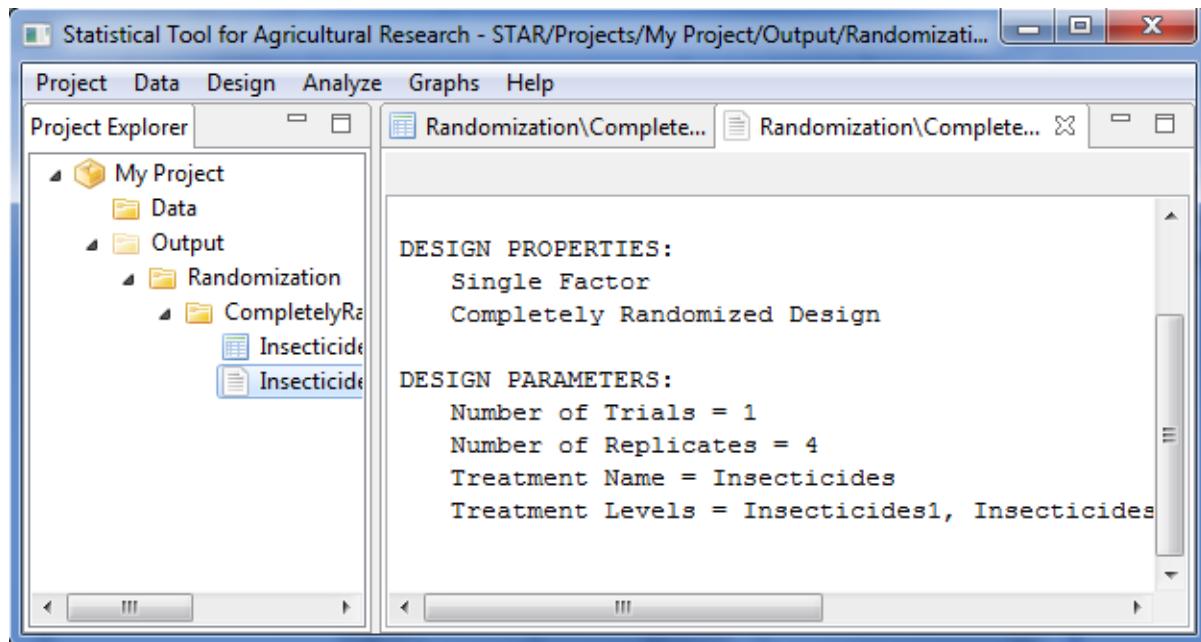


Sample csv data file displayed in the Data Viewer is shown below:

The screenshot shows the 'Data Viewer' window. The title bar indicates it is displaying data from the 'Randomization\\CompletelyR...' tab. The main area of the window is a data grid showing a table with three columns: 'Trial', 'Insecticides', and 'PlotNum'. The data consists of 15 rows of experimental design information. Below the table, a status bar shows 'Column(s): 3 Row(s): 28'.

	Trial	Insecticides	PlotNum
8	1	Insecticides2	8
9	1	Insecticides2	9
10	1	Insecticides3	10
11	1	Insecticides7	11
12	1	Insecticides1	12
13	1	Insecticides2	13
14	1	Insecticides5	14
15	1	Insecticides6	15

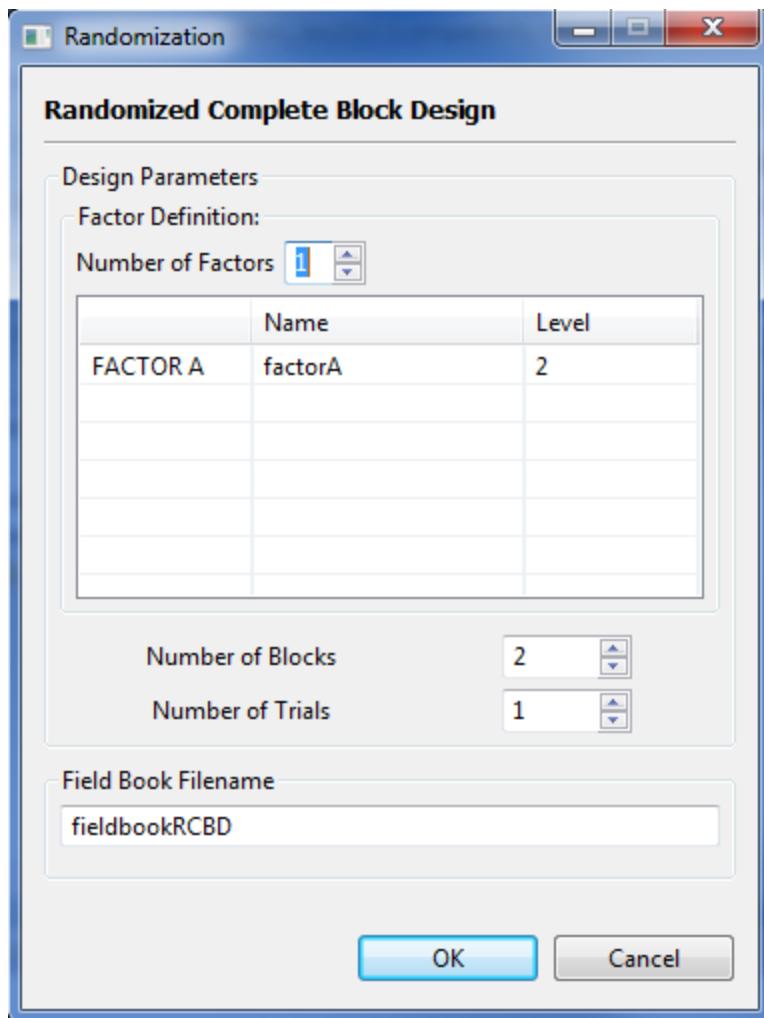
To view the text file created, double click the text file to view it in the **Result Viewer**. Sample *txt* file that was created is shown below:



## Randomized Complete Block Design

The steps to generate randomization in Randomized Complete Block Design are listed below:

- To perform randomization, click **Design | Randomized Complete Block Design ....**.  
The **Randomization** dialog box will appear.



- Specify the required fields and appropriate options.

### Number of Factors

Define the number of factors to be generated with default and minimum value accepted value is 1. The number of factors specified will define the number of rows of the table inside the **Factor Definition** frame. To change the default value, user can either type a value inside the spin box or click the up-arrow key of the spin box to increase the value, down-arrow key, otherwise.

### Factor Definition Frame

This table is required. It lets the user define the name of the factor(s), under the *Name* column, and its levels, under the *Level* column.

The *Name* column contains the default name for the factor. User can change the factor name by typing the desired factor name. In specifying the factor name, the following rules apply: factor name should not contain any space; must begin with a

letter or a period (.); succeeding characters can be a combination of letters, numbers, period(.) and underscore(\_); and factor names should be unique.

The *Level* column contains the level of the factor. User can change the level of the factor by either typing a value inside the spin box or clicking the up-arrow key of the spin box to increase the value, down-arrow key, otherwise. The default value and minimum value of the levels is equal to 2.

### **Number of Blocks**

Define the number of blocks to be generated. The default value and minimum value is equal to 2.

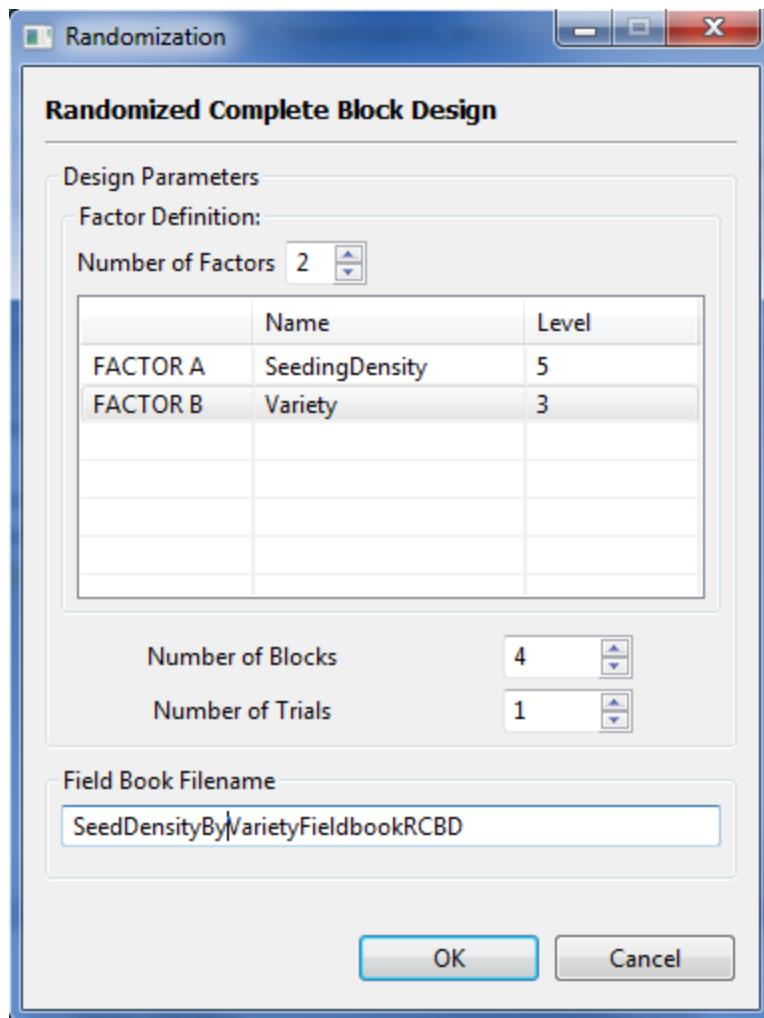
### **Number of Trial**

Define the number of trials to be generated. The default value and minimum value is equal to one.

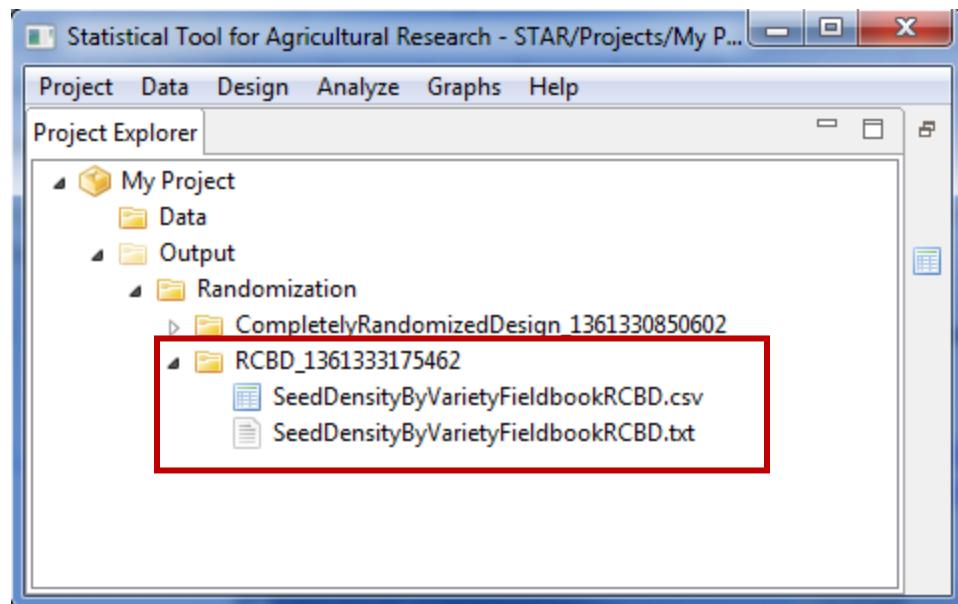
### **Field Book Filename Textbox**

This field is required and it specifies the file name where the result of the randomization will be saved. The default filename is *fieldbookRCBD*.

For the example, suppose we want to generate a randomization for an experiment whose aim is to compare the effects of five seeding densities on the on grain yield of three rice varieties which will be conducted in an randomized complete block design with four blocks and one trial. The completed dialog box should appear as illustrated below:



- Click the **OK** button to generate the randomization. The **Randomization** dialog box will be minimized and STAR will automatically display the csv data file created in the Data Viewer.

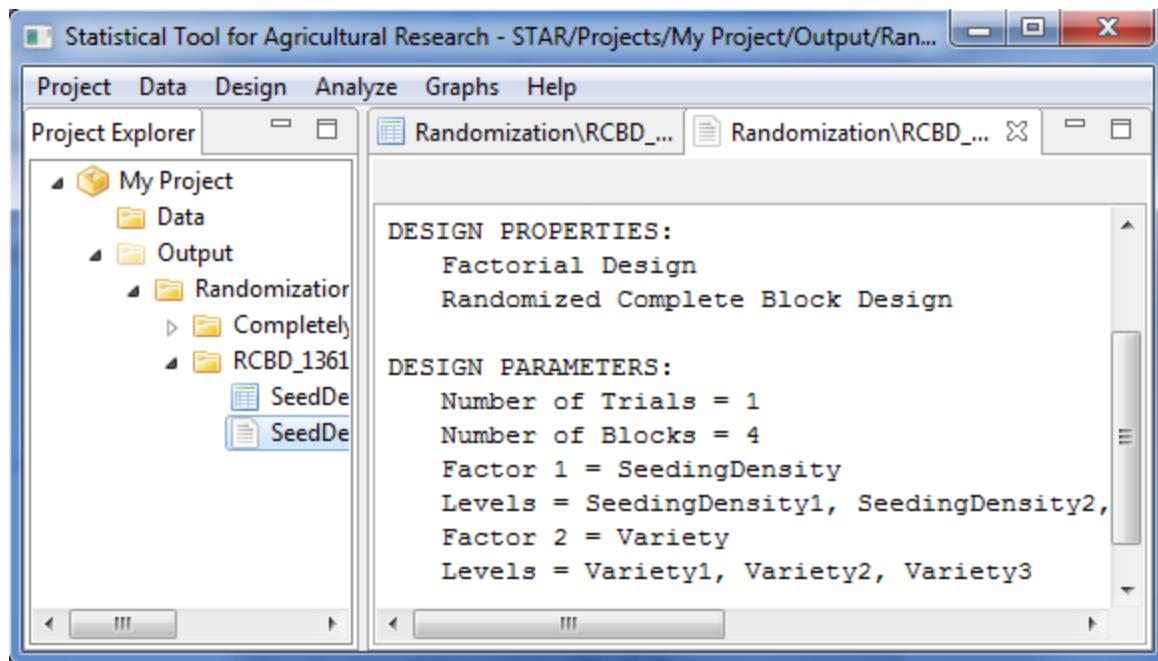


Sample csv data file displayed in the Data Viewer is shown below:

	Trial	Block	SeedingDensity	Variety	PlotNum
1	1	1	SeedingDensity5	Variety2	1
2	1	1	SeedingDensity5	Variety1	2
3	1	1	SeedingDensity4	Variety1	3
4	1	1	SeedingDensity3	Variety3	4
5	1	1	SeedingDensity2	Variety1	5
6	1	1	SeedingDensity3	Variety2	6
7	1	1	SeedingDensity5	Variety3	7
8	1	1	SeedingDensity2	Variety2	8

Column(s): 5 Row(s): 60

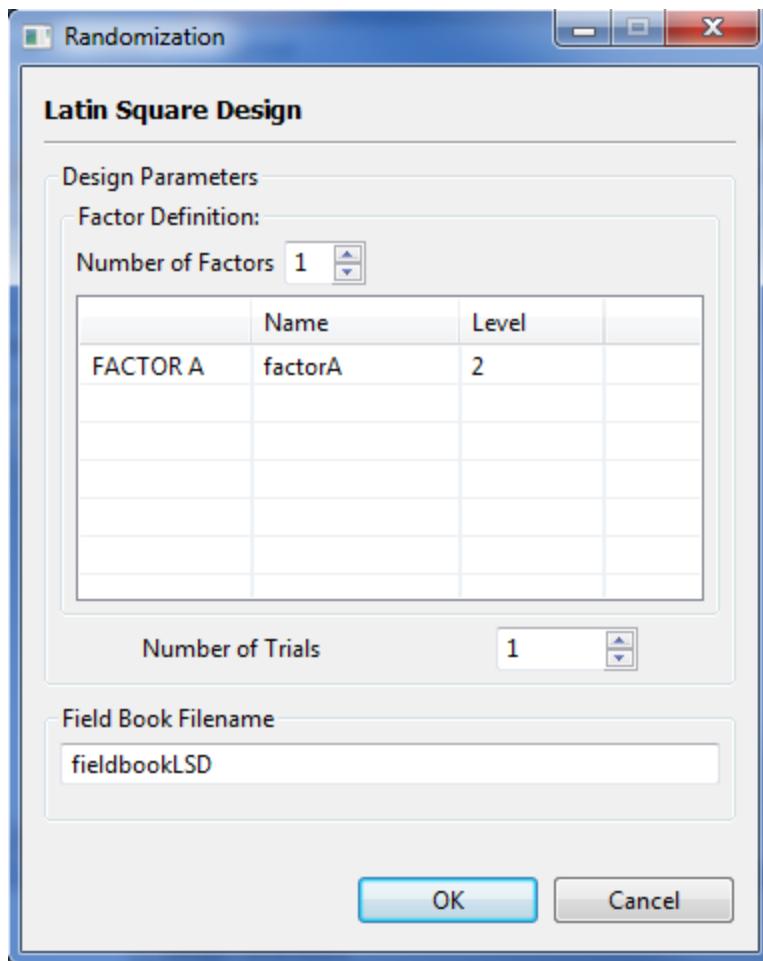
To view the text file created, double click the text file to view it in the **Result Viewer**. Sample *txt* file that was created is shown below:



## Latin Square Design

The steps to generate randomization in Randomized Complete Block Design are listed below:

- To perform randomization, click **Design | Randomized Complete Block Design ....**  
The **Randomization** dialog box will appear.



- Specify the required fields and appropriate options.

#### Number of Factors

Define the number of factors to be generated with default and minimum value accepted value is 1. The number of factors specified will define the number of rows of the table inside the **Factor Definition** frame. To change the default value, user can either type a value inside the spin box or click the up-arrow key of the spin box to increase the value, down-arrow key, otherwise.

#### Factor Definition Frame

This table is required. It lets the user define the name of the factor(s), under the *Name* column, and its levels, under the *Level* column.

The *Name* column contains the default name for the factor. User can change the factor name by typing the desired factor name. In specifying the factor name, the following rules apply: factor name should not contain any space; must begin with a letter or a period (.); succeeding characters can be a combination of letters, numbers, period(.) and underscore(\_); and factor names should be unique.

The *Level* column contains the level of the factor. User can change the level of the factor by either typing a value inside the spin box or clicking the up-arrow key of the spin box to increase the value, down-arrow key, otherwise. The default value and minimum value of the levels is equal to 2.

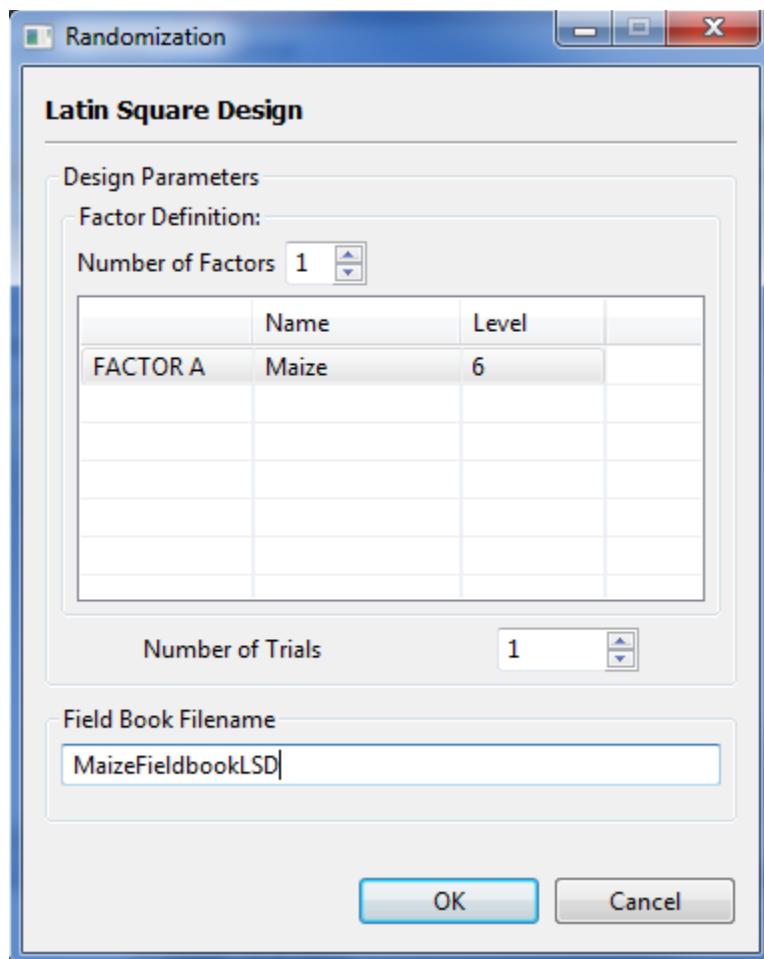
### Number of Trial

Define the number of trials to be generated. The default value and minimum value is equal to one.

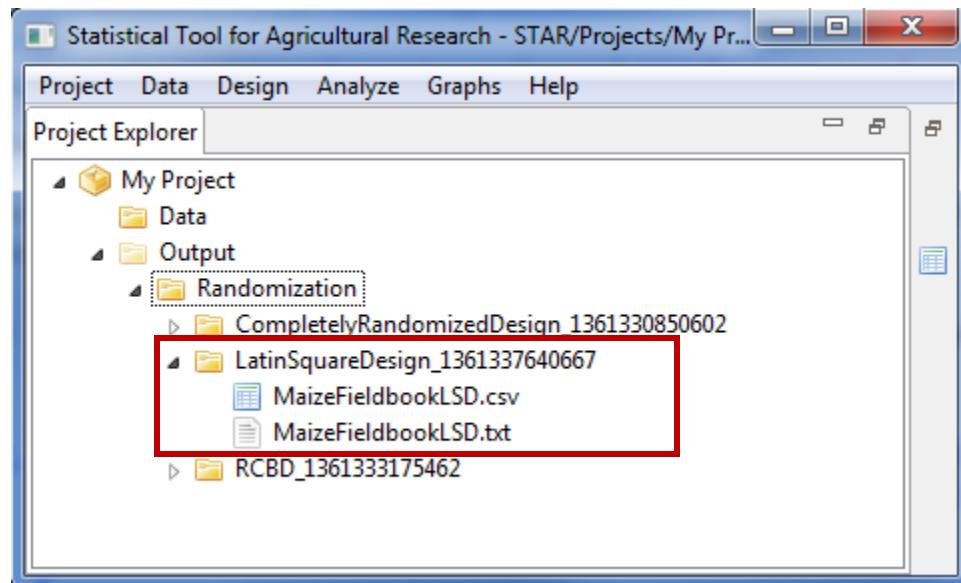
### Field Book Filename Textbox

This field is required and it specifies the file name where the result of the randomization will be saved. The default filename is *fieldbookLSD*.

For the example, suppose we want to generate a randomization for an experiment to be laid out in Latin Square Design whose aim is to compare the effects of five promising maize hybrids and a check variety on the grain yield. The completed dialog box should appear as illustrated below:



- Click the **OK** button to generate the randomization. The **Randomization** dialog box will be minimized and STAR will automatically display the csv data file created in the Data Viewer.

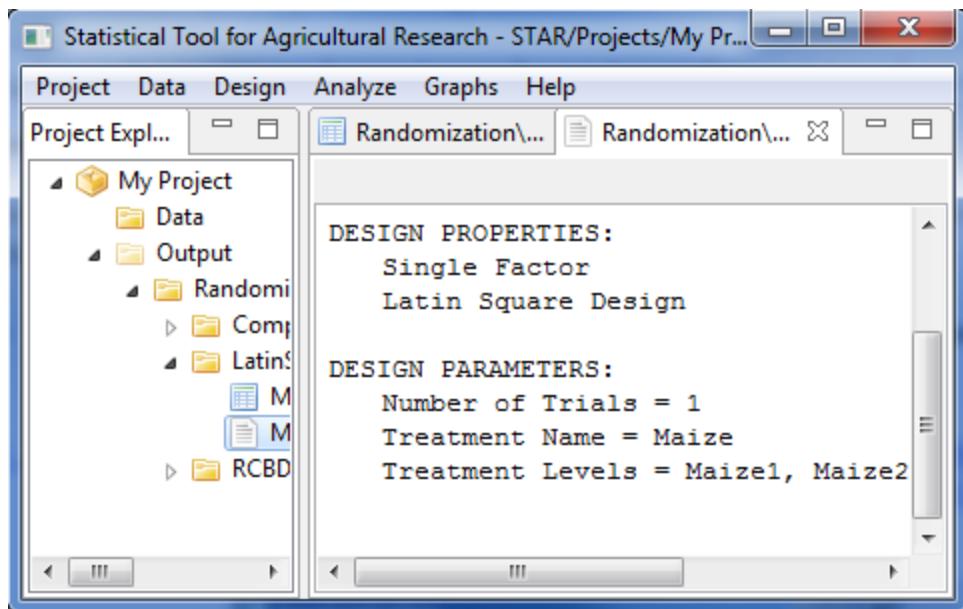


Sample csv data file displayed in the Data Viewer is shown below:

	Trial	Row	Column	Maize
1	1	1	1	Maize2
2	1	1	2	Maize3
3	1	1	3	Maize1
4	1	1	4	Maize4
5	1	1	5	Maize6
6	1	1	6	Maize5

Column(s): 5 Row(s): 36

To view the text file created, double click the text file to view it in the **Result Viewer**. Sample **txt** file that was created is shown below:



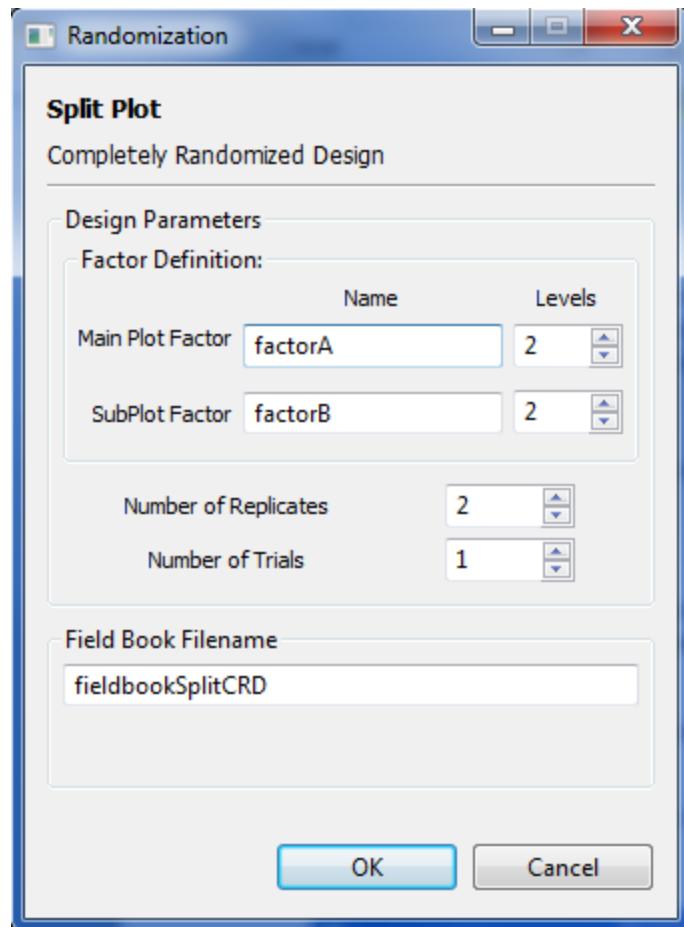
## Split Plot Design

This design can be generated for Completely Randomized Design, Randomized Complete Block Design and Latin Square Design.

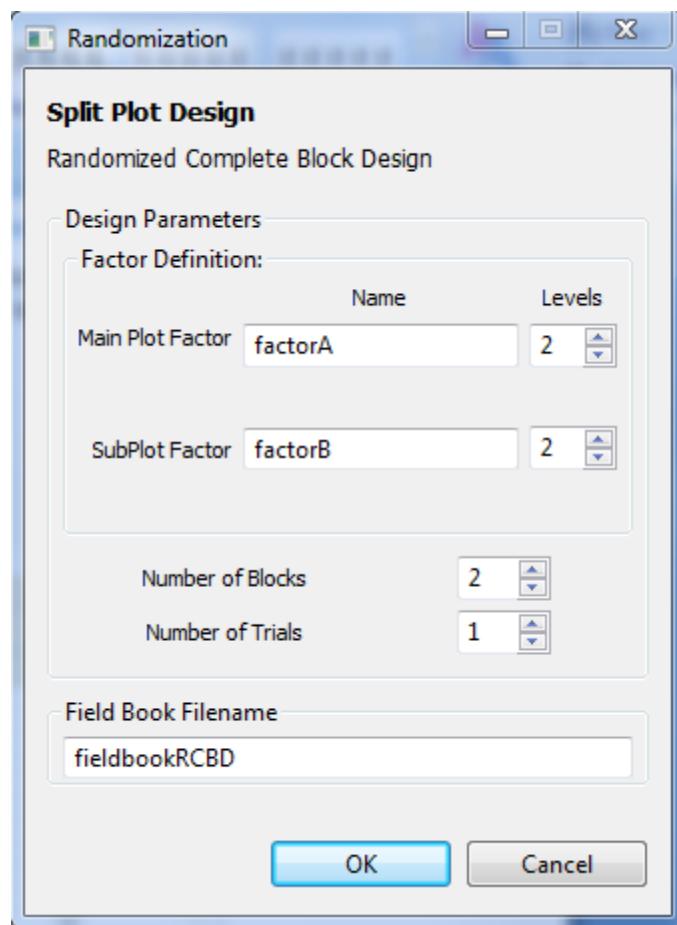
The steps to generate randomization for Split Plot Design are listed below:

- Click **Design | Split Plot Design | Randomized Complete Block Design...** from the main window. The **Randomization** dialog box will appear.

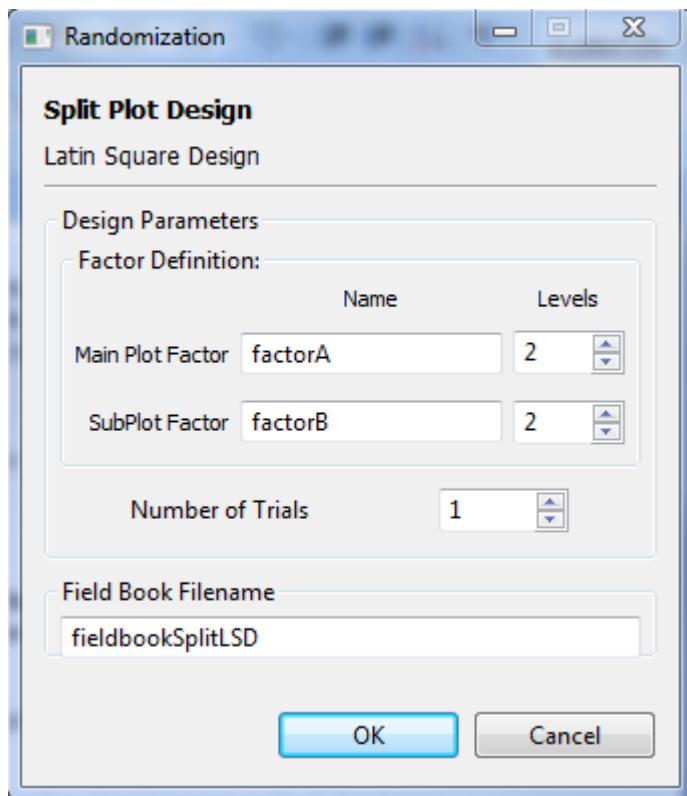
The default **Randomization** dialog box for Completely Randomized Design is shown below:



The default **Randomization** dialog box for Randomized Complete Block Design is shown below:



The default **Randomization** dialog box for Latin Square Design is shown below:



- Specify the required field and appropriate options.

### Main Plot Factor

#### Name

Define the main plot factor name.

The *Name* column contains the default name for the factor. User can change the factor name by typing the desired factor name. In specifying the factor name, the following rules apply: factor name should not contain any space; must begin with a letter or a period (.); succeeding characters can be a combination of letters, numbers, period (.) and underscore (\_); and factor names should be unique.

#### Levels

The *Level* column contains the level of the factor. User can change the level of the factor by either typing a value inside the spin box or clicking the up-arrow key of the spin box to increase the value, down-arrow key, otherwise. The default value and minimum value of the levels is equal to 2.

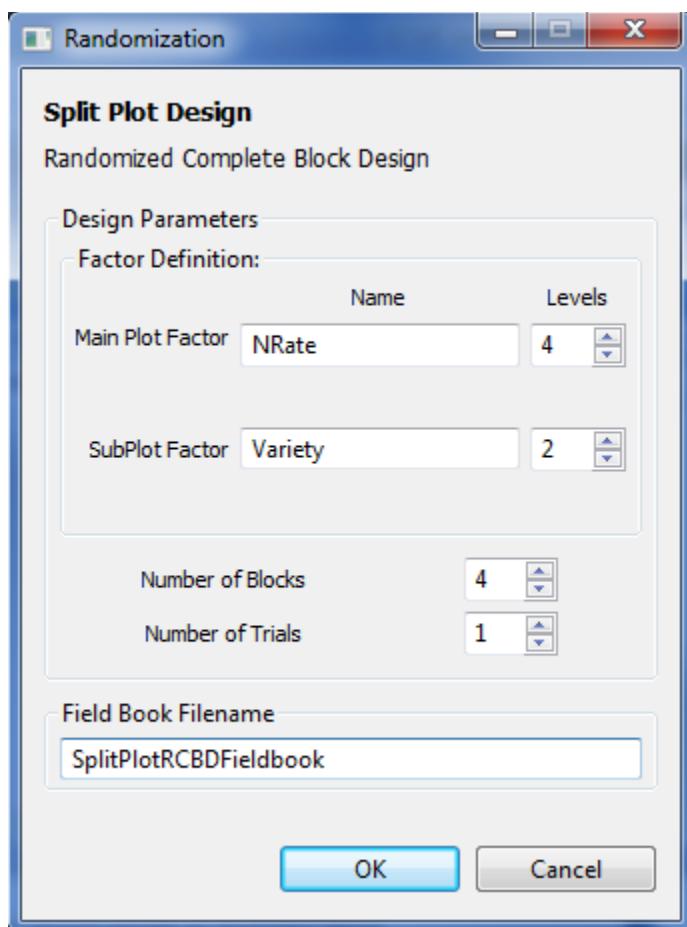
#### Number of Trial

Define the number of trials to be generated. The default value and minimum value is equal to one.

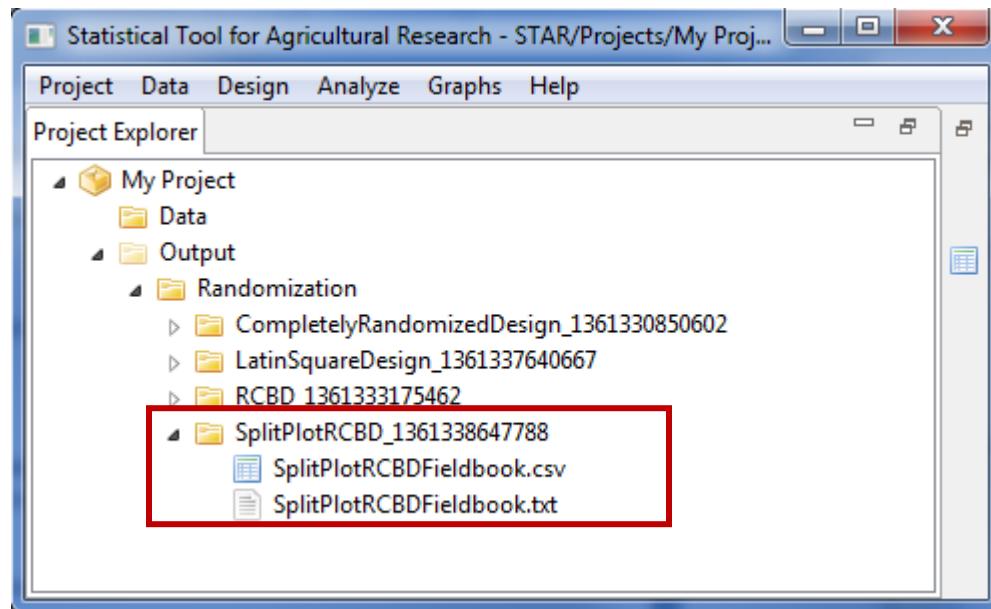
### Field Book Filename Textbox

This field is required and it specifies the file name where the result of the randomization will be saved. The default filename is *fieldbookRCBD*.

For this example, suppose we want to generate a randomization for an experiment whose aim is to compare the effects of four nitrogen rates on the grain yield of five rice varieties which will be conducted in randomized complete block design using Split Plot with four blocks. Nitrogen rates will be assigned as the main plot factor and the varieties as the sub plot factor. The completed dialog box should appear as illustrated below:



- Click the **OK** button to generate the randomization. The **Randomization** dialog box will be minimized and STAR will automatically display the csv data file created in the Data Viewer.

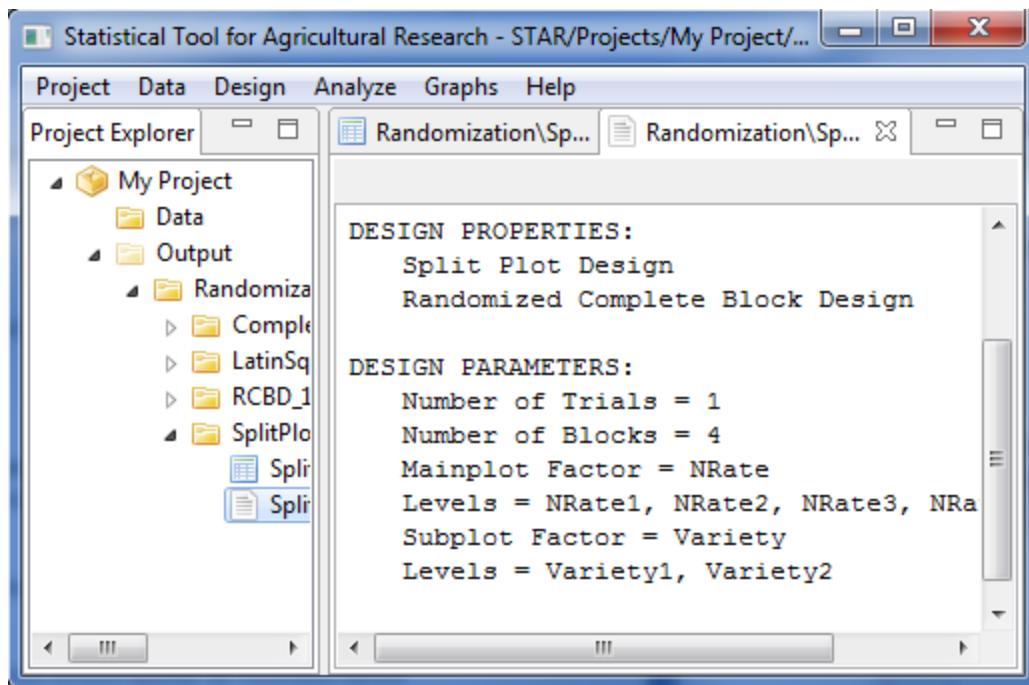


Sample csv data file displayed in the Data Viewer is shown below:

	Trial	Block	NRate	Variety	Plot
1	1	1	NRate4	Variety1	1
2	1	1	NRate4	Variety2	2
3	1	1	NRate1	Variety1	3
4	1	1	NRate1	Variety2	4
5	1	1	NRate2	Variety1	5
6	1	1	NRate2	Variety2	6

Column(s): 5 Row(s): 32

To view the text file created, double click the text file to view it in the **Result Viewer**. Sample *txt* file that was created is shown below:



## Strip Plot Design

The steps to generate randomization for a Strip Plot Design are listed below:

- Choose Design | Strip Plot Design from the main window. The Randomization dialog box will appear.
- Specify the required fields and appropriate options.

For this example, suppose we want to generate a randomization for an experiment to be conducted using Strip Plot, with land preparation (with 3 levels) as the horizontal factor and water stress (with four levels) as the vertical factor. Three blocks will be used. The completed dialog box should appear as illustrated below:

- Click the **OK** button to generate the randomization. The **Randomization** dialog box will be minimized and STAR will automatically display the csv data file created in the Data Viewer.

Sample csv data file displayed in the Data Viewer is shown below:

To view the text file created, double click the text file to view it in the **Result Viewer**. Sample *txt* file that was created is shown below:

## **Split-Split Plot Design**

This design can be generated for Completely Randomized Design, Randomized Complete Block Design and Latin Square Design.

The steps to generate randomization for Split Plot Design are listed below:

- Click **Design | Split Plot Design | Randomized Complete Block Design...** from the main window. The **Randomization** dialog box will appear.

The default **Randomization** dialog box for Completely Randomized Design is shown below:

The default **Randomization** dialog box for Randomized Complete Block Design is shown below:

The default **Randomization** dialog box for Latin Square Design is shown below:

- Specify the required field and appropriate options.

### **Main Plot Factor**

#### **Name**

Define the main plot factor name.

The *Name* column contains the default name for the factor. User can change the factor name by typing the desired factor name. In specifying the factor name, the following rules apply: factor name should not contain any space; must begin with a letter or a period (.); succeeding characters can be a combination of letters, numbers, period(.) and underscore(\_); and factor names should be unique.

### **Levels**

The *Level* column contains the level of the factor. User can change the level of the factor by either typing a value inside the spin box or clicking the up-arrow key of the spin box to increase the value, down-arrow key, otherwise. The default value and minimum value of the levels is equal to 2.

### **Number of Trial**

Define the number of trials to be generated. The default value and minimum value is equal to one.

### **Field Book Filename Textbox**

This field is required and it specifies the file name where the result of the randomization will be saved. The default filename is *fieldbookRCBD*.

For this example, suppose we want to generate a randomization for an experiment whose aim is to compare the effects of four nitrogen rates on the on grain yield of five rice varieties which will be conducted in randomized complete block design using Split Plot with four blocks. Nitrogen rates will be assigned as the main plot factor and the varieties as the sub plot factor. The completed dialog box should appear as illustrated below:

- Click the **OK** button to generate the randomization. The **Randomization** dialog box will be minimized and STAR will automatically display the csv data file created in the Data Viewer.

Sample csv data file displayed in the Data Viewer is shown below:

To view the text file created, double click the text file to view it in the **Result Viewer**. Sample *txt* file that was created is shown below:

## Strip-Split Plot Design

The steps to generate randomization for a Strip Plot Design are listed below:

- Choose Design | Strip Plot Design from the main window. The Randomization dialog box will appear.
- Specify the required fields and appropriate options.

For this example, suppose we want to generate a randomization for an experiment to be conducted using Strip Plot, with land preparation (with 3 levels) as the horizontal factor and water stress (with four levels) as the vertical factor. Three blocks will be used. The completed dialog box should appear as illustrated below:

- Click the **OK** button to generate the randomization. The **Randomization** dialog box will be minimized and STAR will automatically display the csv data file created in the Data Viewer.

Sample csv data file displayed in the Data Viewer is shown below:

To view the text file created, double click the text file to view it in the **Result Viewer**. Sample *txt* file that was created is shown below:

## Split- Split-Split Plot Design

This design can be generated for Completely Randomized Design, Randomized Complete Block Design and Latin Square Design.

The steps to generate randomization for Split Plot Design are listed below:

- Click **Design | Split Plot Design | Randomized Complete Block Design...** from the main window. The **Randomization** dialog box will appear.

The default **Randomization** dialog box for Completely Randomized Design is shown below:

The default **Randomization** dialog box for Randomized Complete Block Design is shown below:

The default **Randomization** dialog box for Latin Square Design is shown below:

- Specify the required field and appropriate options.

#### **Main Plot Factor**

##### **Name**

Define the main plot factor name.

The *Name* column contains the default name for the factor. User can change the factor name by typing the desired factor name. In specifying the factor name, the following rules apply: factor name should not contain any space; must begin with a letter or a period (.); succeeding characters can be a combination of letters, numbers, period(.) and underscore (\_); and factor names should be unique.

##### **Levels**

The *Level* column contains the level of the factor. User can change the level of the factor by either typing a value inside the spin box or clicking the up-arrow key of the spin box to increase the value, down-arrow key, otherwise. The default value and minimum value of the levels is equal to 2.

##### **Number of Trial**

Define the number of trials to be generated. The default value and minimum value is equal to one.

##### **Field Book Filename Textbox**

This field is required and it specifies the file name where the result of the randomization will be saved. The default filename is *fieldbookRCBD*.

For this example, suppose we want to generate a randomization for an experiment whose aim is to compare the effects of four nitrogen rates on the on grain yield of five rice varieties which will be conducted in randomized complete block design using Split Plot with four blocks. Nitrogen rates will be assigned as the main plot factor and the varieties as the sub plot factor. The completed dialog box should appear as illustrated below:

- Click the **OK** button to generate the randomization. The **Randomization** dialog box will be minimized and STAR will automatically display the csv data file created in the Data Viewer.

Sample csv data file displayed in the Data Viewer is shown below:

To view the text file created, double click the text file to view it in the **Result Viewer**. Sample *txt* file that was created is shown below:

## Strip-Split-Split Plot Design

The steps to generate randomization for a Strip Plot Design are listed below:

- Choose Design | Strip Plot Design from the main window. The Randomization dialog box will appear.
- Specify the required fields and appropriate options.

For this example, suppose we want to generate a randomization for an experiment to be conducted using Strip Plot, with land preparation (with 3 levels) as the horizontal

factor and water stress (with four levels) as the vertical factor. Three blocks will be used. The completed dialog box should appear as illustrated below:

- Click the **OK** button to generate the randomization. The **Randomization** dialog box will be minimized and STAR will automatically display the csv data file created in the Data Viewer.

Sample csv data file displayed in the Data Viewer is shown below:

To view the text file created, double click the text file to view it in the **Result Viewer**. Sample *txt* file that was created is shown below:

## Balanced Incomplete Block Design

The steps to generate randomization for Alpha Lattice Design are listed below:

- Click **Design | Incomplete Block Design | Alpha Lattice Design** from the main window. The **Randomization** dialog box will appear.

For this example, suppose we want to generate a randomization for an experiment that will be conducted using Alpha Lattice design with 72 entries grouped into 8 with three replicates. The completed dialog box should appear as illustrated below:

- Click the **OK** button to generate the randomization. The **Randomization** dialog box will be minimized and STAR will automatically display the csv data file created in the Data Viewer.

Sample csv data file displayed in the Data Viewer is shown below:

To view the text file created, double click the text file to view it in the **Result Viewer**. Sample *txt* file that was created is shown below:

## Lattice Design

The steps to generate randomization for Alpha Lattice Design are listed below:

- Click **Design | Incomplete Block Design | Alpha Lattice Design** from the main window. The **Randomization** dialog box will appear.

For this example, suppose we want to generate a randomization for an experiment that will be conducted using Alpha Lattice design with 72 entries grouped into 8 with three replicates. The completed dialog box should appear as illustrated below:

- Click the **OK** button to generate the randomization. The **Randomization** dialog box will be minimized and STAR will automatically display the csv data file created in the Data Viewer.

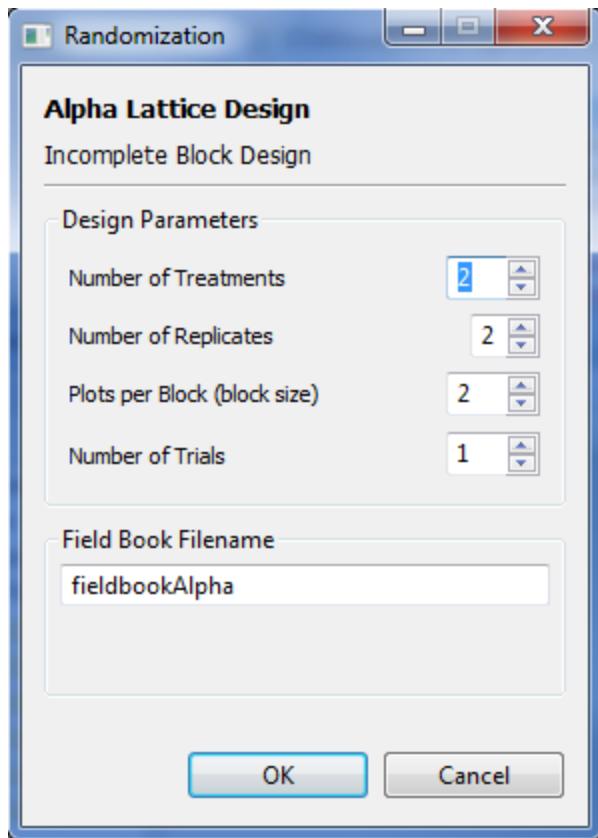
Sample csv data file displayed in the Data Viewer is shown below:

To view the text file created, double click the text file to view it in the **Result Viewer**. Sample *txt* file that was created is shown below:

## Alpha Lattice Design

The steps to generate randomization for Alpha Lattice Design are listed below:

- Click **Design | Incomplete Block Design | Alpha Lattice Design...** from the main window. The **Randomization** dialog box will appear.



- Specify the required field and appropriate options.

#### **Number of Treatments**

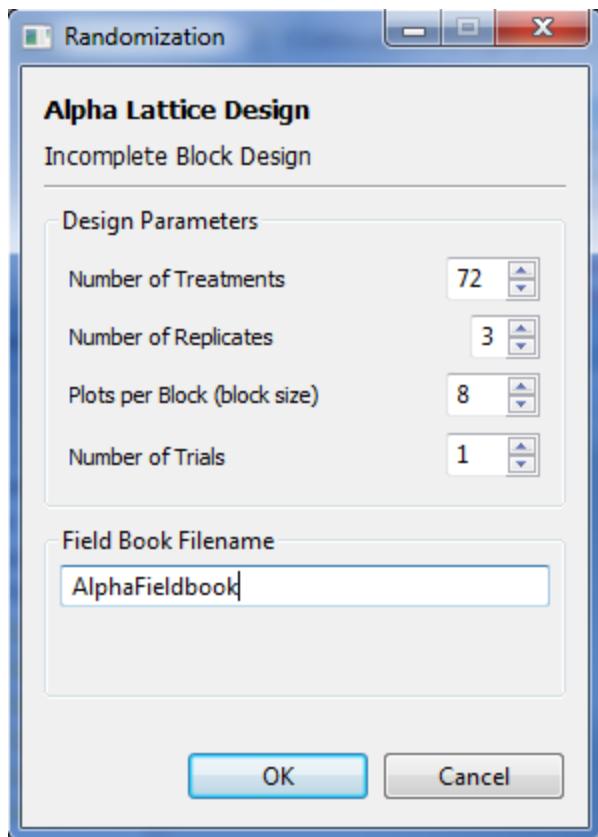
Specify the levels of

#### **Number of Replicates**

#### **Plots per Block (block size)**

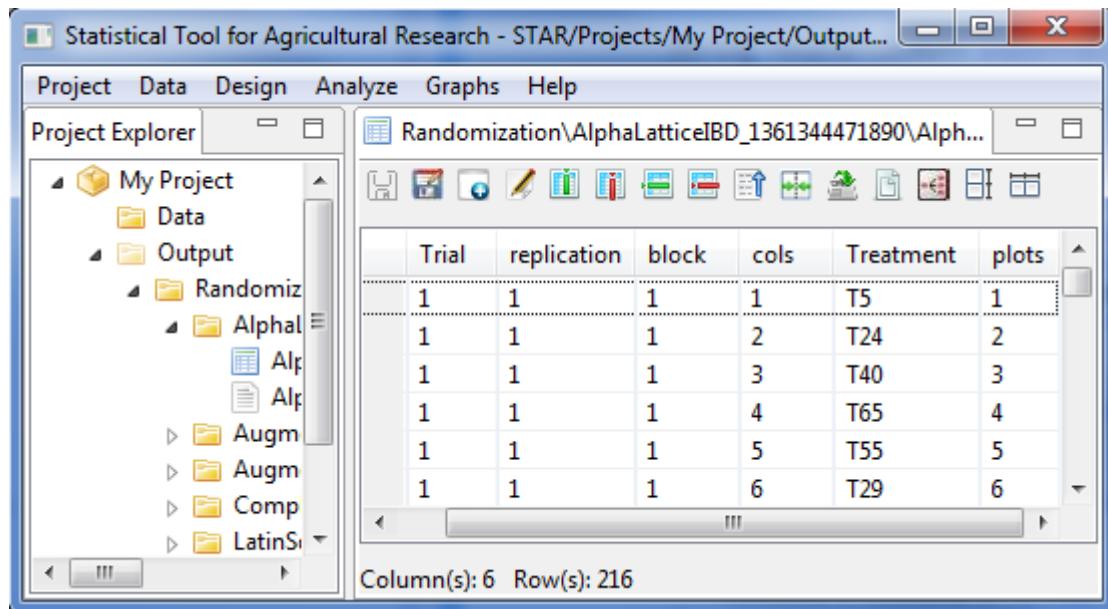
#### **Number of Trials**

For this example, suppose we want to generate a randomization for an experiment that will be conducted using Alpha Lattice design with 72 entries grouped into 8 with three replicates. The completed dialog box should appear as illustrated below:

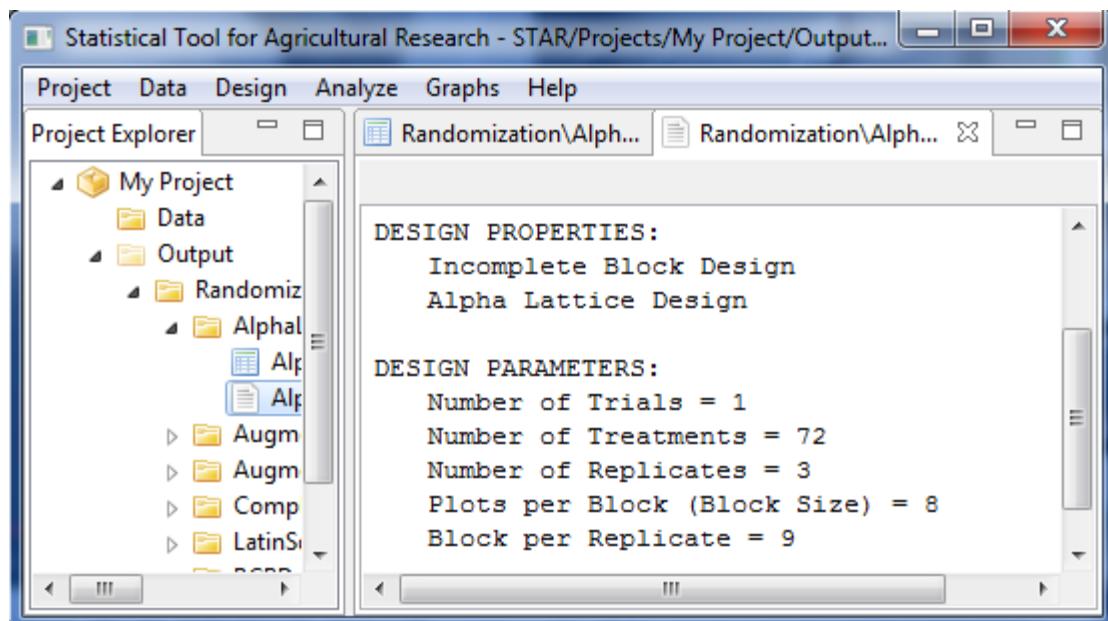


- Click the **OK** button to generate the randomization. The **Randomization** dialog box will be minimized and STAR will automatically display the csv data file created in the Data Viewer.

Sample csv data file displayed in the Data Viewer is shown below:



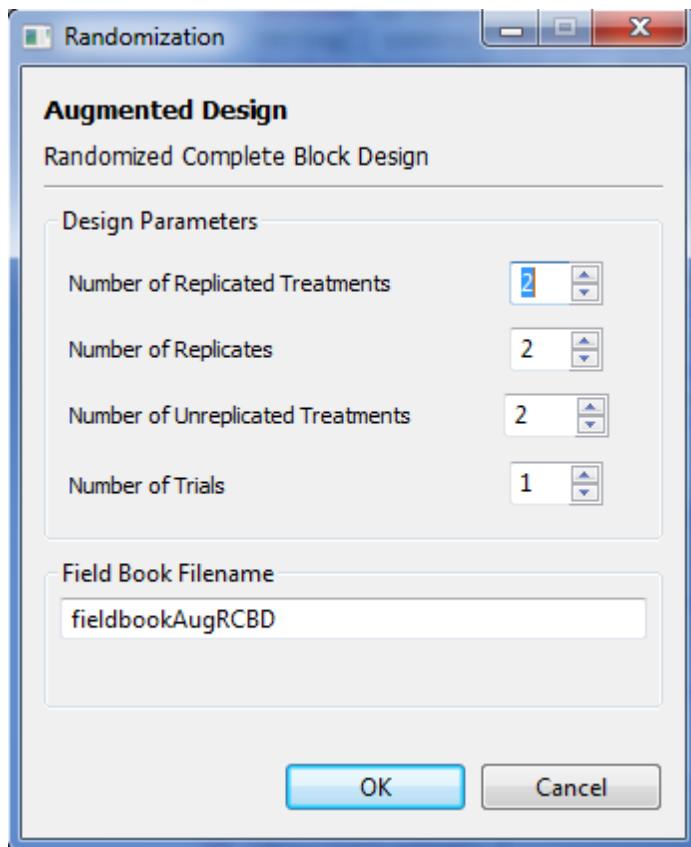
To view the text file created, double click the text file to view it in the **Result Viewer**. Sample *txt* file that was created is shown below:



## Augmented Design in Randomized Complete Block Design

The steps to generate randomization for Augmented Design in Randomized Complete Block are listed below:

- Click **Design | Augmented Design | Randomized Complete Block Design (RCBD)...** from the main window. The **Randomization** dialog box will appear.



- Specify the required fields and appropriate options.

**Number of Replicated Treatments**

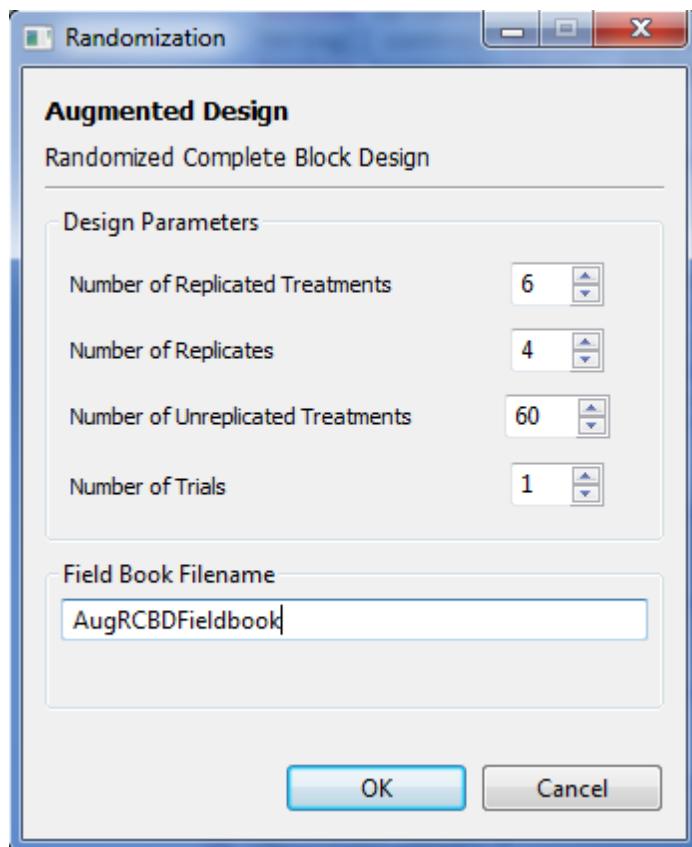
**Number of Replicates**

**Number of Unreplicated Treatments**

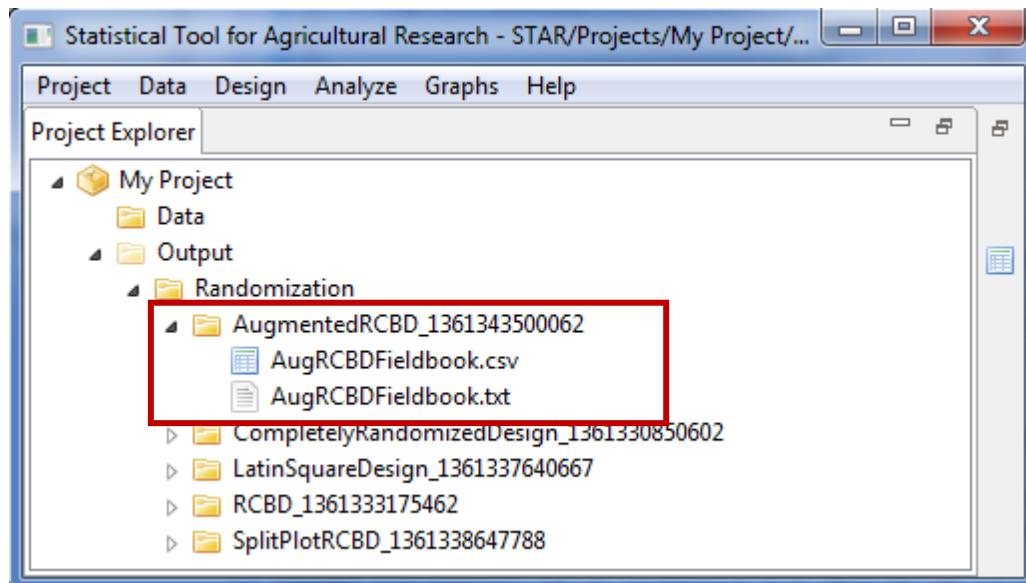
**Number of Trials**

**Field Book Filename**

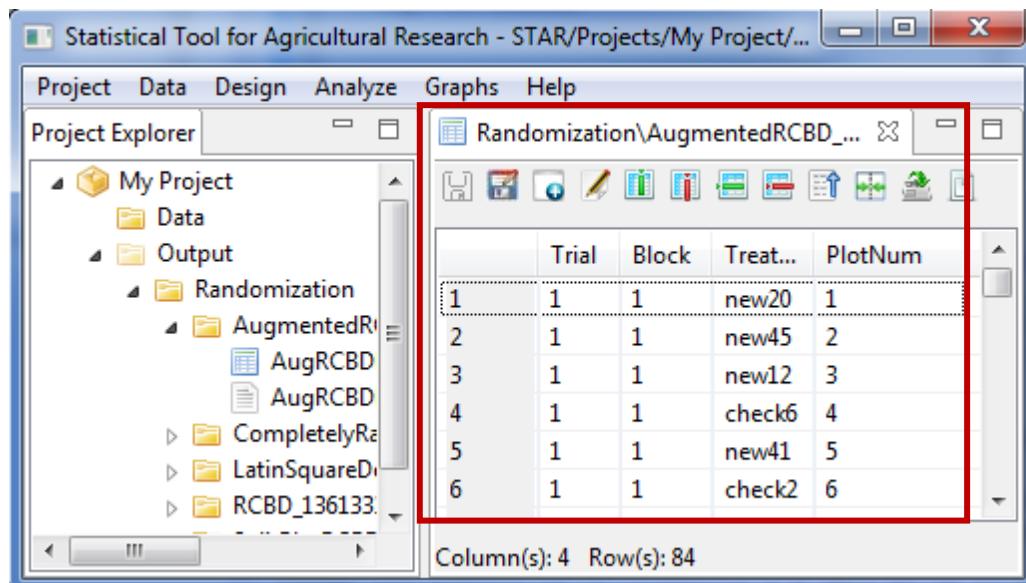
For this example, suppose we want to generate a randomization for an experiment which will be conducted using augmented design in randomized complete block involving four replicates. The experiment will use six replicated treatment and 60 unreplicated treatment (test entries). The completed dialog box should appear as illustrated below:



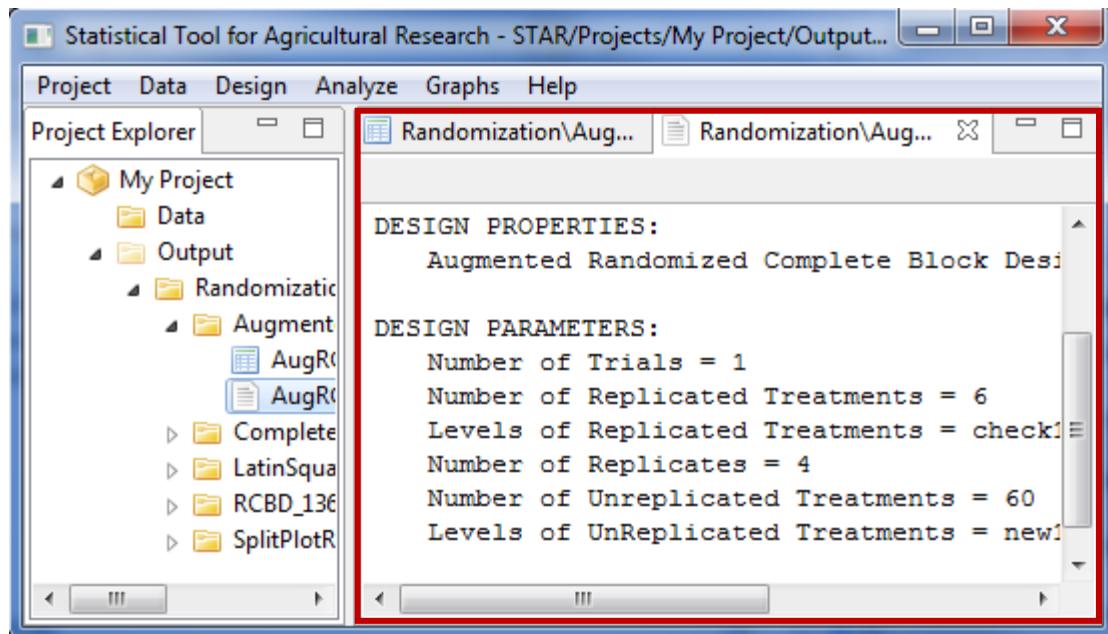
- Click the **OK** button to generate the randomization. The **Randomization** dialog box will be minimized and STAR will automatically display the csv data file created in the Data Viewer.



Sample csv data file displayed in the Data Viewer is shown below:



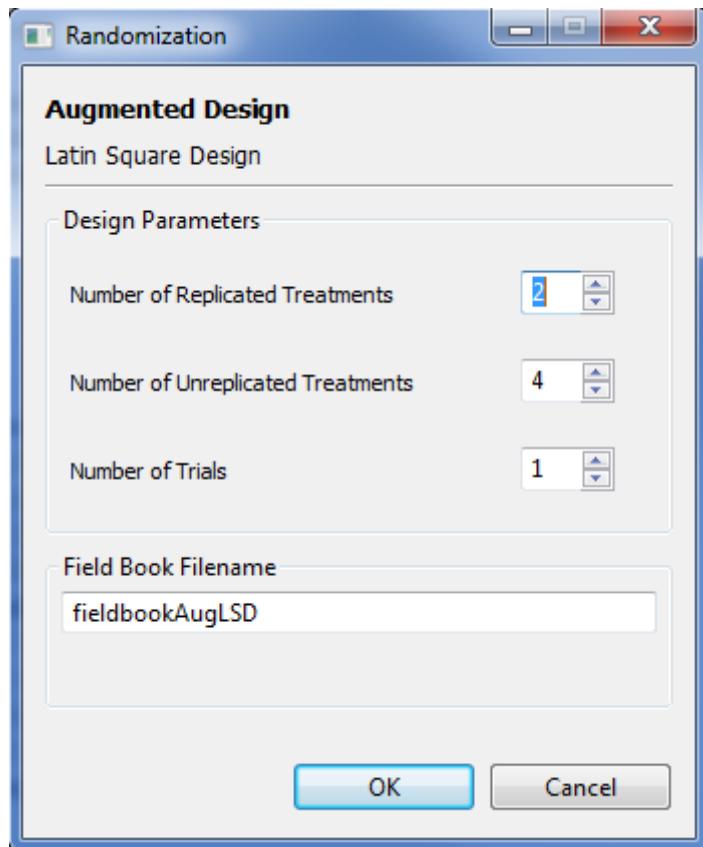
To view the text file created, double click the text file to view it in the **Result Viewer**.  
Sample *txt* file that was created is shown below:



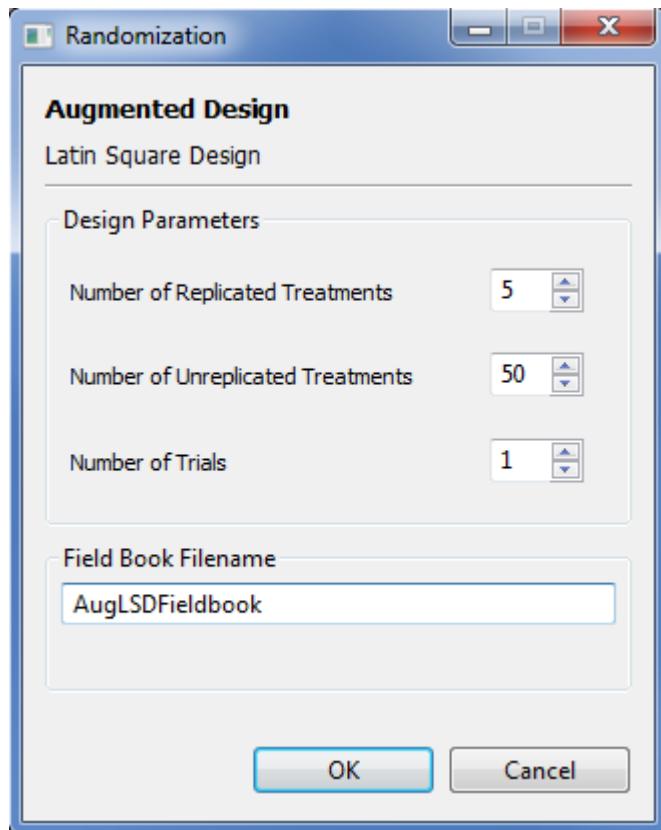
## Augmented Design in Latin Square Design

The steps to generate randomization for Augmented Design in Randomized Complete Block are listed below:

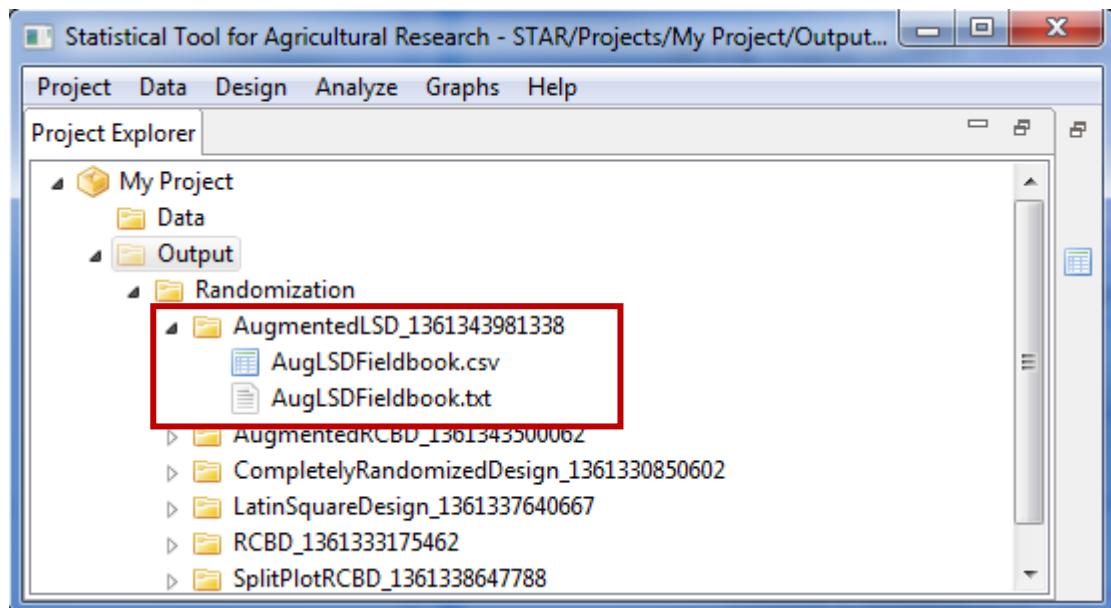
- Click **Design | Augmented Design | Latin Square Design...** from the main window. The **Randomization** dialog box will appear.



For this example, suppose we want to generate a randomization for an experiment which will be conducted using augmented design in randomized complete block involving four replicates. The experiment will use six replicated treatment and 60 unreplicated treatment (test entries). The completed dialog box should appear as illustrated below:



- Click the **OK** button to generate the randomization. The **Randomization** dialog box will be minimized and STAR will automatically display the csv data file created in the Data Viewer.



Sample csv data file displayed in the Data Viewer is shown below:

	Trial	Row	Column	withRxC	Treatment	PlotN
1	1	1	1	1	new21	1
2	1	1	1	2	new41	2
3	1	1	1	3	check2	3
4	1	2	1	1	new32	4
5	1	2	1	2	new37	5
6	1	2	1	3	check4	6

To view the text file created, double click the text file to view it in the **Result Viewer**. Sample *txt* file that was created is shown below:

DESIGN PROPERTIES:  
Augmented Latin Square Design (Augmented)

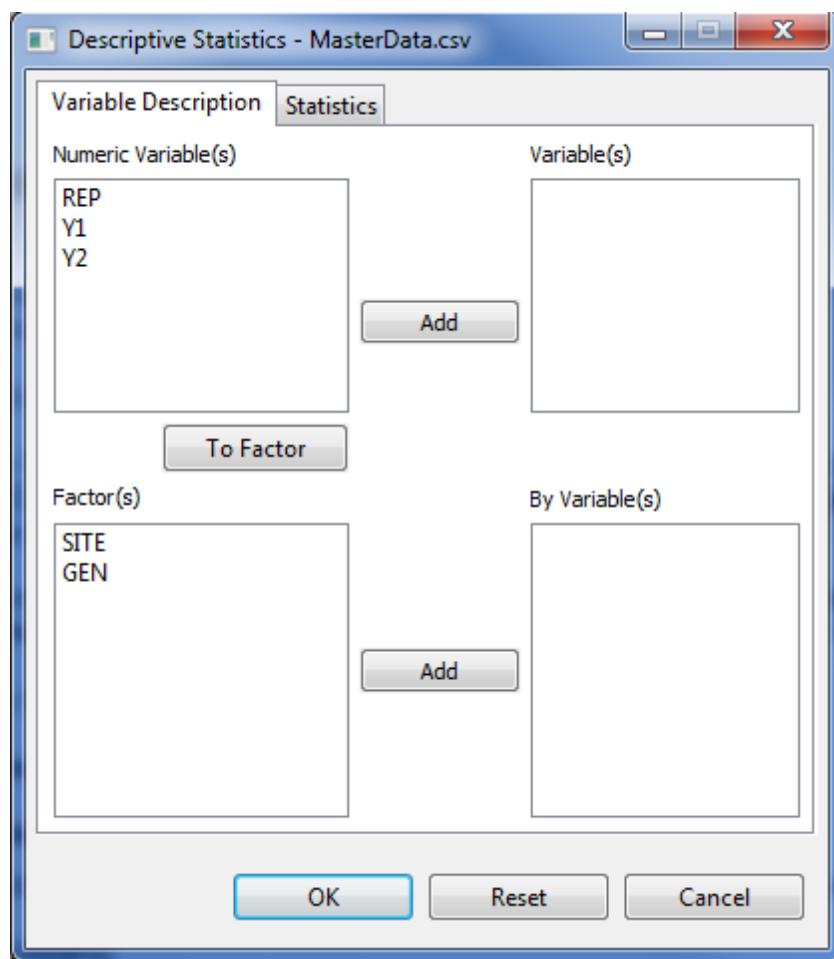
DESIGN PARAMETERS:  
Number of Trials = 1  
Number of Replicated Treatments = 5  
Levels of Replicated Treatments = check1  
Number of Unreplicated Treatments = 50  
Levels of UnReplicated Treatments = new1

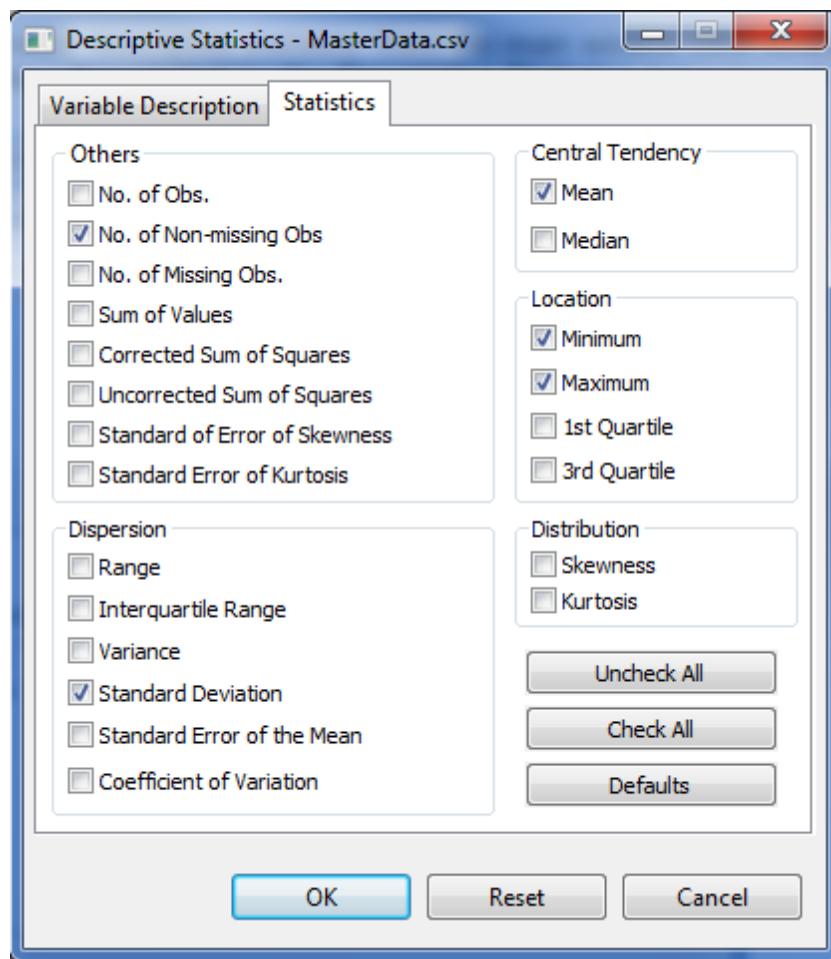
# Descriptive Statistics

The **Descriptive** procedure performs univariate summary statistics for several variables and/or per levels of grouping variables.

The steps to obtain numerical descriptive measures are listed below:

- On the **Project Explorer** panel, using the project named *My Project*, import the data *MasterData.csv* from the *Data* folder of the project named *SampleProject*. Double-click the file to open it and view it in the Data Viewer.
- To generate descriptive statistics, from the main window click **Analyze | Descriptive Statistics | Descriptive....** The **Descriptive Statistics** dialog box will appear.





- Specify the required field and appropriate options for the analysis.

### **Variable Description Tab**

This tab lets the user identify the variables and grouping variable(s) where descriptive statistics will be computed.

#### Variable(s)

This field is required and at least one entry is needed for the analysis to proceed.

#### By Variable(s)

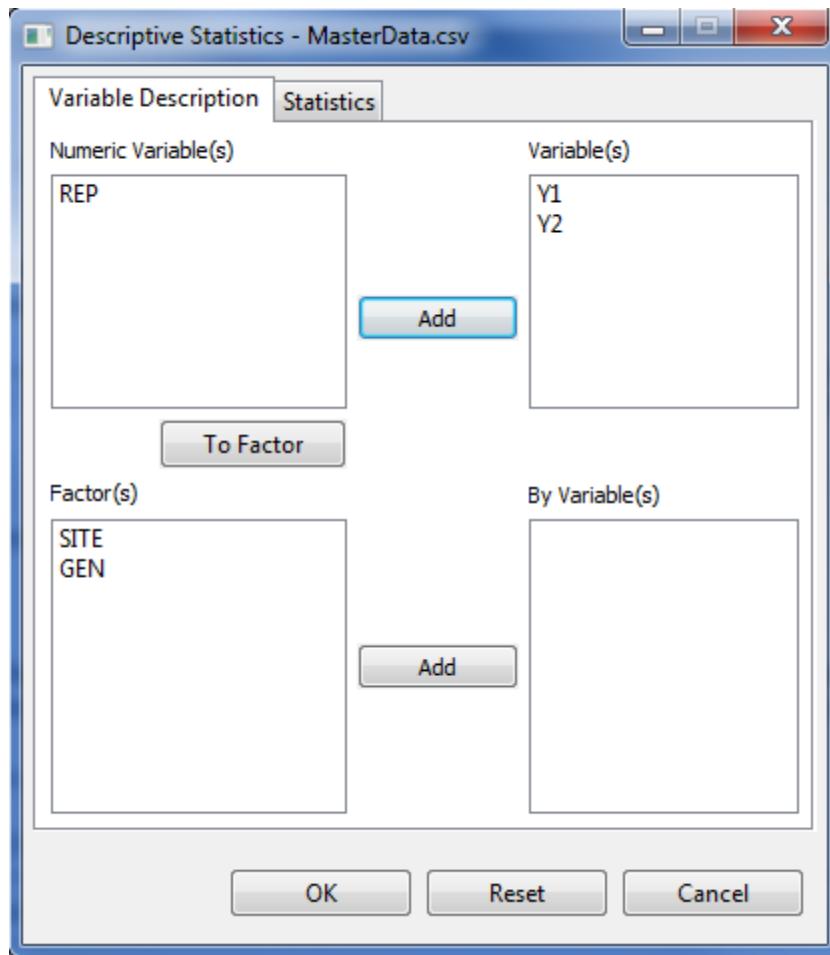
This field is optional. If a **By Variable(s)** is specified, it will generate descriptive statistic per category of the **By Variable**.

### **Statistics Tab**

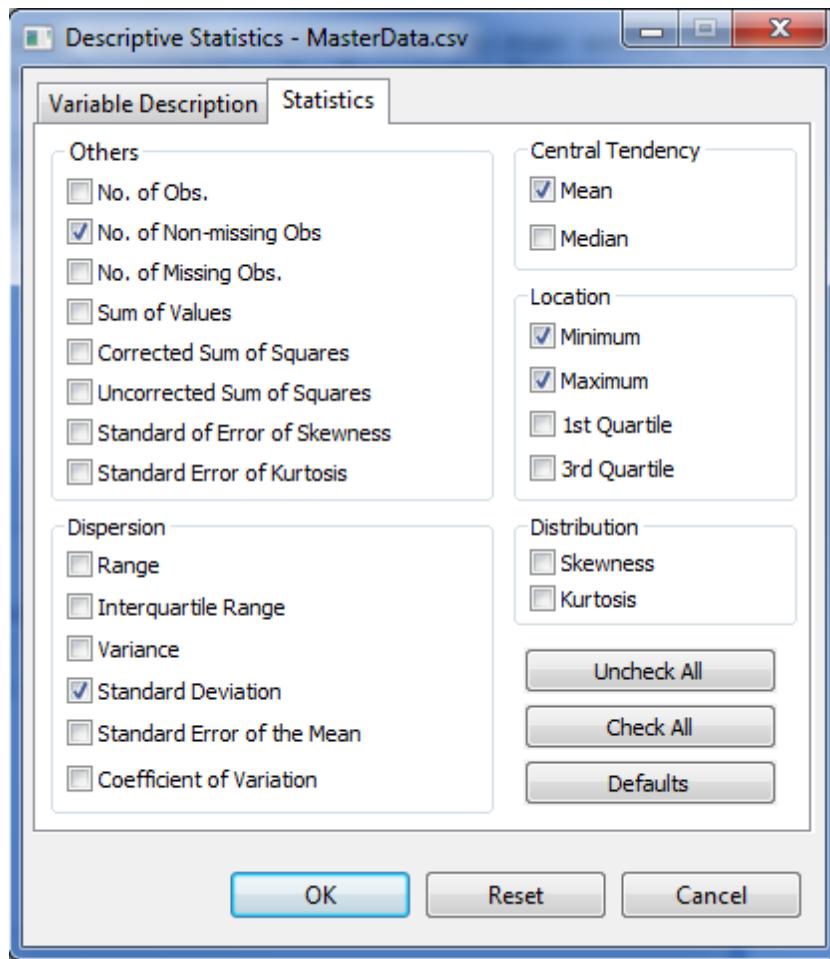
This tab lets the user identify the numerical descriptive measures to be displayed. By default, the procedure will display five statistics, namely: number of non-missing

observations (NNMissObs), minimum (min), maximum (max), mean, and standard deviation (stdev). To request for all statistics, click the **Check All** button of the **Statistics** tab. User may click on the **Uncheck All** button to remove previously selected items and start with a new selection.

For the example, suppose we want to compute the descriptive statistics of variables Y1 and Y2. The completed **Variable Description** tab should appear as illustrated below:



- The completed **Statistics** tab should appear as illustrated below:

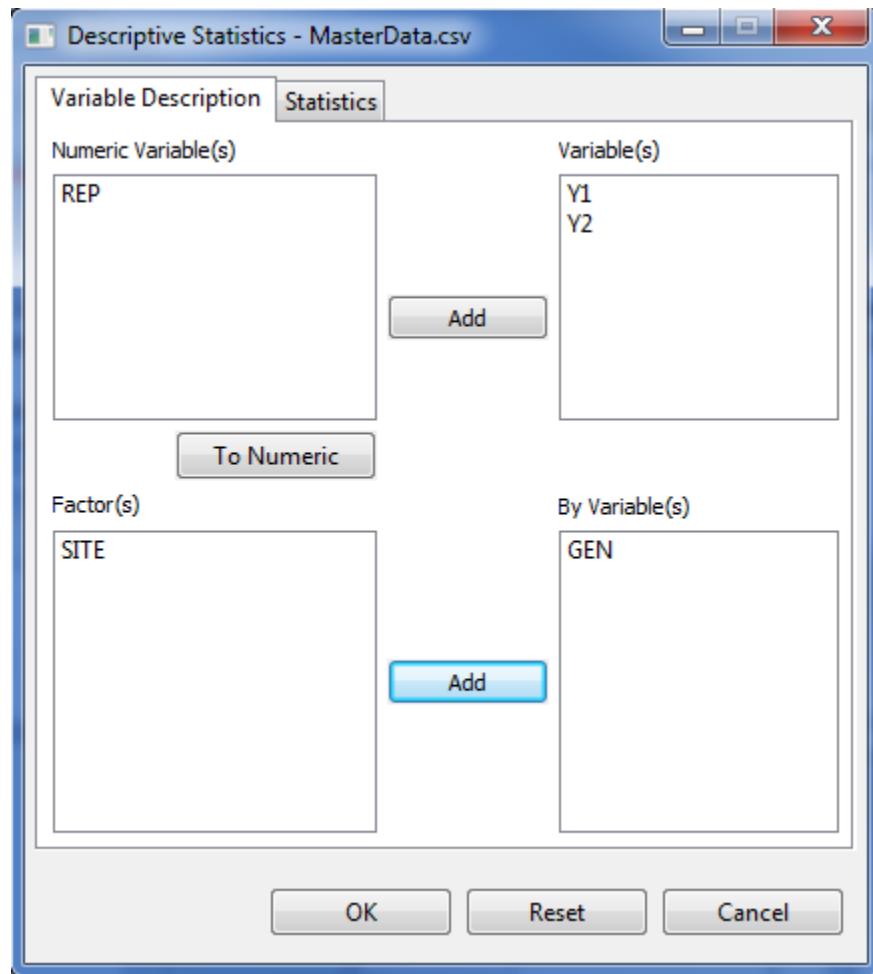


- Click the OK button to generate the summary statistics. The Descriptive Statistics dialog box will be minimize and STAR activates the Output Viewer tab.
- Sample output of the descriptive statistics is shown below:

#### DESCRIPTIVE STATISTICS

Variable	N_NonMissObs	Min	Max	Mean	StdDev
Y1	96	14.00	151.00	130.43	16.05
Y2	96	92.60	163.50	124.50	15.05

- Suppose we want to compute the descriptive statistics for variables Y1 and Y2 per level of GEN. The completed **Variable Description** tab should appear as illustrated below:



- Click the **Ok** button to generate the summary statistics. Sample output of the descriptive statistics is shown below:

## DESCRIPTIVE STATISTICS

Variable	GEN	N_NonMissObs	Min	Max	Mean	StdDev
Y1	Gen1	12	113.00	144.00	132.33	10.50
Y1	Gen2	12	106.00	150.00	134.17	11.07
Y1	Gen3	12	116.00	148.00	132.42	9.46
Y1	Gen4	12	14.00	151.00	122.92	36.36
Y1	Gen5	12	106.00	145.00	129.42	11.84
Y1	Gen6	12	121.00	143.00	133.25	6.84
Y1	Gen7	12	109.00	149.00	130.00	12.05
Y1	Gen8	12	106.00	144.00	128.92	12.26
Y2	Gen1	12	92.60	163.50	128.87	20.06
Y2	Gen2	12	95.20	149.30	119.24	14.21

Y2	Gen3	12	93.10	148.40	120.09	15.03
Y2	Gen4	12	100.50	150.70	124.54	16.45
Y2	Gen5	12	98.60	160.70	125.22	16.83
Y2	Gen6	12	110.20	130.60	119.24	5.54
Y2	Gen7	12	117.90	159.30	130.05	13.78
Y2	Gen8	12	111.70	150.90	128.72	13.98

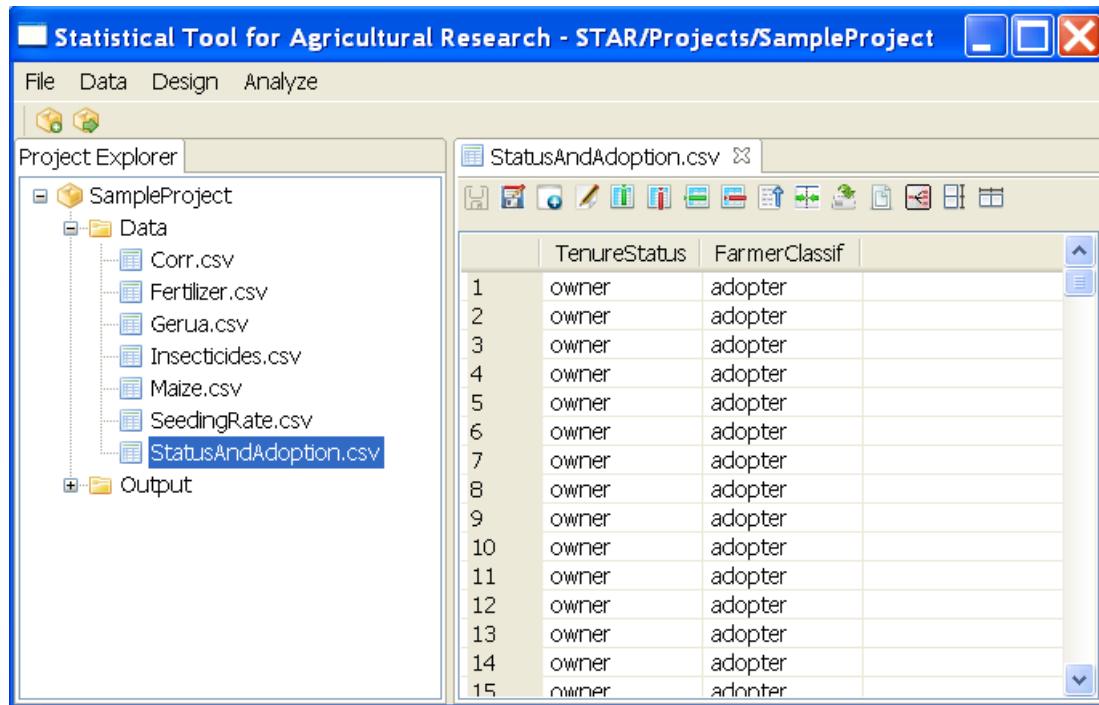
---

# Cross Tabulation

The cross tabulation forms two-way tables and provides a variety of tests and measures of association for a two-way tables.

The steps to perform Cross Tabulation are listed below:

- On the **Project Explorer** panel, using the project named *My Project*, import the data *MasterData.csv* from the *Data* folder of the project named *SampleProject*. Double-click the file to open it and view it in the Data Viewer.



- To generate cross table, from the main window click **Analyze | Descriptive Statistics | Cross Tabulation**. The **Cross Tabulation** dialog box will appear.
- Specify the required field and the appropriate options for the analysis.

## Variable Description Tab

For the analysis to proceed, the **Row Variable(s)** list box and the **Column Variable(s)** list box from the **Variable Description** tab should both have at least one entry and at least one checkbox should be tick from the **Option** tab.

### **Options Tab**

For the analysis to proceed, at least one checkbox should be tick in this tab.

#### Cell Display

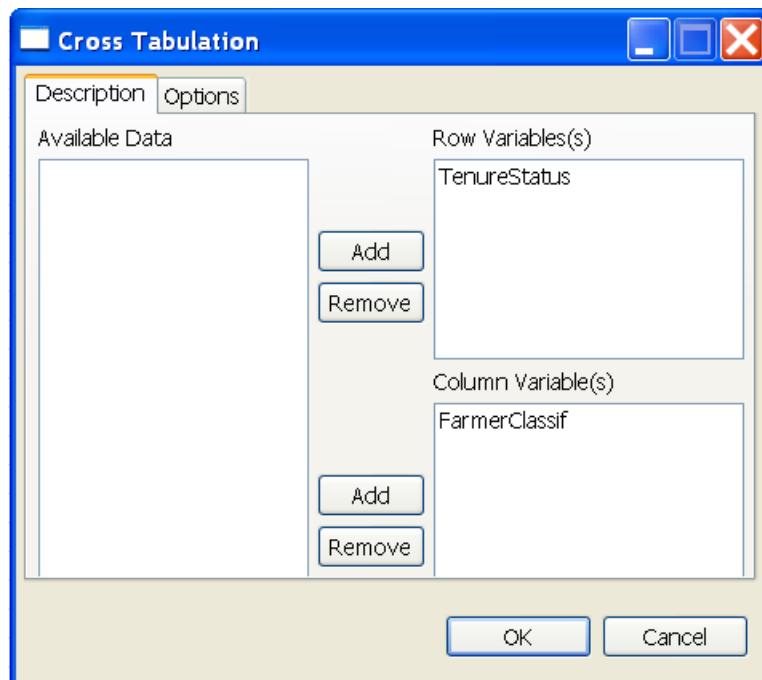
The Crosstabs procedure displays the observed and expected frequency. Each cell of the table may contain counts and percentages.

- Counts  
Display the number of observed frequency and number of expected frequency. By default, the observed frequency is displayed.
- Percentages  
This field is optional. It may display the row, column or the total percentages.
- Residuals

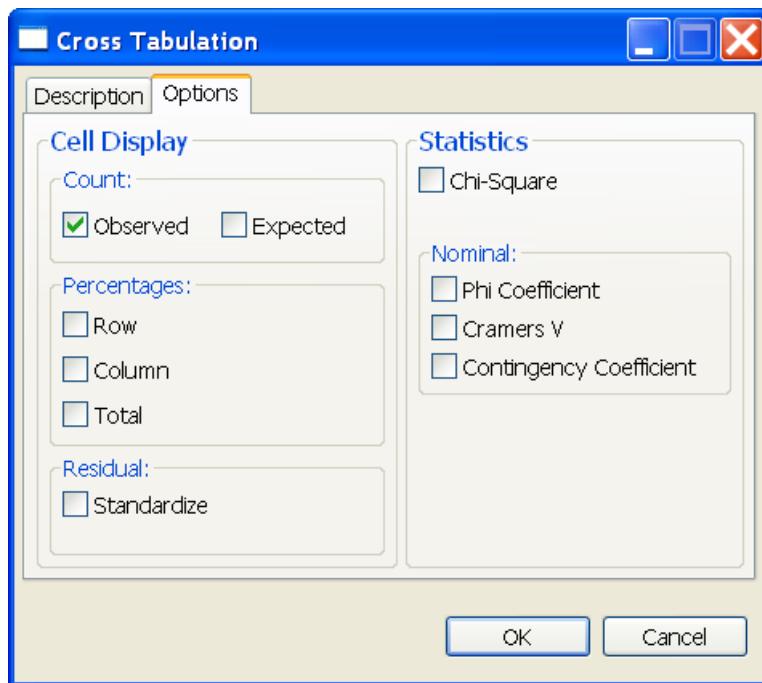
#### Statistics

- Chi-square  
Select Chi-square to calculate the Chi-square Test of Independence and the likelihood-ratio chi-square.
- Nominal  
For nominal data, three measure of association based on chi-square (Phi Coefficient, Cramer's V and Contingency Coefficient) may be requested.

For the example, the completed **Variable Description** tab should appear as illustrated below:



The completed **Options** tab should appear as illustrated below:



- Click the **Ok** button. Sample output of the analysis using the default option is shown below:

#### CROSS TABULATION

Table of Observed Frequency: TenureStatus by FarmerClassif

		FarmerClassif			
TenureStatus	adopter	<u>nonadopter</u>	Total		
fixed-rent		4	3	7	
owner		102	26	128	
share-rent		42	10	52	
Total		148	39	187	

- Sample output of the analysis if all checkbox is tick is shown below:

#### CROSS TABULATION

Table of TenureStatus by FarmerClassif

		FarmerClassif			
TenureStatus		adopter	nonadopter	Total	
fixed-rent	Obs Freq	4	3	7	
	Expected Freq	5.5401	1.4599	7.0000	
owner	Obs Freq	102	26	128	
	Expected Freq	101.3048	26.6952	128.0000	
share-rent	Obs Freq	42	10	52	
	Expected Freq	41.1551	10.8449	52.0000	
Total	Obs Freq	148	39	187	
	Expected Freq	148.0000	39.0000	187.0000	

#### Statistics for Table TenureStatus by FarmerClassif

Statistics	DF	Value	Prob
Pearson Chi-Square	2	2.1589	0.3398

Likelihood Ratio Chi-Square	2	1.8236	0.4018
Phi Coefficient		0.1074	
Contingency Coefficient		0.1068	
Cramer's V		0.1074	
-----			
* Cells with Expected Frequency < 5: 2 of 6 (33.33%)			

# Normality Test

The Test for Normality menu display normality test for at least one numeric variable. There are five procedures available in this menu, namely: Shapiro-Wilk, Shapiro-Francia, Lilliefors (Kolmogorov-Smirnov), Cramer-Von Mises and the Anderson-Darling test for normality.

The Shapiro-Wilk test for normality can be used if the number of non-missing observations is between 3 and 5000. While the Shapiro-Francia test for normality can be used if the number of non-missing observations is between 5 and 5000. The Lilliefors test for normality can be used if the number of non-missing observations is greater than 4. The Cramer-Von Mises and the Anderson-Darling test for normality can both be used if the number of non-missing observations is greater than 7.

The steps to perform Normality Test are listed below:

- On the **Project Explorer** panel, using the project named *My Project*, import the data *MasterData.csv* from the *Data* folder of the project named *SampleProject*. Double-click the file to open it and view it in the Data Viewer.
- Click **Analyze | Descriptive Statistics | Normality Test....** The Normality Test dialog box will appear.
- Opening the data for the first time, Rep field is regarded by STAR as numerical variables, they need to be changed as factors. Choose the variable and click on the To Factor button.
- Specify the required field and appropriate options for the analysis.

## Variable Description Tab

### Variables

This field is required. At least one item should be specified for the analysis to proceed.

**By Variables**

This field is optional. If a **By Variable(s)** is specified, it will perform test for normality per level of the **By Variable(s)**.

**Options Tab**

**Test Procedure**

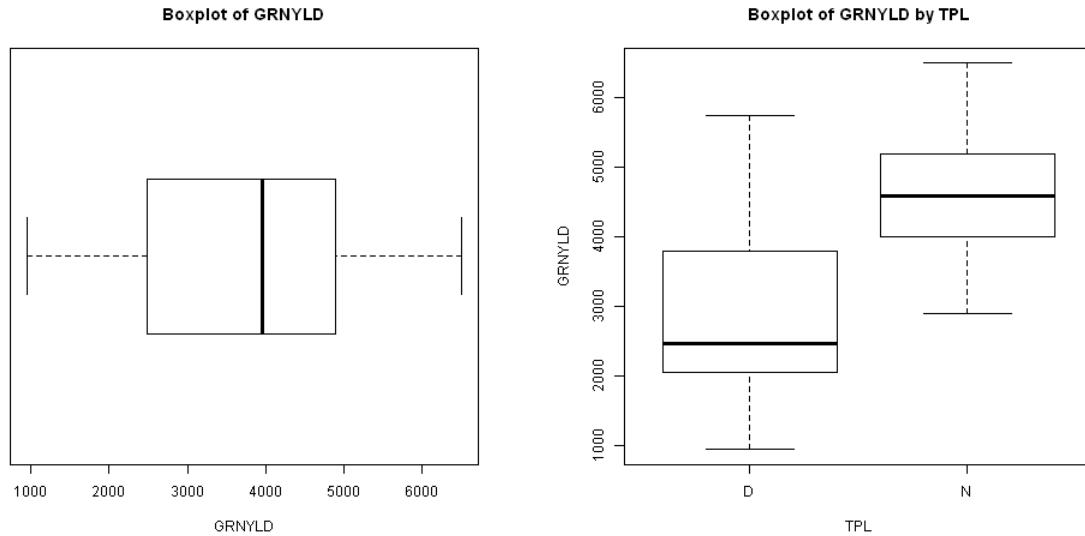
This option is required. At least one test procedure should be tick for the analysis to proceed. By default, the Shapiro-Wilk test is performed.

**Graph**

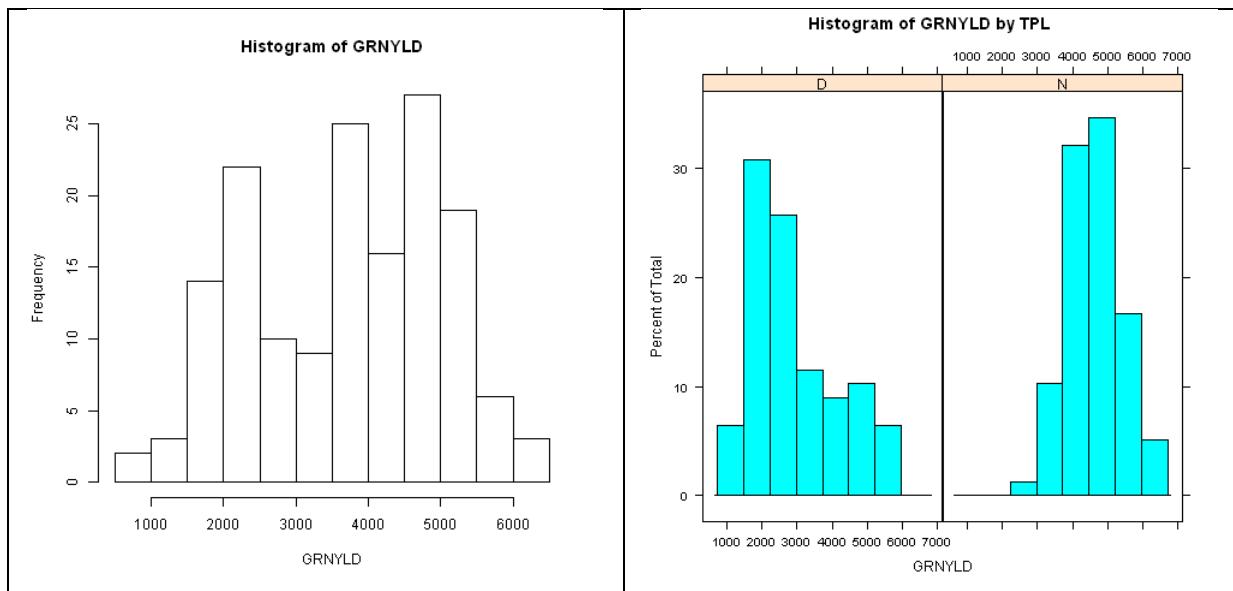
The user has the option to display the box plot and the histogram.

For the example, the completed dialog box should appear as shown below:

- Click Ok button to perform the test. The Normality Test dialog box will be minimized and STAR activates the Output Viewer tab.
- Sample output of the normality test for variable GRNYLD.
- Sample output of the normality test for variable *GRNYLD* by *TPL*.
- If at least one of the graphs is chosen it can be viewed in the **Graph Viewer** tab. Below is the sample output if the boxplot was chosen:



- Below is the sample output if the histogram was chosen:



# Heterogeneity Test

The Heterogeneity Test menu perform test for equally of variances. There are two procedures available in this menu, namely: Bartlett's test and the Levene's test.

The steps to perform Heterogeneity test are listed below:

- On the **Project Explorer** panel, using the project named *My Project*, import the data *MasterData.csv* from the *Data* folder of the project named *SampleProject*. Double-click the file to open it and view it in the Data Viewer.
- Click **Analyze | Descriptive Statistics | Heterogeneity Test**. The **Heterogeneity Test** dialog box will appear.
- Opening the data for the first time, *Rep* field is regarded by R as numerical variables, they need to be changed as factors. Choose the variable and click on the **To Factor** button.
- Specify the required field and appropriate options for the analysis.

## **Variable Description Tab**

### Variables

This field is required. At least one item should be specified for the analysis to proceed.

### By Variables

This field is required. All items specified here should contain two or more levels.

## **Options Tab**

### Test Procedure

This option is required. At least one test procedure should be tick for the analysis to proceed. By default, the Bartlett's test for homogeneity of variances is performed.

Graph

The user has the option to display the box plot and the histogram.

For the example, the complete dialog box should appear as shown below:

Suppose we want to determine whether the variances are equal among the levels of *TPL* for variables *DFF*, *PLHT*, *PNCLE* and *GRNYLD*. For the *example*, the completed **Variable Description** tab should appear as illustrated below:

The completed **Option** tab should appear as illustrated below:

- Click Ok button to perform the test. The Normality Test dialog box will be minimized and STAR activates the Output Viewer tab.
- Sample output of the normality test for variable GRNYLD.

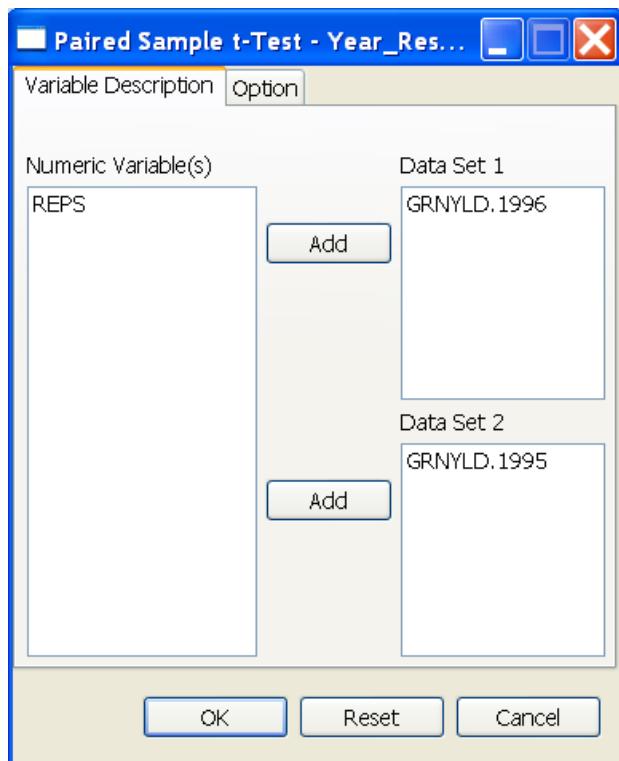
# t-Test

## One Sample t-tests

The One Sample *t*-test procedure determine whether the mean of one variable differ from the hypothesized value. It assumes that the samples are randomly taken from the population of interest and that the observations are obtained from a normal distribution.

The steps to perform Heterogeneity test are listed below:

- On the **Project Explorer** panel, using the project named *My Project*, import the data *MasterData.csv* from the *Data* folder of the project named *SampleProject*. Double-click the file to open it and view it in the Data Viewer.
- Click **Analyze | t-Test | One Sample**. The **One Sample** dialog box will appear.
- Opening the data for the first time, *Rep* field is regarded by R as numerical variables, they need to be changed as factors. Choose the variable and click on the **To Factor** button.
- Specify the required field and appropriate options for the analysis.



## Paired Sample *t*-tests

The paired sample *t*-test is used to compares the means of paired or related samples. It assumes that the samples are randomly taken from the population of interest and the population of differences is normally distributed.

The steps to perform paired *t*-test are listed below:

- Locate the dataset *Paired\_.csv* from the *Data* folder of the project named *SampleProject* in the Project Explorer.

The screenshot shows the Statistical Tool for Agricultural Research interface. The title bar reads "Statistical Tool for Agricultural Research - STAR/Projects/SampleProject". The menu bar includes File, Data, Design, and Analyze. The Project Explorer window on the left shows a project named "SampleProject" with a "Data" folder containing various CSV files, one of which is "Paired\_Yield.csv" (highlighted in blue). The Data View window on the right displays the contents of "Paired\_Yield.csv" as a table with three columns: "cows", "before", and "after". The data is as follows:

	cows	before	after
1	1	0.6	1.2
2	2	0.3	1.6
3	3	0.3	1.5
4	4	0.6	1.9
5	5	1.1	1.9
6	6	0.3	2.1
7	7	1	3.1
8	8	1.4	4
9	9	1.4	3.9
10	10	1.5	3.8
11	11	2	4.2
12	12	1.6	4.1
13	13	1.8	3.8
14	14	1.3	2.8
15	15	1.2	2.9
16	16	1.3	3.9
17	17	2.9	4.1
18	18	1.6	3.6

- Click Analyze | t-Tests | Paired Samples. The Paired Samples dialog box will appear.
- Specify the required field and appropriate options for the analysis.

### Options Tab

The screenshot shows the "Paired Sample t-Test" dialog box for "Paired\_Yield.csv". The "Option" tab is selected. The "Alternative Hypothesis" is set to "two.sided". Under "Display", "Summary Statistics" and "Confidence Interval" (set at 95.00%) are checked. Under "Test for Normality", several tests are listed: Shapiro-Wilk, Shapiro-Francia, Lilliefors (Kolmogorov-Smirnov), Cramer-Von Mises, and Anderson-Darling. At the bottom are OK, Reset, and Cancel buttons.

Alternative Hypothesis

User can select a one-tailed or two-tailed test. The default alternative hypothesis used is that for the two-sided test.

Level of Significance

This will be used to determine if the two groups have equal variance. Its default value is 0.05. The user can change this value by specifying a numeric value from zero to 1.

Display Summary Statistics

If this option is selected, a summary table with number of observations, minimum, maximum, mean and standard deviation will be displayed.

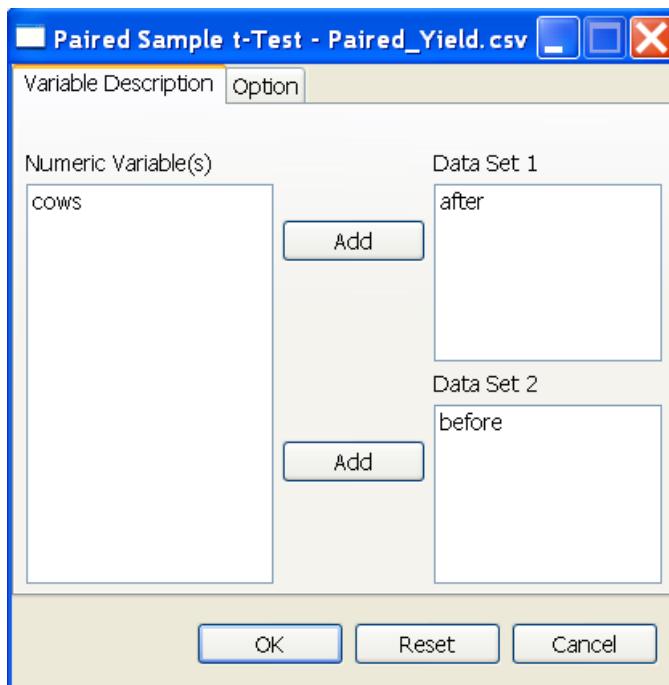
Display Confidence Interval

If this option is selected, a confidence interval of the mean will be displayed. If this is selected, by default, a 95% confidence interval is displayed. Valid value is between 90% to 99%.

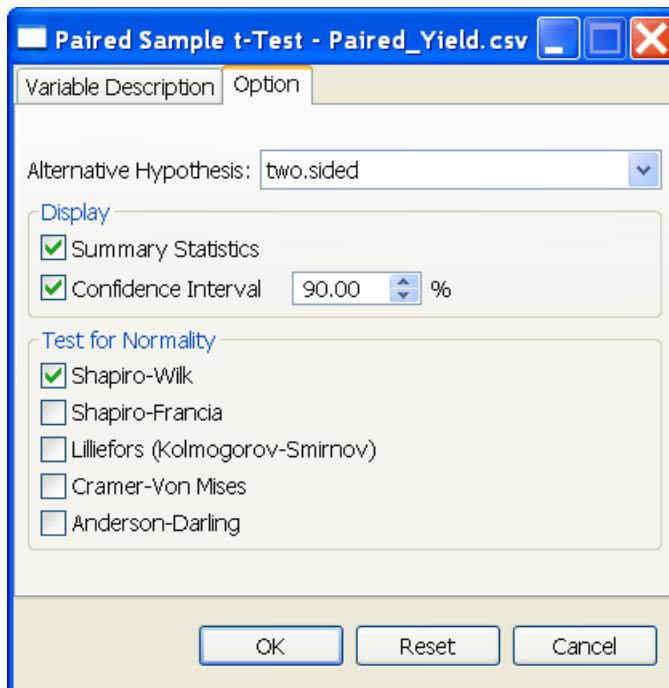
Test Procedure

If at least one option is selected, it displays the test for normality test for each level of the **Grouping Variable**. There are five available test for normality procedure.

For the example, the completed **Variable Description** tab should appear as illustrated below:



The completed **Option** tab should appear as illustrated below:



- Click the **OK** button to perform the analysis.
- Sample output of the analysis is shown below.

Test for Normality

---

Difference	Method	Stat	Value	p Value
after - before	Shapiro-Wilk	W	0.9420	0.3132

---

Descriptive Statistics

---

Difference	N	Lower CI*	Mean	Upper CI*	StdDev	SE_Mean
after - before	18	1.53	1.79	2.04	0.6230	0.1468

---

\* At 90% Confidence Level.

PAIRED SAMPLE t-TEST,  $h_0 = 0$

---

Difference	DF	t Value	Pr >  t
after - before	17	12.18	0.0000

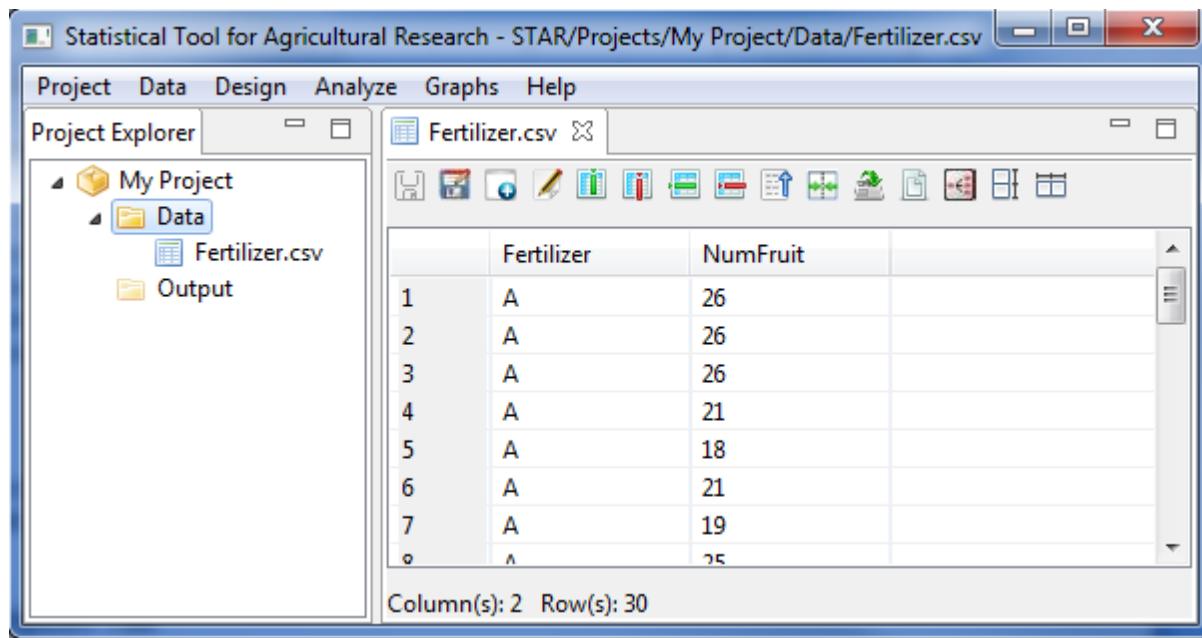
---

## Independent Sample t-tests

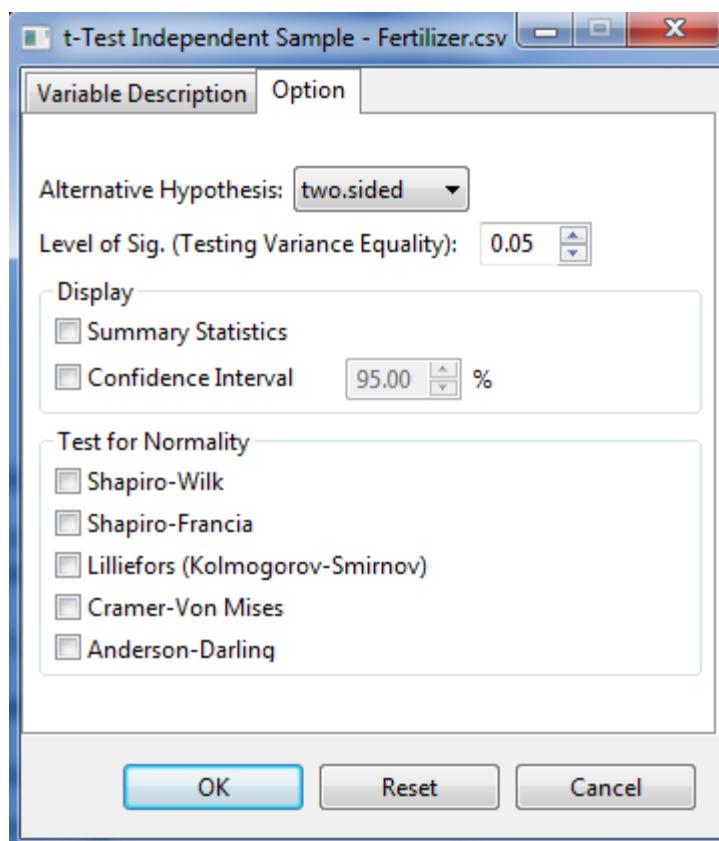
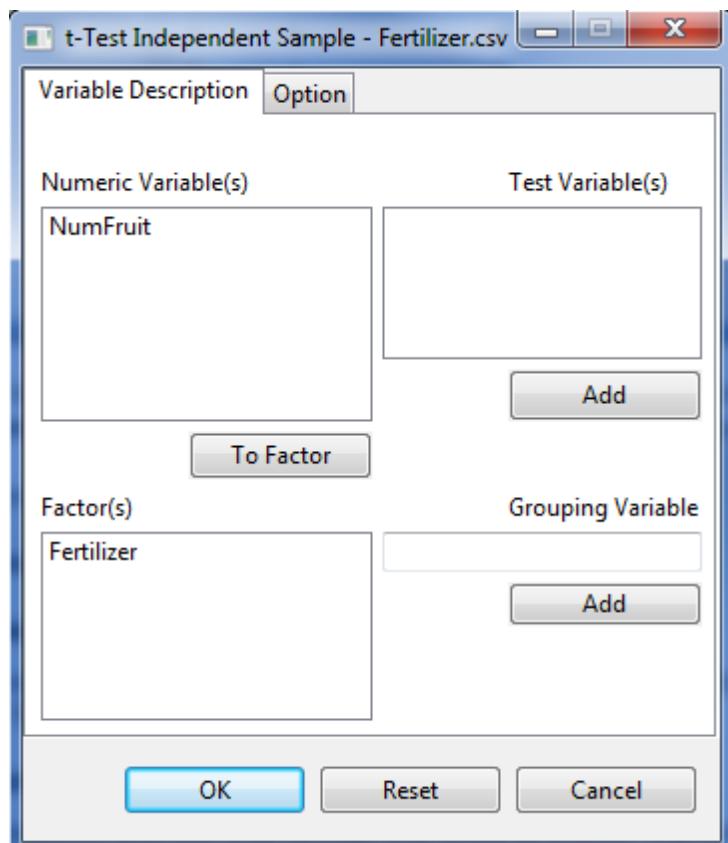
The independent sample *t*-test is used to determine whether the means between two groups or populations are equal. It assumes that (i) the samples are drawn independently from each population; (ii) the samples from each population are randomly taken; and (iii) the observations from each population are obtained from a normal distribution.

The steps to perform *t*-Test for two independent samples are listed below:

- On the **Project Explorer**, using the project named *My Project*, import the data *Fertilizer* from STAR Package. Double-click the file to open and view it in the Data Viewer. The file contains the number of fruits (*NumFruit*) from trees sprayed by two fertilizers (*Fertilizer – A and B*). Suppose we want to test the hypothesis that the mean numbers of fruits from trees sprayed by the two fertilizers are the same.



- To perform *t*-test on two independent samples, from the main window click **Analyze | t-test | Independent Sample....** The **Two Independent Sample** dialog box will appear.



- Specify the required field and appropriate options for the analysis.

### **Variable Description Tab**

#### **Test Variable(s) List Box**

This field is required for the analysis to proceed. This field need at least one entry and should come from the **Numeric Variable(s)** list box.

#### **Grouping Variable List Box**

This field is required and will only accept one entry at a time. The entry must come from the **Factor(s)** list box. The entry should have only two levels.

### **Options Tab**

#### **Alternative Hypothesis Drop-down box**

User can select a one-tailed or two-tailed test. The default alternative hypothesis used is that for the two-sided test.

#### **Level of Significance Spinbox**

This will be used to determine if the two groups have equal variance. Its default value is 0.05. The user can change this value by specifying a numeric value from zero to 1.

#### **Summary Statistics Checkbox**

If this option is selected, a summary table with number of observations, minimum, maximum, mean and standard deviation will be displayed.

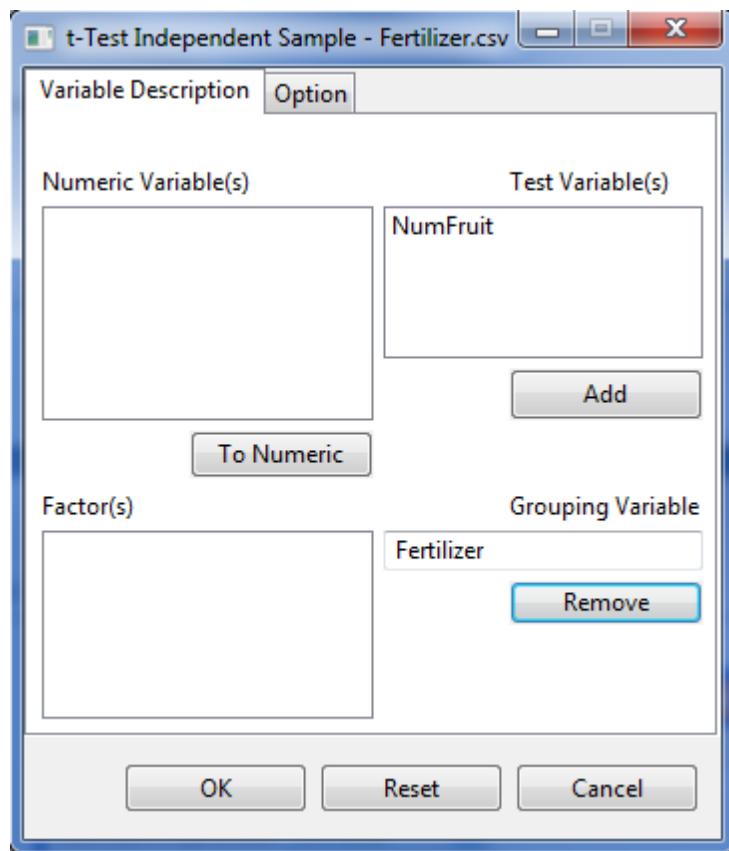
#### **Confidence Interval Checkbox**

If this option is selected, a confidence interval of the mean will be displayed. If this is selected, by default, a 95% confidence interval is displayed. Valid value is between 90% to 99%.

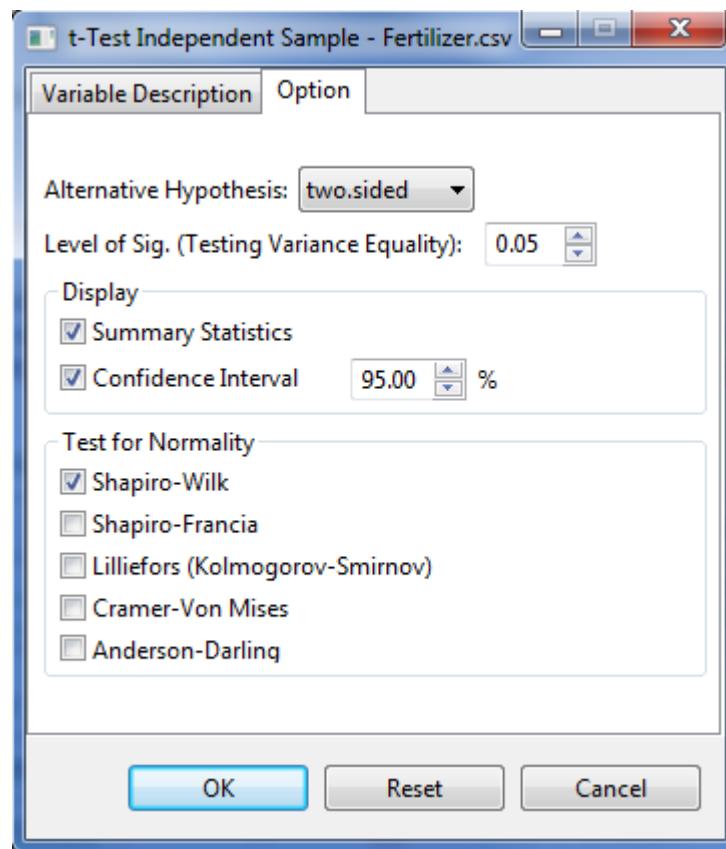
#### **Test for Normality Frame**

If at least one option is selected, it displays the test for normality test for each level of the **Grouping Variable**. There are five available test for normality procedure.

For the example, the completed **Variable Description** tab should appear as illustrated below:



The completed **Option** tab should appear as illustrated below:



- Click the **OK** button to perform the analysis.
- Sample output of the analysis is shown below. The default output of the t-Test for two independent samples includes the test for equality of variances. Depending on the result of the equality of variances, Pooled t-Test or a t-test with satterwaite adjustment is computed.

```
TEST FOR NORMALITY
-----
Grp      Level  Variable  Method      Stat      Value   p Value
-----
Fertilizer A      NumFruit  Shapiro-Wilk W      0.9726  0.8950
Fertilizer B      NumFruit  Shapiro-Wilk W      0.9198  0.1916
-----

Equality of Variances
-----
Variable  Method      Num DF   Den DF   F Value   Pr > F
-----
NumFruit  Folded F      14       14      1.47    0.4820
-----
```

TWO INDEPENDENT SAMPLE t-TEST,  $h_0 = 0$

---

Variable	Method*	Variances	DF	t Value	Pr >  t
NumFruit	Pooled	Equal	28	1.91	0.0663

---

\* At 0.05 level of significance.

# **Chi-Square Test**

The Chi-Square test

**Goodness of fit Test**

**Test of Independence**

# Test on Proportion

# Analysis of Variance

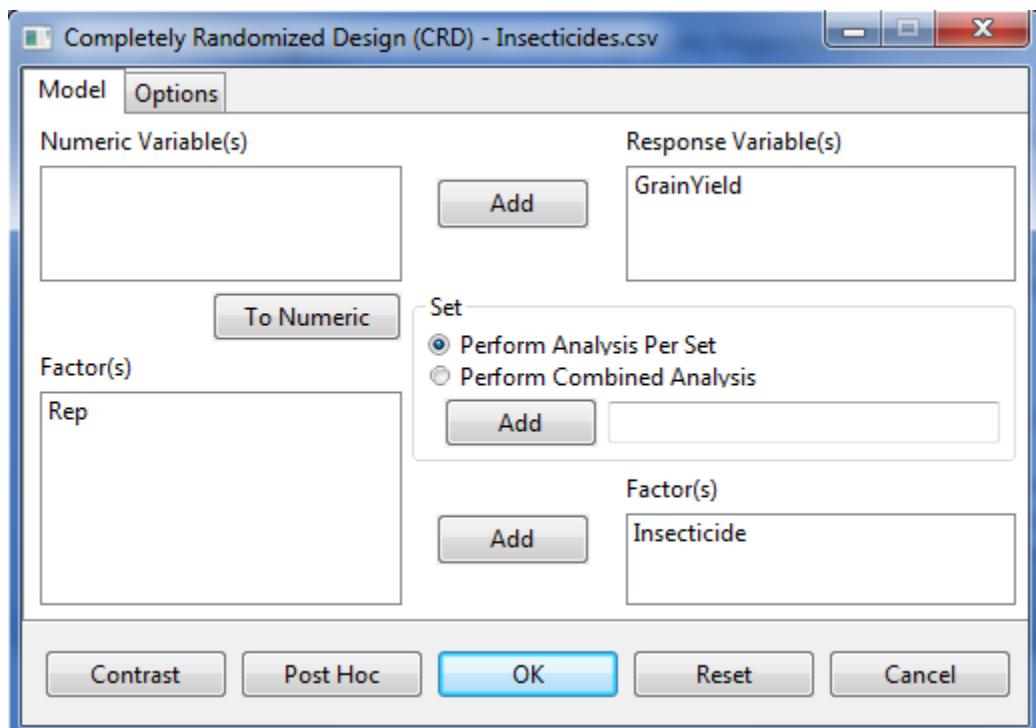
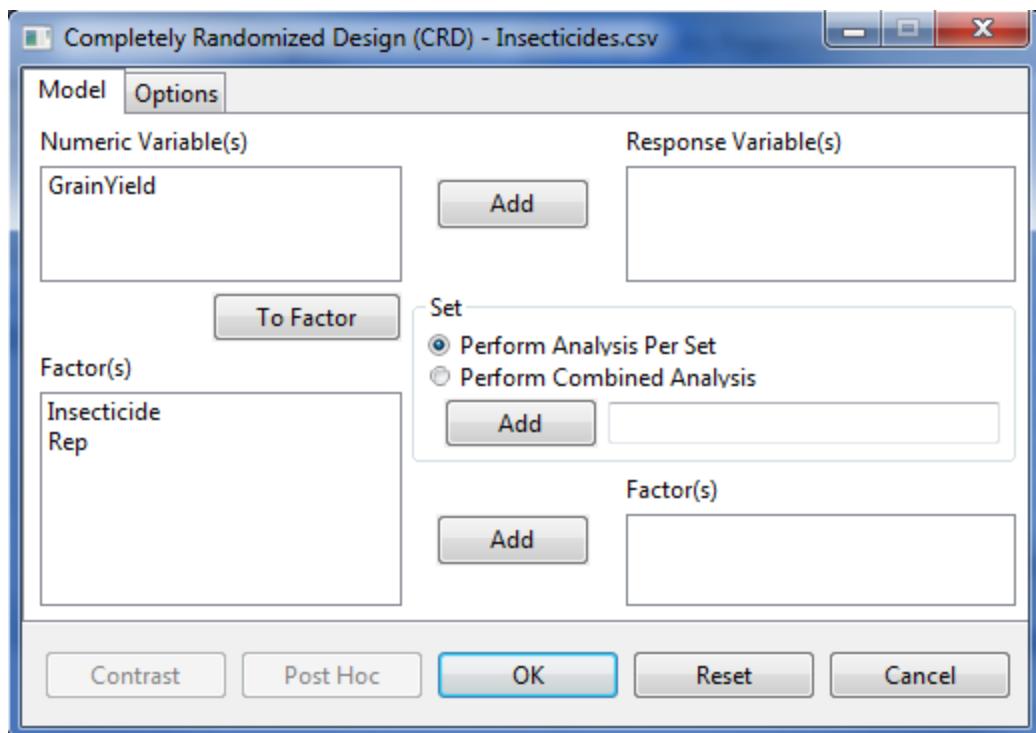
The **Analysis of Variance submenu** can be used to perform analysis of variance for data from experimental designs with single error (e.g., RCB) and with 2 or more errors (e.g., Split Plot).

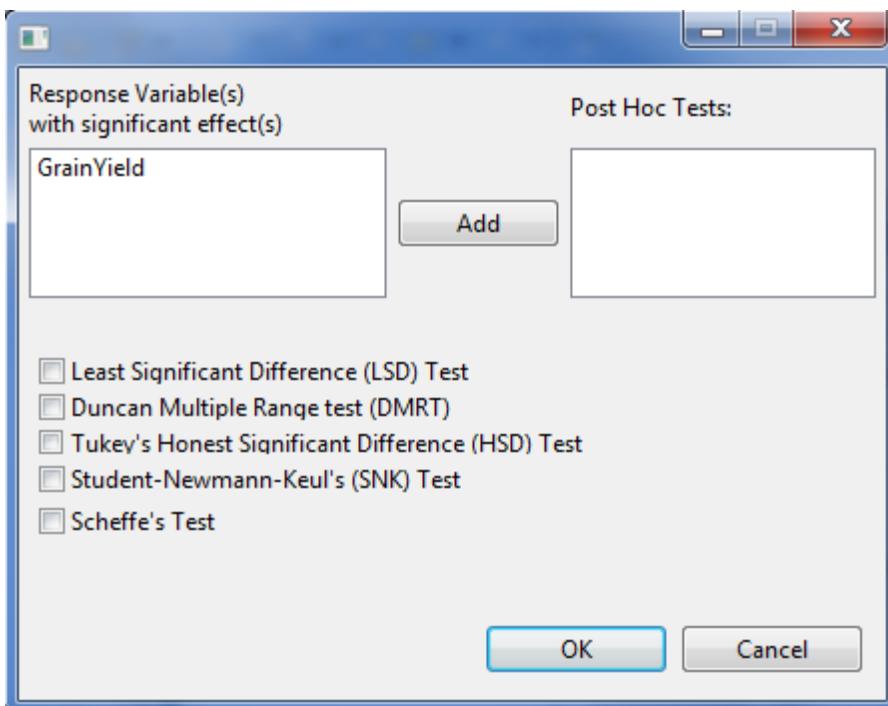
The Analysis of Variance in STAR can be used for balanced data set. If the data set contains less than 10% missing observations,

Pairwise mean comparisons and contrast analyses are available to evaluate differences among specific treatment/treatment combination.

## One Factor Completely Randomized Design

The steps to perform the Analysis of Variance in Randomized Complete Block Design are listed below:



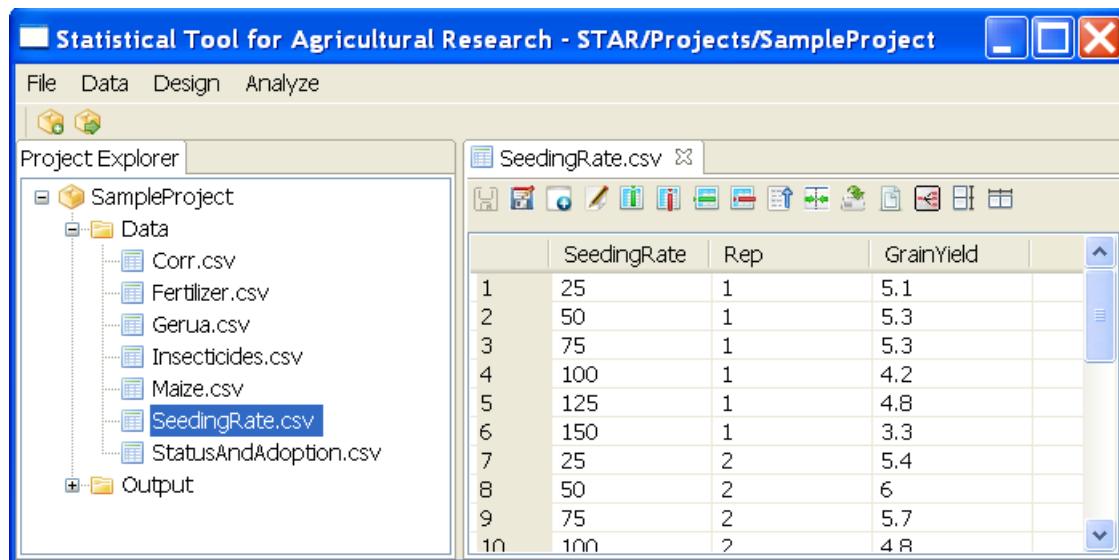


## One Factor Randomized Complete Block

The steps to perform the Analysis of Variance in Randomized Complete Block Design are listed below:

- On the Project Explorer the dataset *RCBD1F\_SeedingRate.csv* located in the *Data* folder of the project named *SampleProject*. Double-click the file to open and view it in the Data Viewer. The example file contains data from an experiment conducted to investigate the effect of six different rates of seeding (*SeedingRate*, in kg seed/ha with levels 25, 50, 75, 100, 125 and 150) on the grain yield (*GrainYield*, in kg/ha) of rice a variety using Randomized Complete Block (RCB) field design with four blocks (*Rep* with levels 1, 2, 3 and 4).

**<change screen shots to reflect all the data included in STAR and new filename of the dataset>**



- From the main window of STAR click **Analyze | Analysis of Variance | Randomized Complete Block Design (RCBD)**. The **Randomized Complete Block Design (RCBD)** dialog box will appear.
- Opening the data for the first time, *SeedingRate* and *Rep* fields in the data file are regarded by R as numerical variables; they need to be changed as factors. Choose the variable and click on the **To Factor** button.
- Specify the required field and appropriate options for the analysis.

### Model Specification Tab

#### Response Variable(s)

This field is required. For the analysis to proceed, at least one item should be entered in the list box. Only Items from the **Numeric Variable(s)** can be added in this dialog box.

#### Factor(s)

This field is required. At least one item can be added in this list box and should come from the **Factor(s)** list box.

**Block**

This field is required. Only one item can be added in this field and should come from the **Factor(s)** list box.

**Options Tab**

**Display Descriptive Statistics**

If this option is selected, a summary table with number of non-missing observations, minimum, maximum, mean and standard deviation of the response variable will be displayed.

**Shapiro-Wilk Test**

If this option is selected, test for normality of residuals using Shapiro-Wilk will be displayed.

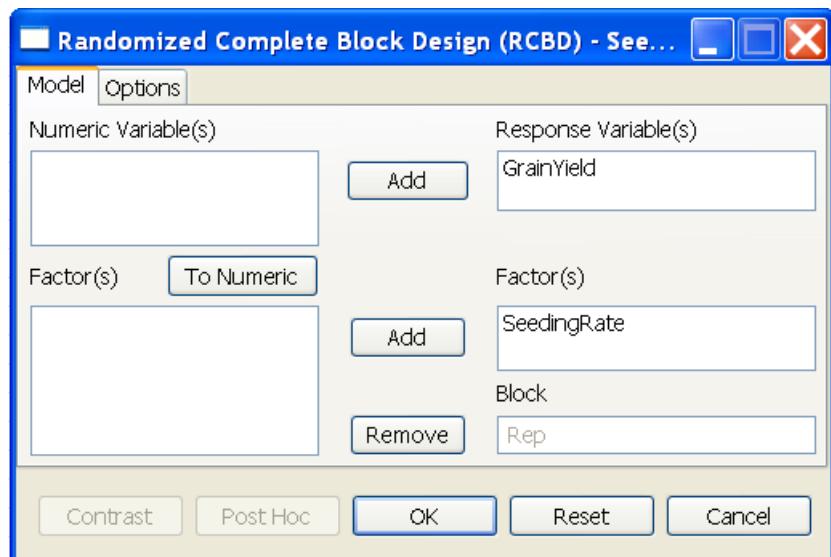
**Bartlett's Test**

If this option is selected, test for homogeneity of variances using Bartlett's Test will be displayed.

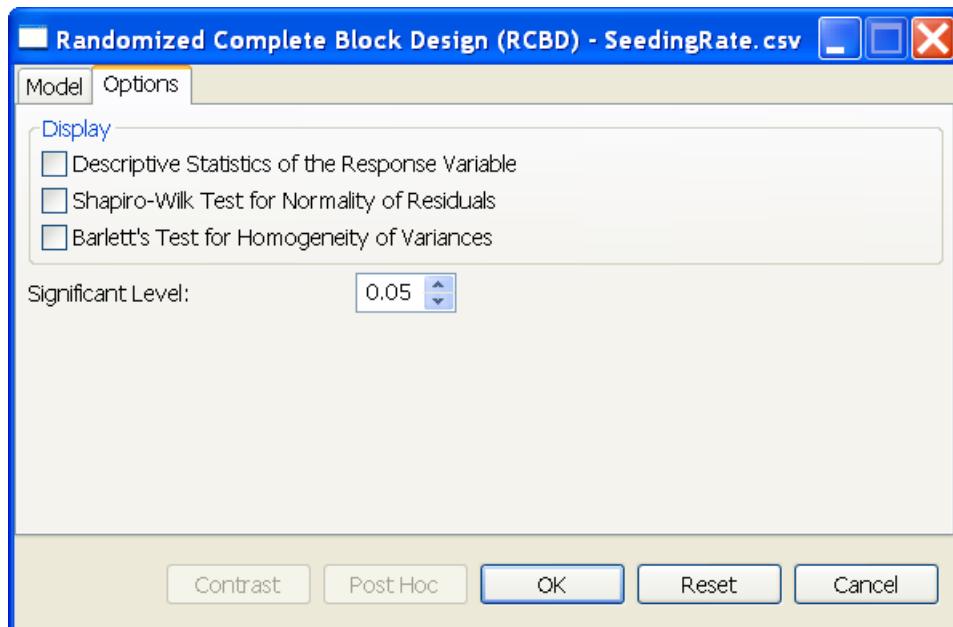
**Significance Level**

This will be used to determine if the treatment effects and interaction effects are significant in Analysis of Variance. This is also the level of significance to be used when pairwise mean comparison is performed. Its default value is 0.05. The user can change this value by specifying a numeric value from zero to 1.

For the example, the completed **Model** Specification tab should appear as illustrated below:



The completed **Options** tab should appear as illustrated below:



- Click **OK** button to perform the analysis. The **Randomized Complete Block Design (RCBD)** dialog box will be minimized and STAR activates the **Output Viewer** tab and the **Graph Viewer** tab.

### Output Viewer

This tab contains the text output which begins with the descriptive statistics and the output for the tests for homogeneity of variances and test for normality, whichever was specified in the **Options** tab. The next part is the Analysis of Variance table. If there is only one factor considered in the analysis, and if the factor is not significant a table of treatment means will be displayed. If there are 2 or more factors in the analysis and if the highest interaction is not significant, table of means for all levels of the treatment combinations will be displayed. Then, depending on the result of the analysis of variance, pairwise comparison of means will be automatically generated using one applicable pairwise comparison procedure. If at most 5 treatment levels are to be compared, the default pairwise comparison procedure used in STAR is the Least Significant Difference (LSD) test; otherwise, the Honestly Significant Difference (HSD) or Tukey's test is used.

### Graph Viewer

The tab displays two diagnostics plots. The left plot, entitled *Residuals vs. Fitted* is for assessing the distribution of the residuals. An ideal plot should reveal that the points are distributed around 0. The residuals should not be affected by the size of the fitted values. Problematic data may result to a plot wherein the points increase as the fitted values increase, thus forming a “funnel-shaped” distribution. This will indicate a violation of the homogeneity of variances requirement for analysis of variance. The *Normal Q-Q* plot is used for assessing normality. The points should lie about the line.

- Sample text output of the analysis displayed in the Output Viewer tab is shown below:

Analysis of Variance  
Randomized Complete Block Design (RCBD)

CLASS INFORMATION

Class Level Information

-----  
FACTOR            NO. OF LEVELS LEVELS

-----  
SeedingRate        6 25, 50, ..., 150  
Rep                4 1, 2, 3, 4

-----  
Number of Observations Read and Used: 24

Bartlett's Test for Homogeneity of Variances

---

Method	DF	Test Stat	p Value
bartlett	5	4.76	0.4462

---

TEST FOR NORMALITY

---

Variable	Method	Stat	Value	p Value
GrainYield_resid	Shapiro-Wilk W		0.9346	0.1235

---

ANOVA TABLE

Response Variable: GrainYield

---

Source	DF	Sum of Square	Mean Square	F Value	Pr > F
Rep	3	1.7667	0.5889	4.87	0.0147
SeedingRate	5	10.1800	2.0360	16.84	0.0000
Error	15	1.8133	0.1209		
Total	23	13.7600			

---

Summary Statistics

---

Coef	Var	GrainYield	Mean
		7.48	4.65

---

Standard Errors

---

Effects	StdErr
Rep	0.2007
SeedingRate	0.2459

---

Pairwise Mean Comparison of SeedingRate

Tukey's Honest Significant Difference (HSD) Test

Alpha	0.05
Error Degrees of Freedom	15
Error Mean Square	0.1209
Critical Value	4.5947
Test Statistics	0.7988

Summary of the Result:

---

---

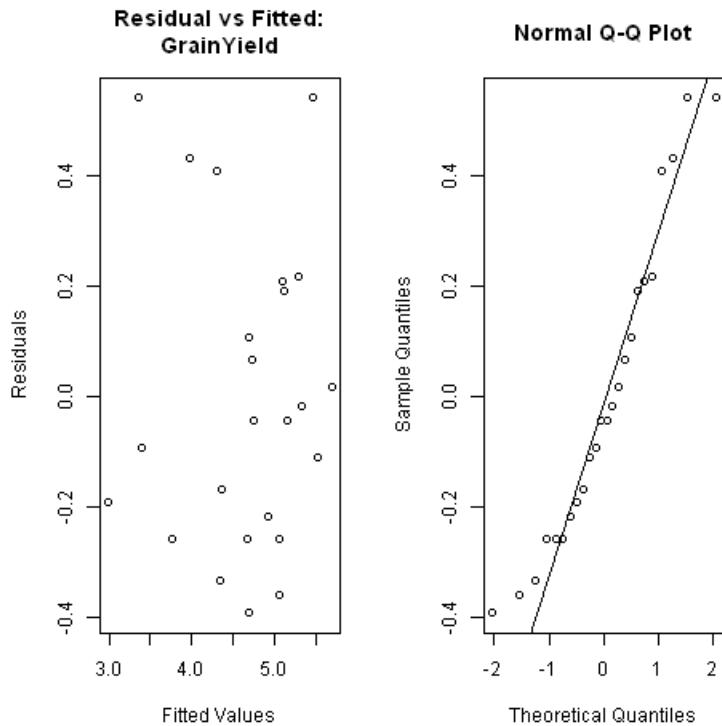
SeedingRate	means	N	group
100	4.35	4	b
125	4.67	4	ab
150	3.38	4	c
25	5.12	4	ab
50	5.08	4	ab
75	5.30	4	a

---

---

\* Means with the same letter are not significantly different.

- Sample graphical output of the analysis displayed in the Graph Viewer tab is shown below:



## Additional Options

If there are still modifications to be made, the following option buttons may be used:

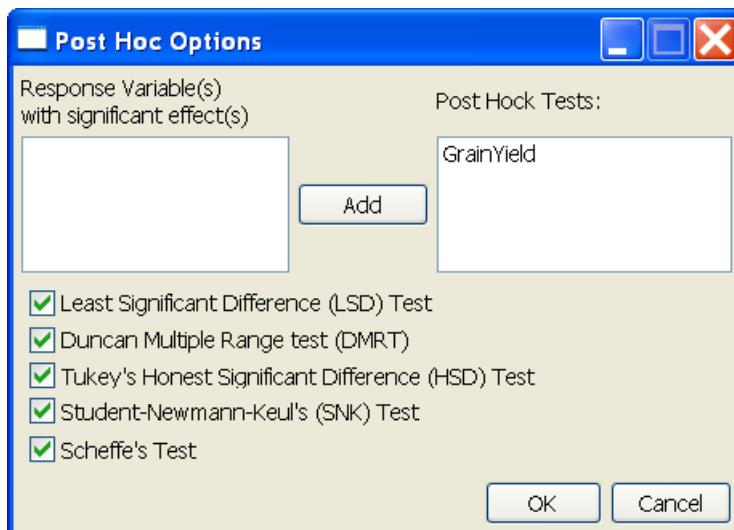
- **Post Hoc**

Use this option if other pairwise comparison procedures, other than what was presented in the **Output Viewer** tab page, are desired. There are five pairwise mean comparison procedure available, namely: Least Significant Difference Test, Duncan Multiple Range Test, Tukey's Honest Significant Test, Student Newmann-Keul's Test and the Scheffe's Test. This button will be disabled if *F*-tests conducted using ANOVA yielded results that are not significant.

Suppose additional pairwise mean comparison is requested.

- Click the **Post Hoc Option** button. The **Post Hoc Option** dialog box will appear.

- Specify the at least one response variable where pairwise mean comparison will be perform and choose at least one pairwise mean comparison procedure.
- The completed **Post Hoc Option** dialog box should appear as shown below:



- Click the **OK** button to perform the pairwise mean comparison. The **Post Hoc Option** dialog box will be closed and STAR activates the **Output Viewer** tab.
- Sample result of the pairwise mean comparison requested is shown below:

#### Result of Pairwise Comparison

Response Variable: GrainYield

Pairwise Mean Comparison of SeedingRate

Alpha 0.05

Error Degrees of Freedom 15

Error Mean Square      0.1209

LSD    HSD scheffe

Critical Value   2.1314 4.5947 2.9013

Test Statistic   0.5240 0.7988 0.9364

Summary:

---

SeedingRate   means N std.err LSD   HSD   scheffe

---

100	4.35	4	0.1708	c	b	b
125	4.67	4	0.0946	bc	ab	ab
150	3.38	4	0.2287	d	c	c
25	5.12	4	0.1548	ab	ab	a
50	5.08	4	0.3705	ab	ab	a
75	5.30	4	0.2160	a	a	a

---

\* Means with the same letter are not significantly different

Duncan's Multiple Range Test (DMRT)

Alpha                  0.05

Error Degrees of Freedom      15

Error Mean Square      0.1209

---

Number of Means    2    3    4    5    6

---

Tabular Value    3.01    3.16    3.25    3.31    3.36

Test Statistics    0.52    0.55    0.57    0.58    0.58

---

Summary of the Result:

---

SeedingRate means N group

---

100        4.35 4 c

125        4.67 4 bc

150        3.38 4 d

25        5.12 4 ab

50        5.08 4 ab

75        5.30 4 a

---

\* Means with the same letter are not significantly different.

Student Newman Keuls (SNK) Test

Alpha                    0.05

Error Degrees of Freedom            15

Error Mean Square            0.1209

Number of Means    2    3    4    5    6

Critical Value 3.0143 3.6734 4.0760 4.3670 4.5947

Test Statistics 0.5240 0.6386 0.7086 0.7592 0.7988

Summary of the Result:

---

---

SeedingRate means N group

---

---

100 4.35 4 b

125 4.67 4 ab

150 3.38 4 c

25 5.12 4 a

50 5.08 4 a

75 5.30 4 a

---

---

\* Means with the same letter are not significantly different.

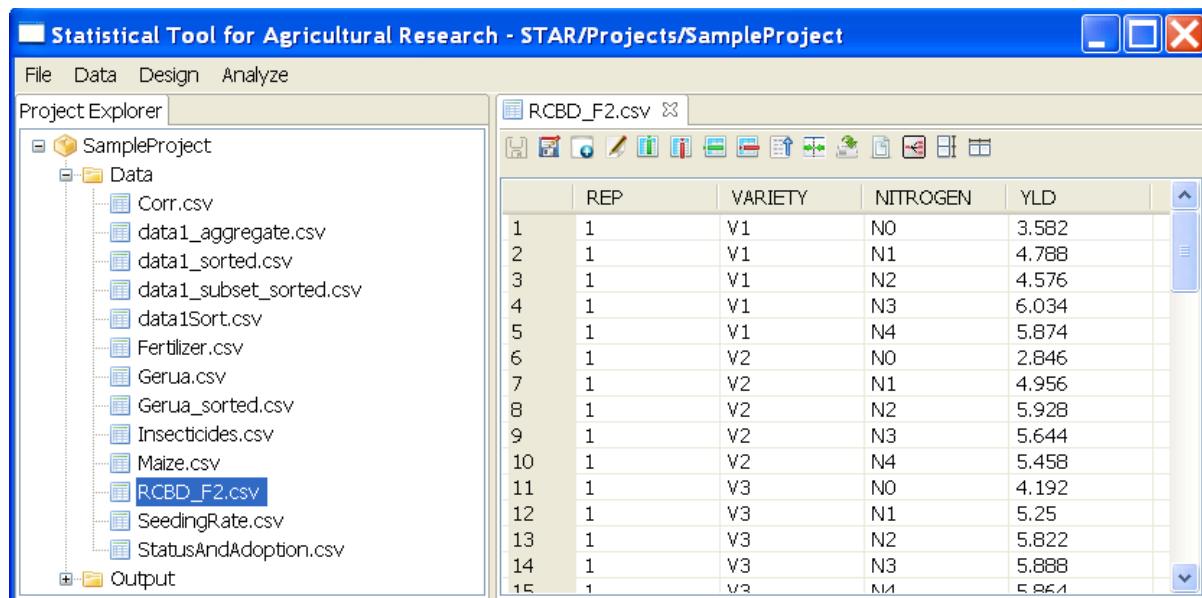
- **Contrast**

This button will be enabled if there is at least one factor that has more than two levels. Use of this button will be discussed in Partitioning Sum of Squares section of this module.

## Two Factor Randomized Complete Block

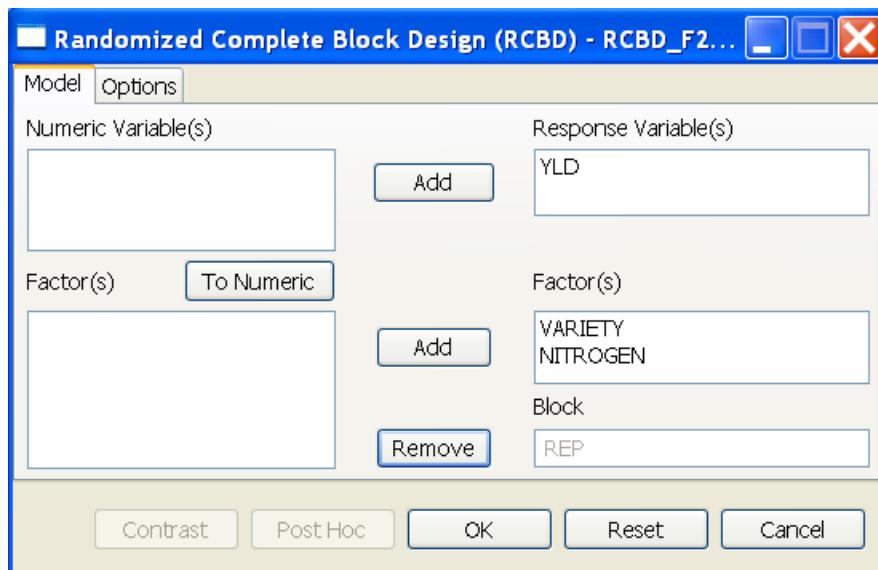
The steps to perform the Analysis of Variance in Randomized Complete Block Design are listed below:

- On the Project Explorer the dataset *RCBD\_F2.csv* located in the *Data* folder of the project named *SampleProject*. Double-click the file to open and view it in the Data Viewer. The example file contains data from an experiment conducted to compare the effects of three rice variety (*VARIETY*, with levels *V1*, *V2* and *V3*) and five nitrogen levels (*NITROGEN*, with levels *N0*, *N1*, *N2*, *N3* and *N4*) on grain yield (*YLD*, in t/ha) using Randomized Complete Block (RCB) field design with four blocks (*REP* with levels 1, 2, 3 and 4).

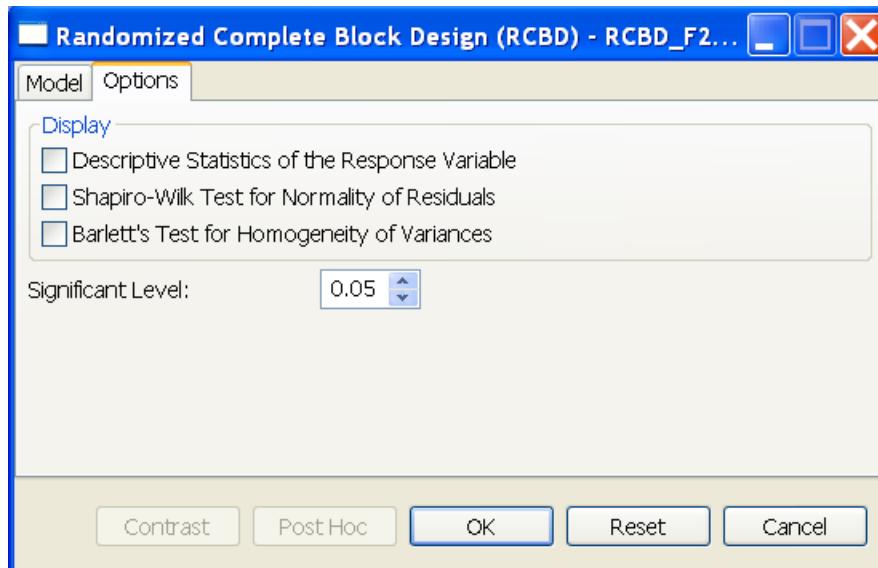


- From the main window of STAR click **Analyze | Analysis of Variance | Randomized Complete Block Design (RCBD)**. The **Randomized Complete Block Design (RCBD)** dialog box will appear.
- Opening the data for the first time, *REP* field in the data file is regarded by R as numerical variable; it need to be changed as factors. Choose the variable and click on the **To Factor** button.
- Specify the required field and appropriate options for the analysis.

For the example, the completed **Model** Specification tab should appear as illustrated below:



The completed **Options** tab should appear as illustrated below:



- Click **OK** button to perform the analysis. The **Randomized Complete Block Design (RCBD)** dialog box will be minimized and STAR activates the **Output Viewer** tab and the **Graph Viewer** tab.
  
- Sample text output of the analysis displayed in the Output Viewer tab is shown below:

Analysis of Variance

Randomized Complete Block Design (RCBD)

CLASS INFORMATION

Class Level Information

---

FACTOR NO. OF LEVELS LEVELS

---

REP 4 1, 2, 3, 4

VARIETY 3 V1, V2, V3

NITROGEN 5 N0, N1, N2, N3, N4

---

Number of Observations Read and Used: 60

ANOVA TABLE

Response Variable: YLD

---

Source DF Sum of Square Mean Square F Value Pr > F

---

REP 3 2.5018 0.8339 5.73 0.0022

VARIETY	2	1.1527	0.5763	3.96	0.0266
NITROGEN	4	42.0064	10.5016	72.12	0.0000
VARIETY:NITROGEN	8	2.3943	0.2993	2.06	0.0627
Error	42	6.1157	0.1456		
Total	59	54.1709			

---

Summary Statistics

---

Coef Var YLD Mean

---

7.71 4.95

---

Standard Errors

---

Effects StdErr

---

REP 0.1393

VARIETY 0.1207

NITROGEN 0.1558

VARIETY:NITROGEN 0.2698

---

Table of Means

NITROGEN	N0	N1	N2	N3	N4
VARIETY					

V1	3.0565	4.7235	4.4595	5.7170	5.8230
V2	3.5480	4.8060	5.4360	5.7345	5.6805
V3	3.7780	4.7535	5.3200	5.5525	5.8865

#### Pairwise Mean Comparison of VARIETY

#### Least Significant Difference (LSD) Test

Alpha	0.05
Error Degrees of Freedom	42
Error Mean Square	0.1456
Critical Value	2.0181
Test Statistics	0.2435

#### Summary of the Result:

-----  
VARIETY means N group  
-----

V1      4.76    20    b  
V2      5.04    20    a  
V3      5.06    20    a  
-----

\* Means with the same letter are not significantly different.

#### Pairwise Mean Comparison of NITROGEN

Least Significant Difference (LSD) Test

Alpha	0.05
Error Degrees of Freedom	42
Error Mean Square	0.1456
Critical Value	2.0181
Test Statistics	0.3144

Summary of the Result:

---

---

NITROGEN means N group

---

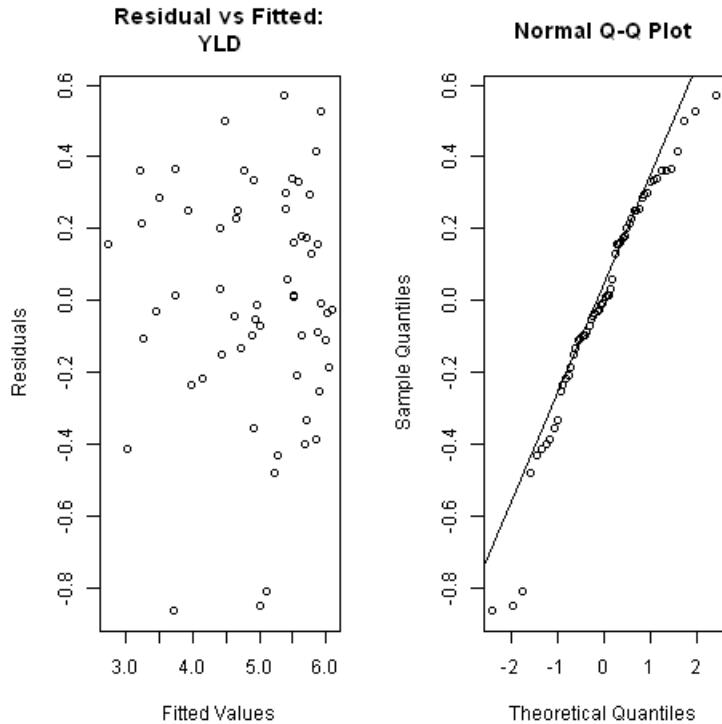
---

N0	3.46	12	c
N1	4.76	12	b
N2	5.07	12	b
N3	5.67	12	a
N4	5.80	12	a

---

\* Means with the same letter are not significantly different.

- Sample graphical output of the analysis displayed in the Graph Viewer tab is shown below:



## Split Plot Design in Randomized Complete Block

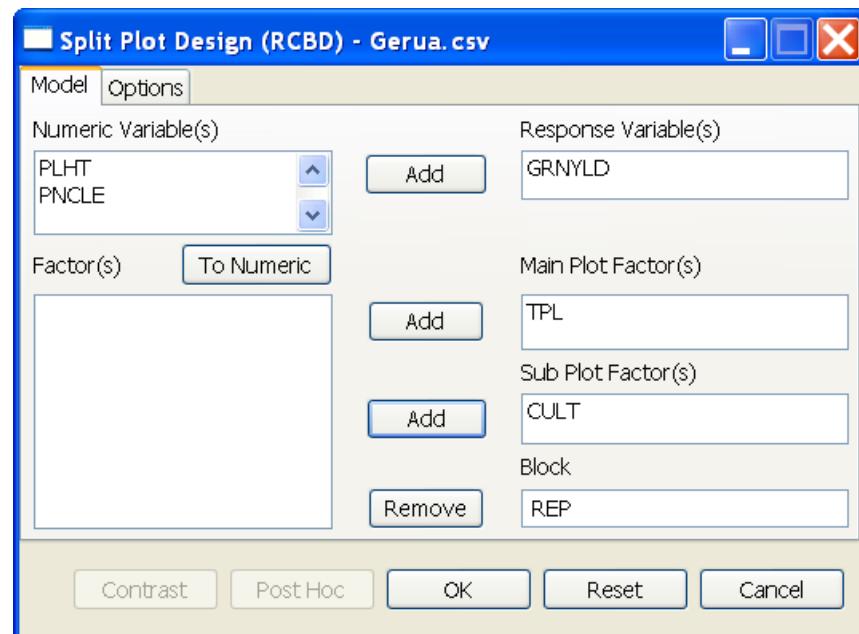
The steps to perform the Analysis of Variance using Split Plot Design in Randomized Complete Block are listed below:

- On the Project Explorer the dataset *Gerua.csv* located in the *Data* folder of the project named *SampleProject*. Double-click the file to open and view it in the Data Viewer. The example file contains data from an experiment conducted using Split Plot Design with transplanting method (*TPL*) as the main plot factor and cultivar (*CULT*) as the subplot factor in RCB. The experiment was done to compare the effects of two transplanting method (with levels *T* and *N*) using 25 cultivars with three blocks (*REP* with levels 1, 2, and 3) on grain yield (*GRNYLD*, in kg/ha) as well as other variables: plant height (*PLHT*, in cm) and panicle number (*PNCLE*).

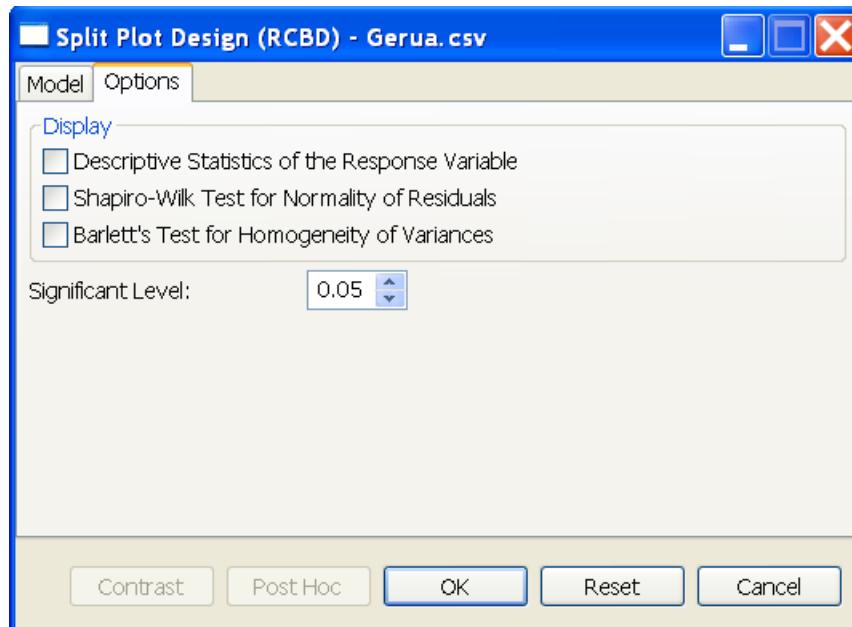
	REP	TPL	CULT	DFF	PLHT	PNCL	GRNYLD
1	1	D	CN1	136	115.8	239	1680
2	2	D	CN1	133	120.5	231	1350
3	3	D	CN1	135	117.8	234	1900
4	2	D	NDR1	129	100.5	200	4900
5	3	D	NDR1	128	98.6	195	5500
6	2	D	OR1	128	122.9	236	2800
7	1	D	CN2	139	125.6	240	2200
8	2	D	CN2	138	128.4	236	1450
9	3	D	CN2	139	123.2	237	2250
10	2	D	NDR2	130	113.9	180	2050
11	3	D	NDR2	130	115.4	152	2450
12	2	D	OR2	130	124.6	271	3150
13	1	D	CR1	137	120.5	31	3500
14	2	D	CR1	140	121.8	299	2700
15	3	D	CR1	138	119.2	307	3200
16	2	D	NDR3	116	120.8	210	5750
17	3	D	NDR3	116	128.4	204	5200
18	2	D	OR3	131	115.6	212	2500
19	1	D	CR2	124	120.7	193	2100
20	2	D	CR2	125	124.3	190	3100
21	3	D	CR2	123	124.2	196	2750
22	2	D	NDR4	141	122.4	232	3860
23	3	D	NDR4	141	120.9	228	3000
24	2	D	OR4	141	113.7	213	2150
25	1	D	IR1-CN3	133	92.6	231	2850
26	2	D	IR1-CN3	136	95.2	224	2750
27	3	D	IR1-CN3	134	93.1	229	2250
28	2	D	NDR5	149	135.9	213	1800
29	3	D	NDR5	145	133.8	207	2100
30	2	D	OR5	134	120.4	205	2050
31	1	D	IR1-CN4	136	140.4	233	1000
32	2	D	IR1-CN4	135	147.2	220	1260
33	3	D	IR1-CN4	136	143.5	228	950
34	2	D	NDR6	142	109.3	213	2360
35	3	D	NDR6	144	107.9	209	3850
36	2	D	OR6	135	112.6	290	3950

- From the main window of STAR click **Analyze | Analysis of Variance | Split Plot Design | Randomized Complete Block Design (RCBD)**. The **Split Plot Design (RCBD)** dialog box will appear.
- Opening the data for the first time, *REP* field in the data file is regarded by R as numerical variable; it need to be changed as factors. Choose the variable and click on the **To Factor** button.
- Specify the required field and appropriate options for the analysis.

For the example, the completed **Model** Specification tab should appear as illustrated below:



The completed **Options** tab should appear as illustrated below:



- Click **OK** button to perform the analysis. The **Split Plot Design (RCBD)** dialog box will be minimized and STAR activates the **Output Viewer** tab and the **Graph Viewer** tab.

- Sample text output of the analysis (only results from *response variable = GRNYLD*) displayed in the Output Viewer tab is shown below:

Analysis of Variance

Split Plot Design in RCBD

CLASS INFORMATION

Class Level Information

---

FACTOR NO. OF LEVELS LEVELS

---

REP 3 1, 2, 3

TPL 2 D, N

CULT 26 CN1, CN2, ..., S2

---

Number of Observations Read and Used: 156

ANOVA TABLE

Response Variable: GRNYLD

---

Source	DF	Sum of Square	Mean Square	F Value	Pr > F
--------	----	---------------	-------------	---------	--------

---

REP	2	58473.3974	29236.6987	0.35	0.7425
-----	---	------------	------------	------	--------

TPL	1	109947636.0577	109947636.0577	1303.92	0.0008
Error(a)	2	168641.3462	84320.6731		
CULT	25	134144970.6731	5365798.8269	51.02	0.0000
TPL:CULT	25	16611234.7756	664449.3910	6.32	0.0000
Error(b)	100	10517968.5897	105179.6859		
Total	155	271448924.8397			

---

#### Summary Statistics

---

Coef	Var(a)	Coef	Var(b)	GRNYLD	Mean
------	--------	------	--------	--------	------

---

7.72	8.63	3759.20
------	------	---------

---

#### Comparison of TPL at each level of CULT

#### Least Significant Difference (LSD) Test

Alpha	0.05
Error Degrees of Freedom	101
Error Mean Square	104377.4162
Critical Value	1.9837
Test Statistic	523.2683

Summary:

---

TPL N CULT = CN1 group CULT = CN2 group ... CULT = S2 group

---

D 3 1643.33 b 1966.67 b ... 2163.33 b

N 3 3683.33 a 3763.33 a ... 4260.00 a

---

\* Means with the same letter are not significantly different

Comparison of CULT at each level of TPL

Tukey's Honest Significant Difference (HSD) Test

Alpha 0.05

Error Degrees of Freedom 100

Error Mean Square 105179.6859

Critical Value 5.3519

Test Statistic 1002.1128

Summary:

---

CULT N TPL = D group TPL = N group

---

CN1 3 1643.33 jk 3683.33 hij

CN2 3 1966.67 ijk 3763.33 ghij

CR1 3 3133.33 efgh 5033.33 abcde

CR2 3 2650.00 ghi 4270.00 efgi

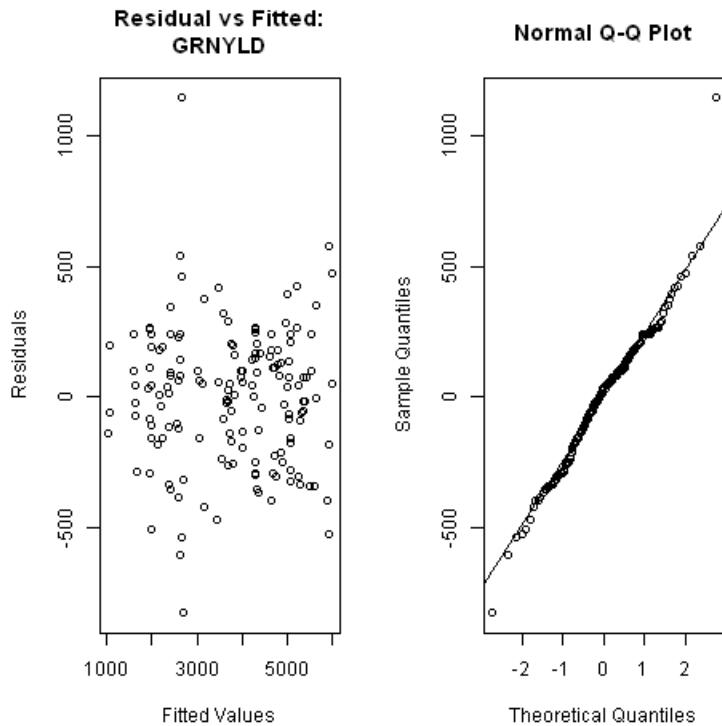
IR1-CN3 3 2616.67 ghij 5050.00 abcde

IR1-CN4	3	1070.00	k	3026.67	j
IR2	3	1950.00	ijk	4260.00	efghi
NDR1	3	5216.67 ab		5890.00 ab	
NDR2	3	2416.67 hij		4926.67 bcdef	
NDR3	3	5520.00 a		5956.67 a	
NDR4	3	3453.33 defg		4690.00 cdefg	
NDR5	3	1966.67 ijk		3986.67 fghij	
NDR6	3	2686.67 fghi		4830.00 cdef	
NDR7	3	4783.33 abc		5333.33 abcd	
OR1	3	2583.33 ghij		5250.00 abcde	
OR2	3	2616.67 ghij		4326.67 efghi	
OR3	3	2416.67 hij		4400.00 defghi	
OR4	3	1966.67 ijk		4000.00 fghij	
OR5	3	2216.67 hij		4653.33 cdefgh	
OR6	3	3800.00 cde		5033.33 abcde	
OR7	3	5066.67 ab		5616.67 abc	
OR8	3	4316.67 bcd		5386.67 abcd	
RA1	3	1633.33 jk		3763.33 ghij	
RA2	3	3673.33 def		4616.67 cdefgh	
S1	3	2385.00 hij		3560.00 ij	
S2	3	2163.33 hij		4260.00 efghi	

---

\* Means with the same letter are not significantly different

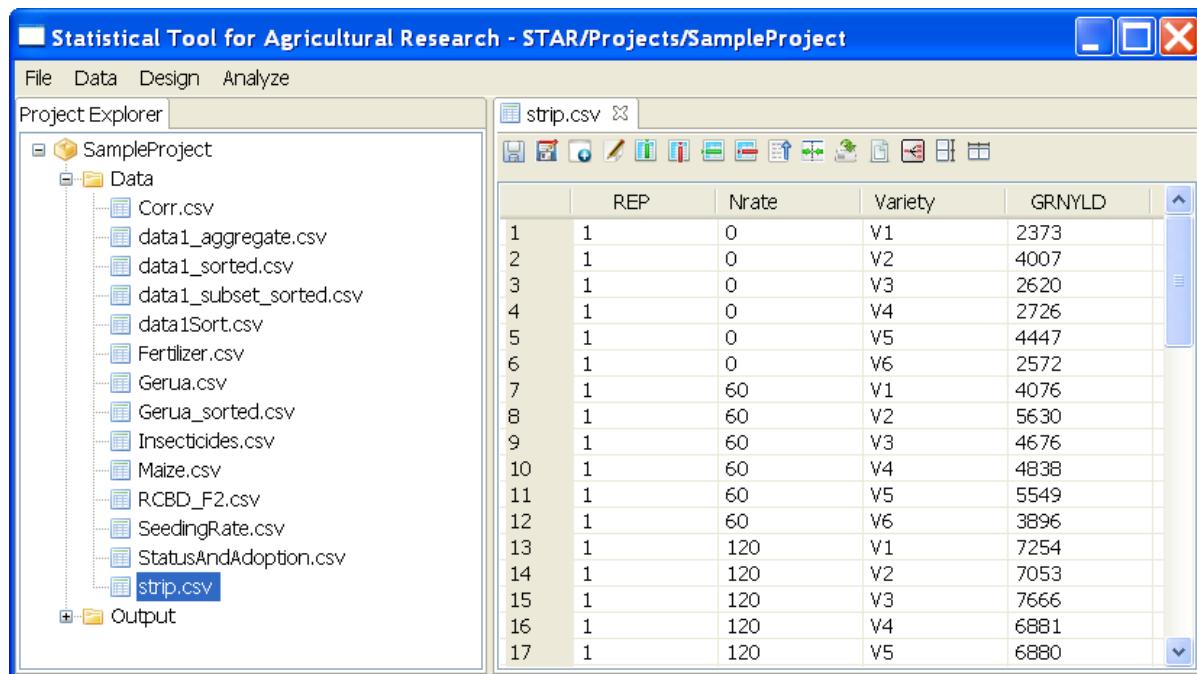
- Sample graphical output of the analysis displayed in the Graph Viewer tab is shown below:



## Strip Plot Design

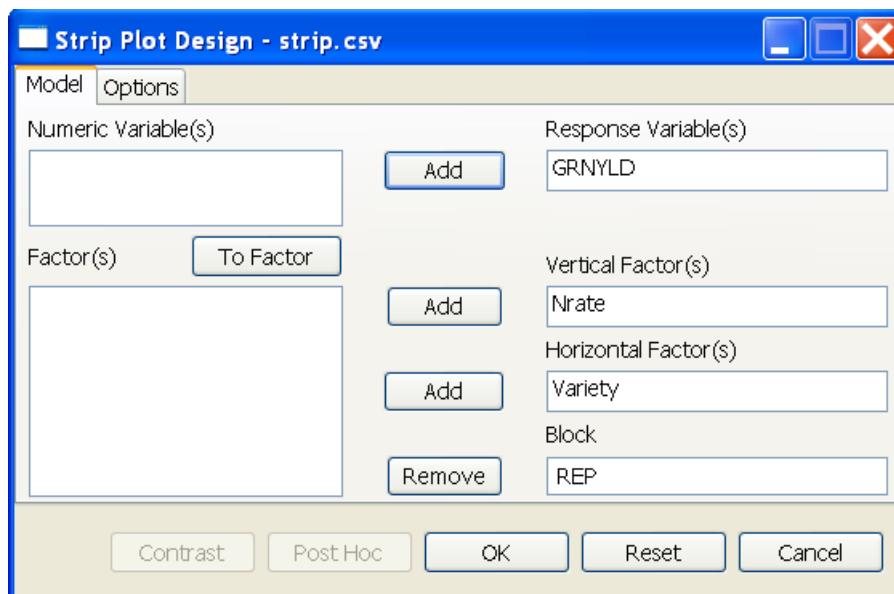
The steps to perform the Analysis of Variance in Randomized Complete Block Design are listed below:

- On the Project Explorer the dataset *strip.csv* located in the *Data* folder of the project named *SampleProject*. Double-click the file to open and view it in the Data Viewer. The example file contains data from an experiment conducted to compare the effects of six rice variety (*Variety*, with levels V1, V2, V3, V4, V5 and V6) and three rates of nitrogen (*Nrate*, in kg/ha with levels 0, 60 and 120) on grain yield (*GRNYLD*, in kg/ha). A strip plot design with four blocks (*REP* with levels 1, 2, and 3) was used with rice variety as the horizontal factor and nitrogen rates as the vertical factor.

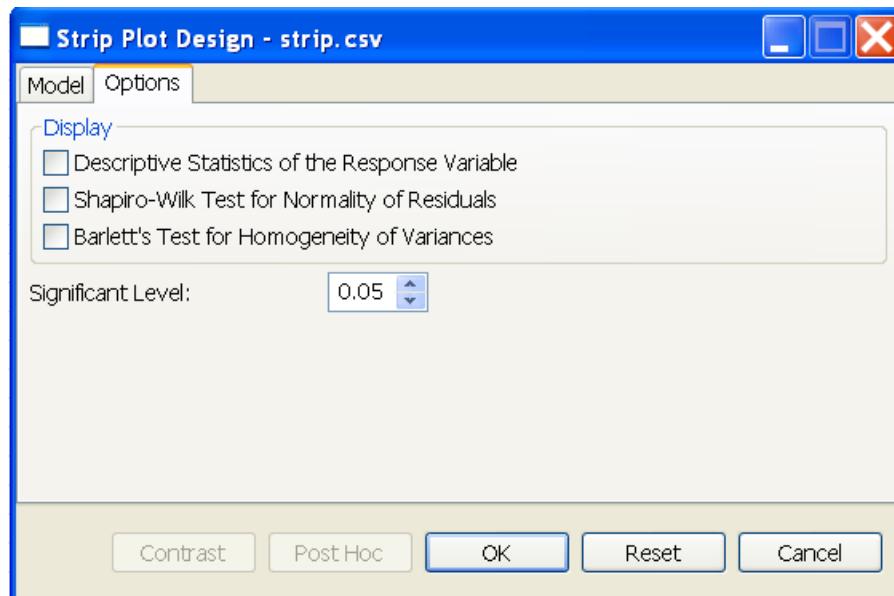


- From the main window of STAR click **Analyze | Analysis of Variance | Strip Plot Design**. The **Strip Plot** dialog box will appear.
- Opening the data for the first time, *REP* and *Nrate* fields in the data file are regarded by R as numerical variables; they need to be changed as factors. Choose the variable and click on the **To Factor** button.
- Specify the required field and appropriate options for the analysis.

For the example, the completed **Model** Specification tab should appear as illustrated below:



The completed **Options** tab should appear as illustrated below:



- Click **OK** button to perform the analysis. The **Strip Plot Design** dialog box will be minimized and STAR activates the **Output Viewer** tab and the **Graph Viewer** tab.
  
- Sample text output of the analysis displayed in the Output Viewer tab is shown below:

Analysis of Variance

Strip Plot Design

#### CLASS INFORMATION

Class Level Information

---

FACTOR NO. OF LEVELS LEVELS

---

REP 3 1, 2, 3

Nrate 3 0, 60, 120

Variety 6 V1, V2, ..., V6

---

Number of Observations Read and Used: 54

#### ANOVA TABLE

Response Variable: GRNYLD

---

Source DF Sum of Square Mean Square F Value Pr > F

---

REP 2 9215077.1481 4607538.5741 6.19 0.0596

Nrate 2 50672299.5926 25336149.7963 34.05 0.0031

Error(a) 4 2975911.9630 743977.9907

Variety 5 57101029.4259 11420205.8852 7.65 0.0034

Error(b) 10 14922379.9630 1492237.9963

Nrate:Variety	10	23874076.8519	2387407.6852	5.80	0.0004
Error(c)	20	8230550.9259	411527.5463		
Total	53	166991325.8704			

---

#### Summary Statistics

---

Coef Var(a)	Coef Var(b)	Coef Var(c)	GRNYLD Mean
-------------	-------------	-------------	-------------

---

16.31	23.09	12.13	5289.76
-------	-------	-------	---------

---

#### Comparison of Nrate at each level of Variety

#### Least Significant Difference (LSD) Test

Alpha	0.05
Error Degrees of Freedom	22
Error Mean Square	466935.9537
Critical Value	2.0716
Test Statistic	1155.8252

#### Summary:

---

-----Nrate N Variety = V1 group Variety = V2  
group ... Variety = V6 group

---

-----0 3 3571.67 c 4934.33 b ...  
3207.33 ab

120	3	7548.00 a	7211.33 a	...	2492.00 b
60	3	5132.00 b	6713.67 a	...	3714.33 a

-----\* Means with the same letter are not significantly different

#### Comparison of Variety at each level of Nrate

#### Tukey's Honest Significant Difference (HSD) Test

Alpha	0.05
Error Degrees of Freedom	10
Error Mean Square	1492237.9963
Critical Value	4.9120
Test Statistic	3464.3214

#### Summary:

---

Variety N Nrate = 0 group Nrate = 60 group Nrate = 120 group

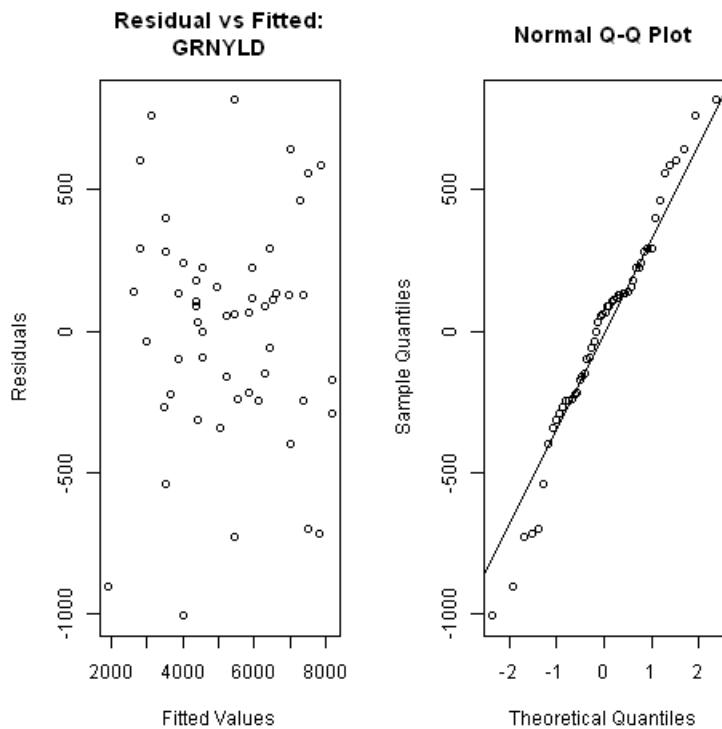
---

V1	3	3571.67 a	5132.00 a	7548.00 a
V2	3	4934.33 a	6713.67 a	7211.33 a
V3	3	4249.67 a	6122.33 a	7868.33 a
V4	3	4059.00 a	5553.67 a	7094.33 a
V5	3	4101.67 a	5630.00 a	6012.00 a
V6	3	3207.33 a	3714.33 a	2492.00 b

---

\* Means with the same letter are not significantly different

- Sample graphical output of the analysis displayed in the Graph Viewer tab is shown below:



## Partitioning Sum of Squares

The **Contrast** option is used in partitioning sum of squares that decompose the variability of the response(s) into various components to have a better view of the nature of variability. There are different selections in partitioning sum of squares such as, “Compare with Control”, “User Specified Contrast (Group Comparison)” and “Orthogonal Polynomial Contrast”.

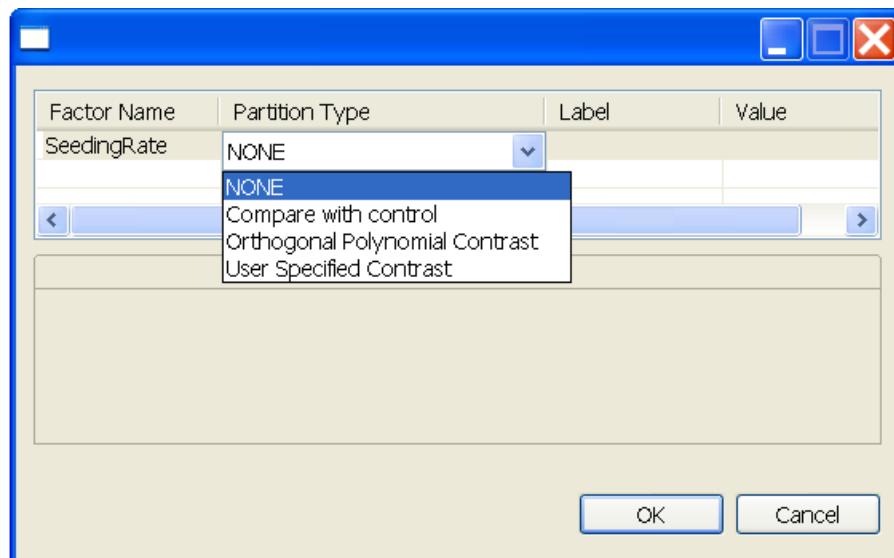
## Group Comparison

The steps to perform the Group Comparison are listed below:

- On the Project Explorer the dataset *SeedingRate.csv* located in the *Data* folder of the project named *SampleProject*. Double-click the file to open and view it in the Data Viewer.
- Perform the Analysis of Variance. Follow the discussion in **Randomized Complete Block Design (RCBD)** of this module.
- After performing the Analysis of Variance, the **Contrast** button will be enabled if there is at least one factor in the analysis with more than two levels.

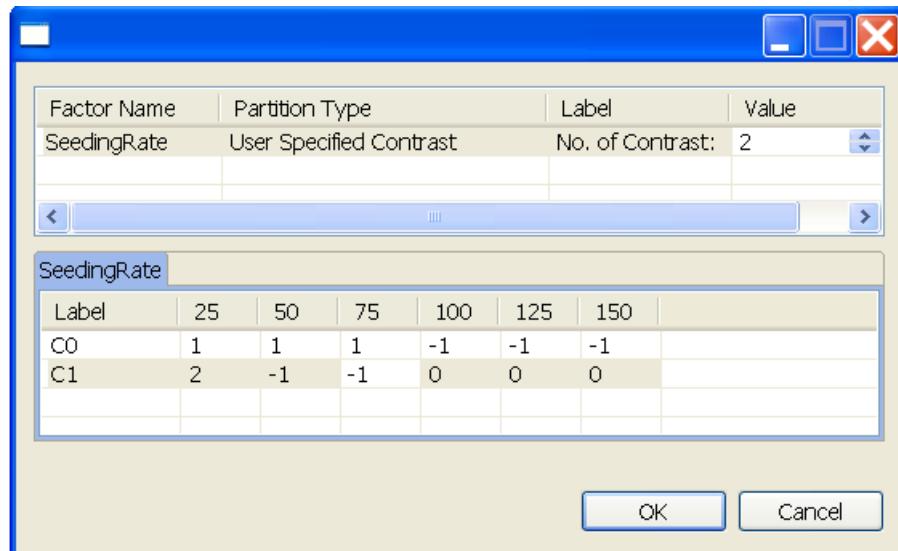
Suppose we want to determine the following:

- i. If the mean of the *SeedingRate 25, 50, and 75* is significantly different from *SeedingRate 100, 125 and 150*
  - ii. If the mean of the *SeedingRate 25*, is significantly different from *SeedingRate 50, and 75*
- Click the **Contrast** button. A dialog box will appear.



- Specify the required fields and appropriate options for the analysis. In the **Partition Type** column, click the drop-down menu and choose *User Specified Contrast*. Specify the number of contrast. A tab will be displayed in the lower part of the Contrast Analysis dialog box.

For the example, the completed dialog box should appear as illustrated below:



- Click the **OK** button to perform Group Comparison. The Contrast Analysis dialog box will be closed and STAR actives the Output Viewer tab.

- Sample output of the analysis:

## **Trend Comparison**

This procedure is applicable and available if the levels of the factor are quantitative.

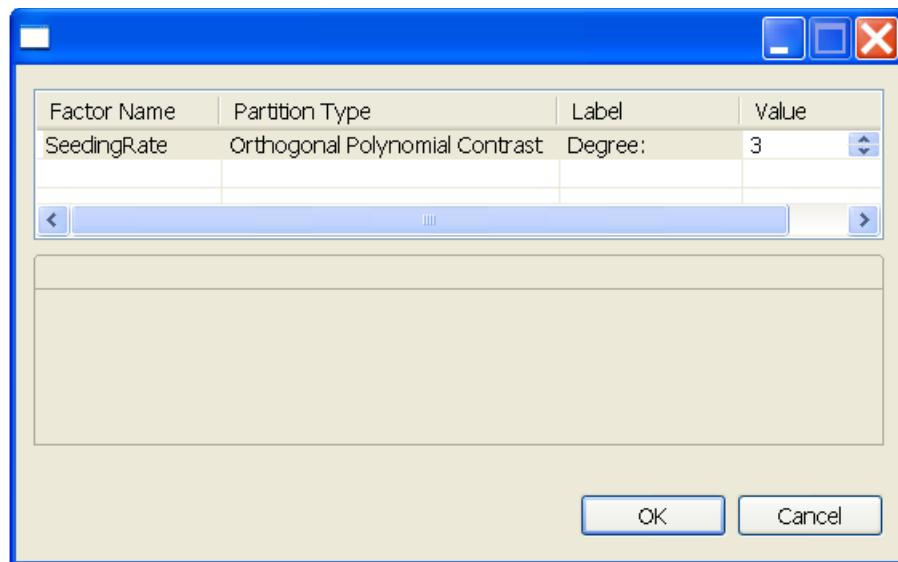
The steps to perform the Group Comparison are listed below:

- On the Project Explorer the dataset *SeedingRate.csv* located in the *Data* folder of the project named *SampleProject*. Double-click the file to open and view it in the Data Viewer.
- Perform the Analysis of Variance. Follow the discussion in **Randomized Complete Block Design (RCBD)** of this module.
- After performing the Analysis of Variance, the **Contrast** button will be enabled if there is at least one factor in the analysis with more than two levels.

Suppose we also want to know the degree of the relationship between yield response and Seeding Rate.

- Click the **Contrast** button. A dialog box will appear.
- Specify the required fields and appropriate options for the analysis. In the **Partition Type** column, click the drop-down menu and choose *Orthogonal Polynomial Contrast*. Specify the highest degree polynomial that will be fitted.

For the example, the completed dialog box should appear as illustrated below:



- Click the **OK** button to perform Trend Comparison. The Contrast Analysis dialog box will be closed and STAR actives the Output Viewer tab.
- Sample output of the analysis:

#### Result of Contrast Analysis

#### ANOVA TABLE

Response Variable: GrainYield

---

Source	DF	Sum of Square	Mean Square	F Value	Pr > F
<hr/>					
Rep	3	1.7667	0.5889	4.87	0.0147
SeedingRate	5	10.1800	2.0360	16.84	0.0000
SeedingRate: 1	1	6.7891	6.7891	56.16	0.0000
SeedingRate: 2	1	1.6296	1.6296	13.48	0.0023

SeedingRate:	3	1	0.1027	0.1027	0.85	0.3712
Error		15	1.8133	0.1209		
Total		23	13.7600			

---

# Incomplete Block Design

The steps to perform Analysis for Incomplete Block Design are listed below:

- On the Project Explorer, locate the *data1.csv* file from the *Data* folder of the project named *SampleProject*. Double-click the file to view it in the Data Viewer. The file contains data for an experiment conducted using Randomized Complete Block (RCB) design for two response variables, *Y1* and *Y2*. The environment variable *Site* has two levels (*Env1* and *Env2*), the blocking variable *Blk* has four levels (1, 2, 3, and 4) and the genotype variable *Gen* has eight levels (1, 2, ..., 8).

The screenshot shows the 'Plant Breeding Tools - PBTools/Projects/SampleProject' window. The Project Explorer on the left lists files under 'SampleProject' / 'Data', including 'data1.csv', 'data1\_merge.csv', 'data2\_merge.csv', 'data\_mean.csv', 'Diallel\_M1.csv', 'Diallel\_M2.csv', 'Diallel\_M3.csv', 'Diallel\_M4.csv', 'GenMean(raw).csv', 'GenMean(summaryStats).csv', 'Gerula.csv', 'markers.csv', 'NCI\_ME.csv', and 'NCII ME.csv'. The Data Viewer on the right displays the contents of 'data1.csv' in a grid format. The columns are Site, Blk, Gen, Y1, and Y2. The data consists of 14 rows, each with Site values 1 or 2, Blk values 1 through 4, Gen values 1 through 8, and Y1 and Y2 values ranging from 19.5 to 50.2.

	Site	Blk	Gen	Y1	Y2
1	Env1	1	1	50.2	20.5
2	Env1	1	2	41.8	19.5
3	Env1	1	3	39.2	19
4	Env1	1	4	37.8	20
5	Env1	1	5	35.6	20
6	Env1	1	6	53.4	19.2
7	Env1	1	7	43.8	19.5
8	Env1	1	8	50.6	19.7
9	Env1	2	1	41.4	20.6
10	Env1	2	2	47.2	20.1
11	Env1	2	3	37.6	18.5
12	Env1	2	4	49.6	20.3
13	Env1	2	5	31.4	20.8
14	Env1	2	6	50.2	19.5

- Choose **Analysis > Single-environment Analysis**.
- Since the *Blk* and *Gen* fields in the phenotypic data file are regarded by R as numerical variables, they need to be changed as factors. Choose these variable and click on the **Set to Factor** button.
- Specify the required fields and appropriate options for the analysis.

## **Model Specifications Tab**

### Type of Design

There are five available experimental designs, Randomized Complete Block Design (RCB), Augmented RCB, Augmented Latin Square, Alpha-Lattice and Row-Column. For the example, select RCB.

### 'Genotype as Fixed' Option

Select this if genotype is considered as a fixed factor

### 'Genotype as Random' Option

Select this if genotype is considered as a random factor

### Block

This field is required if the design is RCB, Augmented RCB or Alpha-Lattice.

### Replicate

This field is required if the design is Augmented Latin Square, Alpha-Lattice or Row-Column.

### Row

This field is required if the design is Augmented Latin Square or Row-Column.

### Column

This field is required if the design is Augmented Latin Square or Row-Column.

## **Options Tab**

### Perform pairwise mean comparisons: Compare with control(s)

If this is selected, the user should specify the control level(s) to be compared with the rest of the genotype levels. This can be done by selecting the level(s) of genotype that are considered as control(s) then click the **Add** button.

### Perform pairwise mean comparisons: Perform all comparisons

This option is not recommended when the number of genotype levels is very large.

### Exclude controls in the estimation of genotypic variance

If this is selected, the user should specify the control level(s) to be compared with the rest of the genotype levels. This can be done by selecting the level(s) of genotype that are considered as control(s) then click the **Add** button.

### Estimate genotypic and phenotypic correlations

This option is enabled if there are two or more response variables specified in the Model Specifications tab.

### Display Descriptive Statistics

If selected, a summary table with number of missing observations, mean and standard deviation will be displayed.

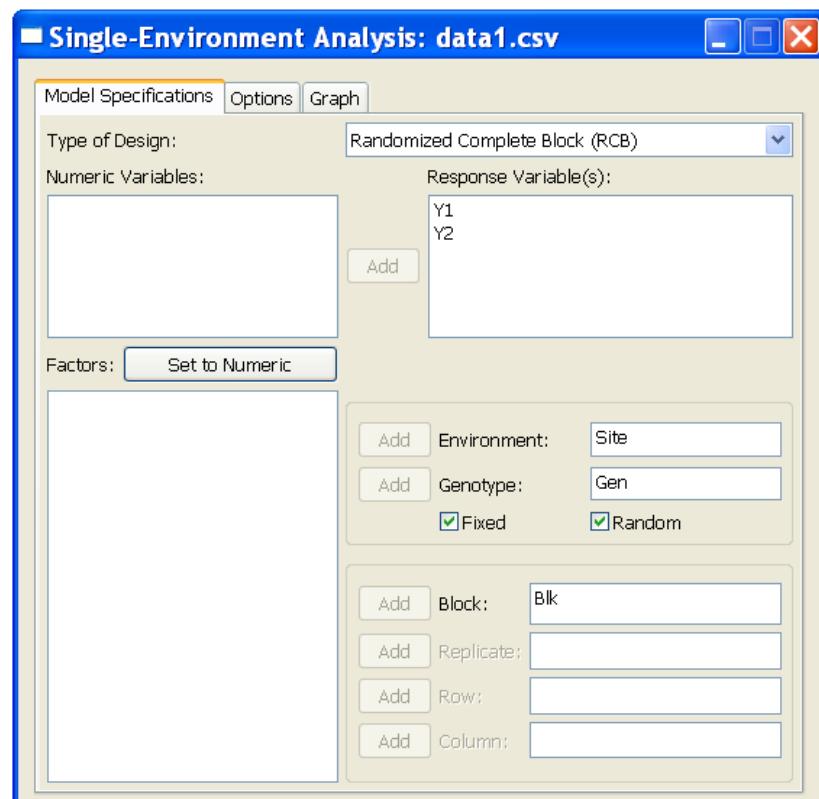
### Display Variance Components

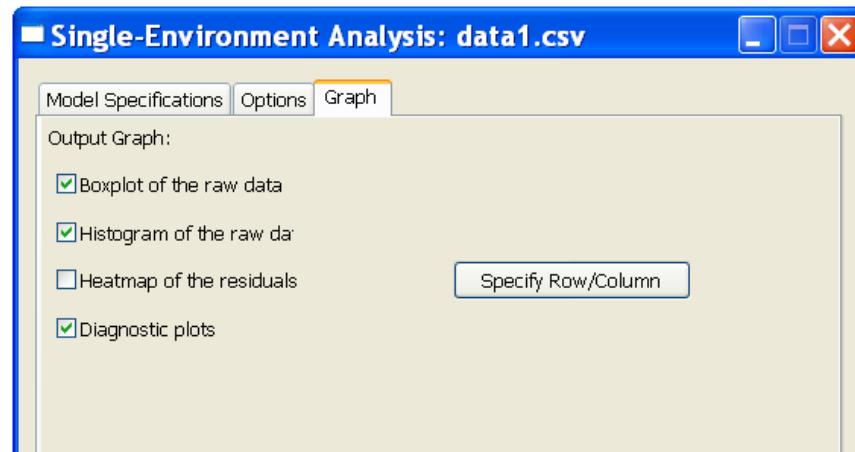
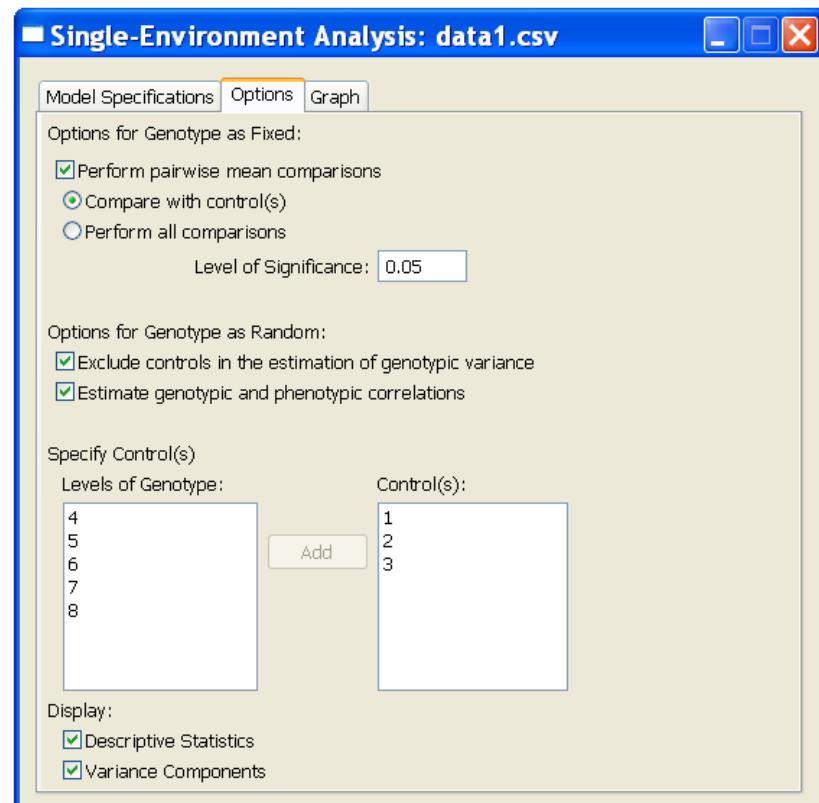
If selected, a table with the variance estimates of the some model components will be displayed.

## Graph Tab

Graphs like boxplot, histogram, heatmap and diagnostic plots can be generated as part of the output of the analysis

For the *example*, the completed dialog box should appear as illustrated below:





- Click OK.
  
- Sample output of the analysis (only results from *response variable = Y1* and *Site = Env1*) is shown below:

DATA FILE: C:/Documents  
Settings/NSales/workspace3/Star/Projects/SampleProject/Data/data1.csv and

#### SINGLE-ENVIRONMENT ANALYSIS

DESIGN: Randomized Complete Block (RCB)

=====

GENOTYPE AS: Fixed

=====

-----  
RESPONSE VARIABLE: Y1

-----

### **Descriptive Statistics**

Descriptive Statistics:

Variable	Site	N	NonMissObs	Mean	StdDev
1	Y1 Env1	32	42.49063	6.739166	
2	Y1 Env2	32	42.99063	5.741213	

-----  
ANALYSIS FOR: Site = Env1

-----  
Trial Summary:

Number of observations read: 32

Number of observations used: 32

Factors Number of Levels Levels

Gen 8 1 2 3 ... 8

Blk 4 1 2 3 4

### **Estimates of Variance Components**

Variance Components Table:

Groups Variance Std.Dev.

1 Blk 2.857857 1.690520

2 Residual 13.563289 3.682837

### **Analysis of Variance Table**

ANOVA Table:

Linear Mixed Model fit by Maximum likelihood ratio test

Environment Variable: Site = Env1

Response Variable: Y1

Df Sum Sq Mean Sq F value Chisq Chi Df Pr(>Chisq)

Gen 7 1013.8 144.83 10.678 42.910 7 3.471e-07 \*\*\*

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 '' 1

### **Genotype Means and Standard Errors**

Genotype means and standard errors:

Gen	Mean	StdErrMean
-----	------	------------

1	41.900	2.026107
2	43.800	2.026107
3	37.300	2.026107
4	41.150	2.026107
5	32.500	2.026107
6	52.625	2.026107
7	43.900	2.026107
8	46.750	2.026107

### **Pairwise Mean Comparisons**

Significant Pairwise Comparisons (if any):

Compared with control(s)

Trmt[i]	Trmt[j]	Estimate	lwr	upr	
1	4	1	-39.950	-48.01257	-31.88743
2	5	2	-48.600	-56.66257	-40.53743
3	6	3	-28.475	-36.53757	-20.41243
4	7	1	-37.200	-45.26257	-29.13743
5	8	2	-34.350	-42.41257	-26.28743

=====

GENOTYPE AS: Random

=====

-----  
RESPONSE VARIABLE: Y1

-----

## **Descriptive Statistics**

Descriptive Statistics:

Variable	Site	N	NonMissObs	Mean	StdDev
1	Y1 Env1	32	42.49063	6.739166	
2	Y1 Env2	32	42.99063	5.741213	

-----

ANALYSIS FOR: Site = Env1

-----

Trial Summary:

Number of observations read: 32

Number of observations used: 32

Factors	Number of Levels	Levels
Site	2	Env1 Env2
Gen	8	1 2 3 ... 8
Blk	4	1 2 3 4

### **Estimates of Variance Components**

Variance Components Table:

Groups	Variance	Std.Dev.
1 Test:Check	51.720292	7.191682
2 Blk	2.857874	1.690525
3 Residual	13.563282	3.682836

### **Genotype Predicted Means**

Predicted means:

Gen	Means
1 4	41.28751
2 5	33.16972
3 6	52.05649
4 7	43.86831
5 8	46.54296

### **Estimate of Heritability**

Heritability:

0.94

### **Test for the Significance of Genotypic Effect**

Linear Mixed Model fit by Maximum likelihood ratio test

Environment Variable: Site = Env1

Response Variable: Y1

Chisq Pr(>Chisq)

Gen 14.605 0.0001325 \*\*\*

---

Signif. codes: 0 '\*\*\*\*' 0.001 '\*\*\*' 0.01 '\*\*' 0.05 '\*' 0.1 '' 1

### **Genotypic and Phenotypic Correlations**

=====

Genotypic Correlations:

Site: Env1

Y1      Y2

Y1      -2.147807

Y2 -2.147807

Site: Env2

	Y1	Y2
Y1	0.003393196	
Y2	0.003393196	

Phenotypic Correlations:

Site: Env1

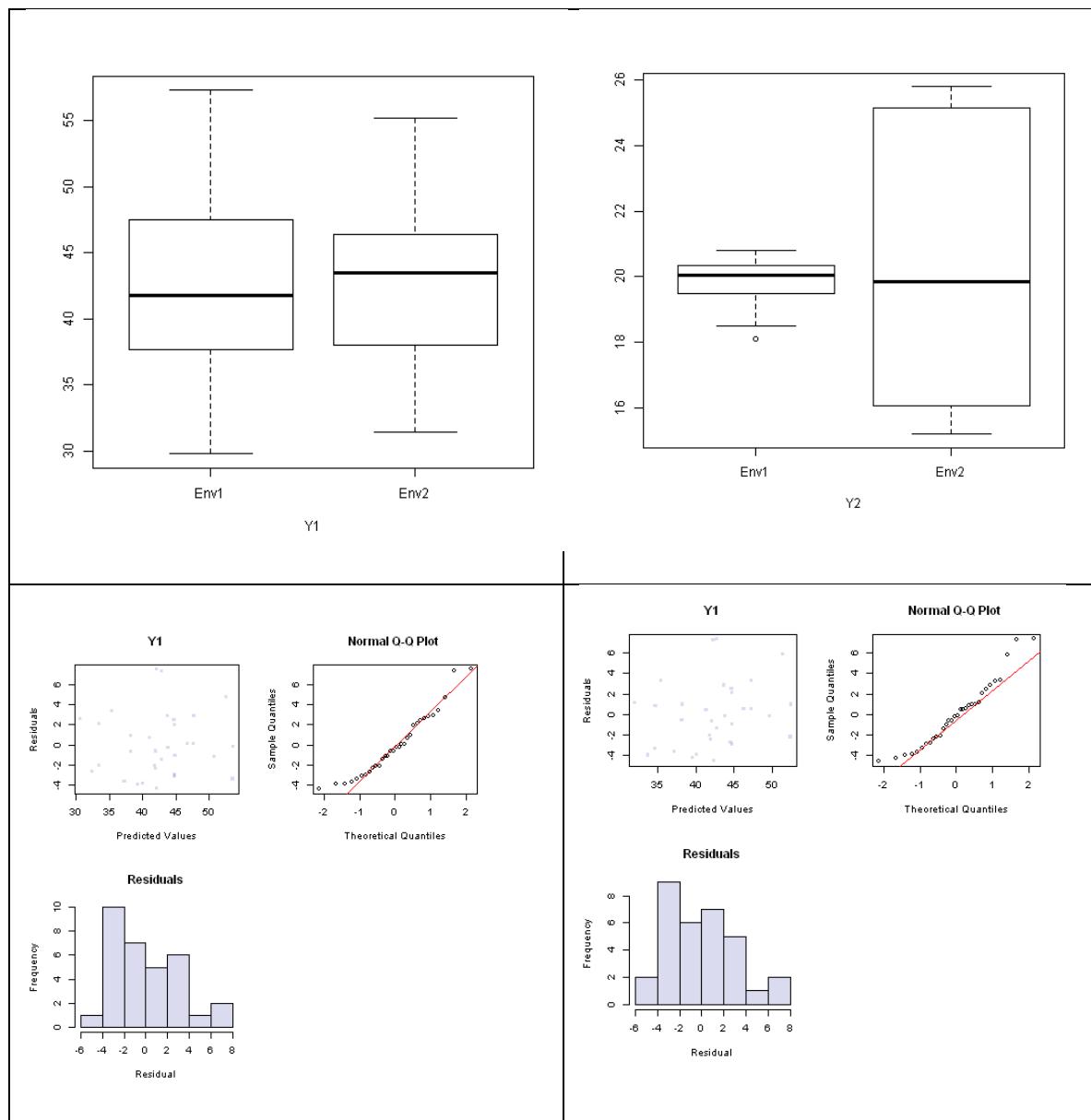
	Y1	Y2
Y1	-0.815358	
Y2	-0.815358	

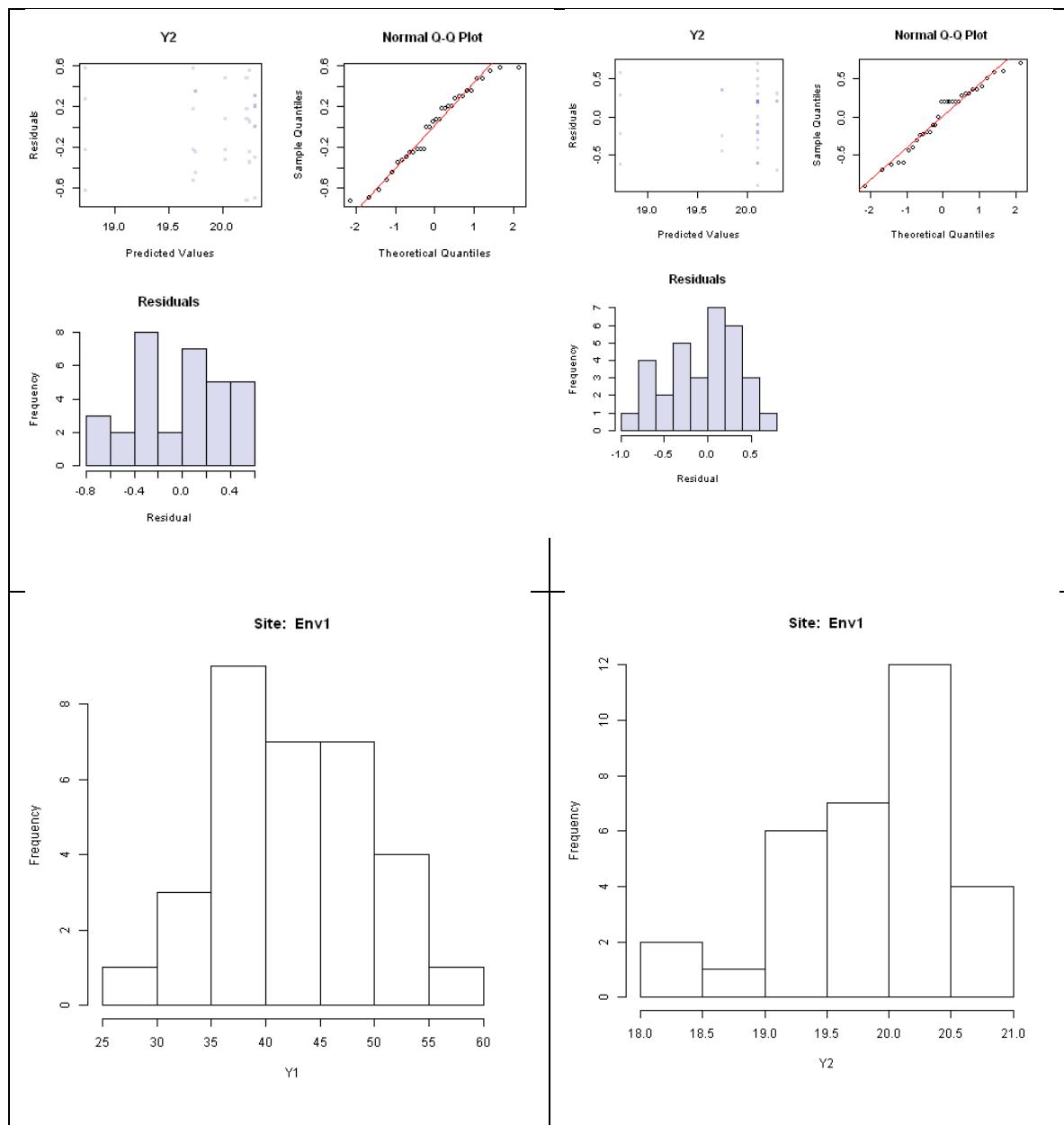
Site: Env2

	Y1	Y2
Y1	0.004514488	
Y2	0.004514488	

=====

- Generated graphs can be viewed by clicking the Graph Tab of the displayed analysis folder. Sample generated graphs are shown below:





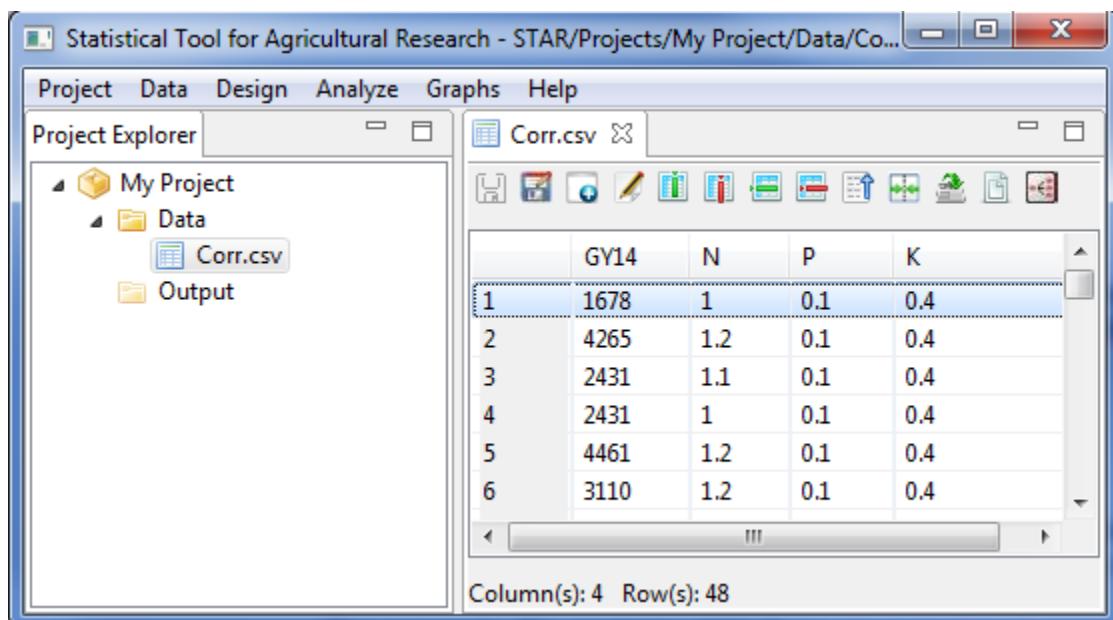
# Correlation Analysis

The **Correlation Analysis** is used to determine the strength of linear relationship between variables. The **Correlation Analysis** submenu performs bivariate correlation using the pearson's correlation coefficient, spearman's rho and kendall tau. By default, it uses the pearson's correlation coefficient.

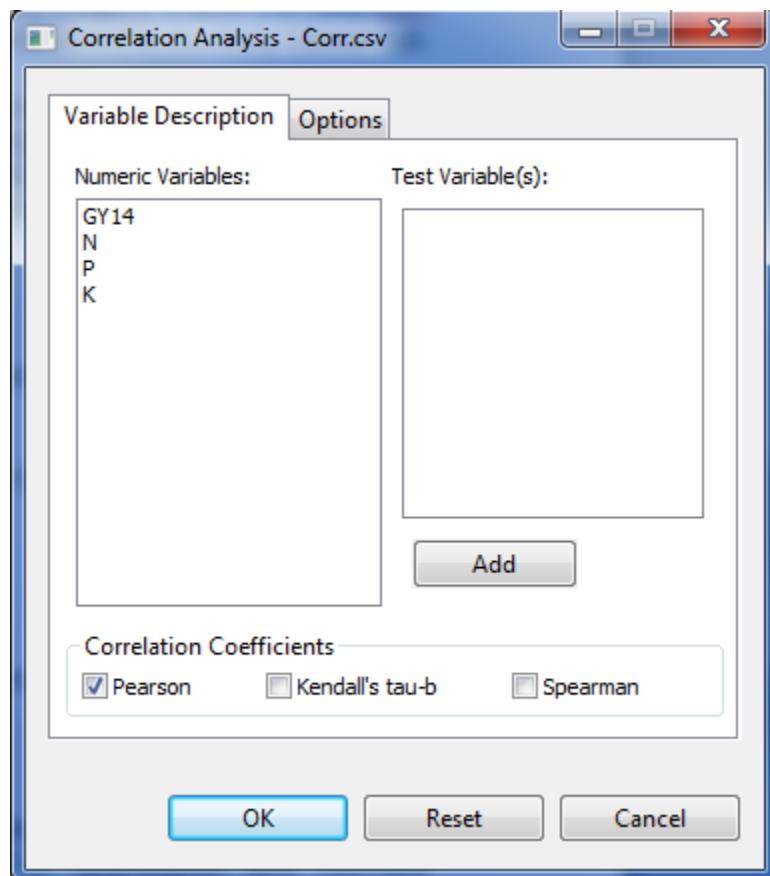
The steps to perform Correlation Analysis are listed below:

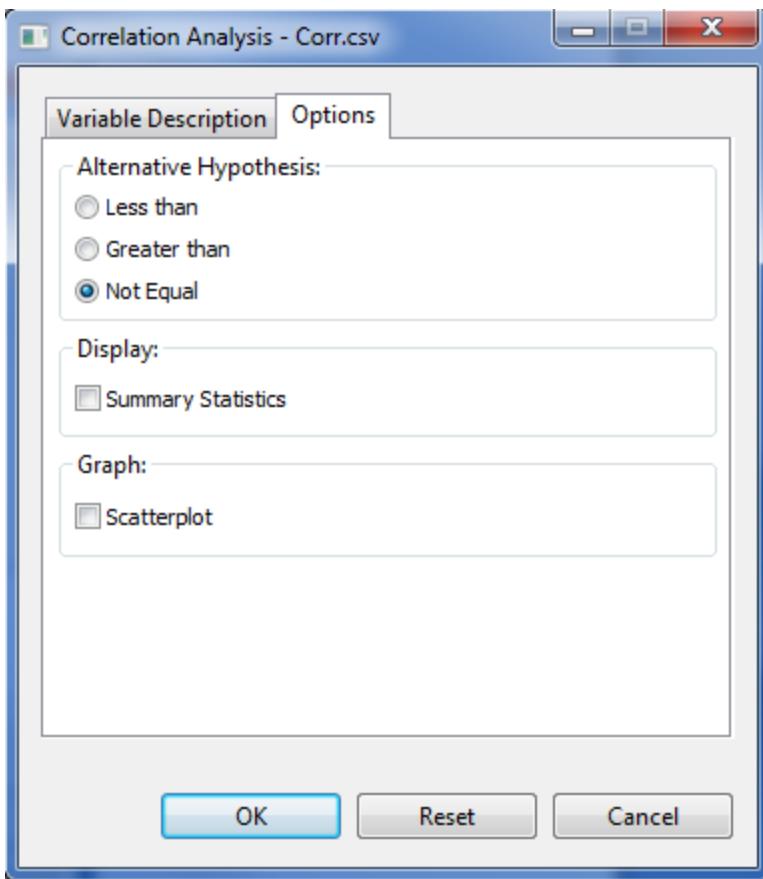
- On the **Project Explorer**, using the project named *My Project*, import the data *Corr* from STAR Package. Double-click the file to open and view it in the Data Viewer tab.

The example file contains data from an experiment conducted to investigate the relationship between grain yield (*GY14*, in kg/ha), the grain's nitrogen (*N*), phosphorus (*P*) and potassium (*K*) content in percent. The data were collected from 48 experimental plots with grains adjusted to 14% moisture content.



- Click **Analyze | Correlation...** from the main window. The **Correlation Analysis** dialog box will appear.





- Specify the required field and appropriate options for the analysis:

### **Variable Description Tab**

#### Test Variable(s)

This field is required. For the analysis to proceed, this list box should have at least two entries.

#### Correlation Coefficient

For the analysis to proceed, at least one of the methods should be tick. By default, Pearson's correlation coefficient is computed. For quantitative and normally distributed variables, choose the Pearson correlation coefficient. If the data are not normally distributed or ordinal level, choose Kendall's tau or Spearman, which measures the association between ranks. The correlation coefficient ranges from -1 to +1.

### **Option Tab**

### Alternative Hypothesis

User can select a one-tailed (less than or greater than) or two-tailed test (not equal). The default alternative hypothesis used is that for the two-sided test.

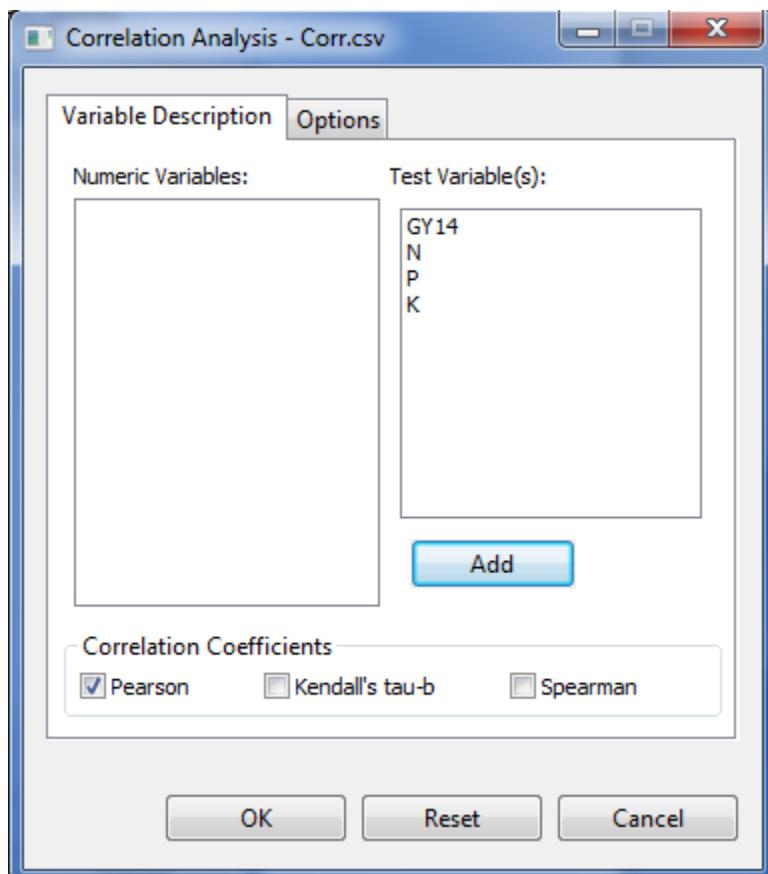
### Display Summary Statistics

If this option is selected, a summary table with number of observations, minimum, maximum, mean and standard deviation will be displayed.

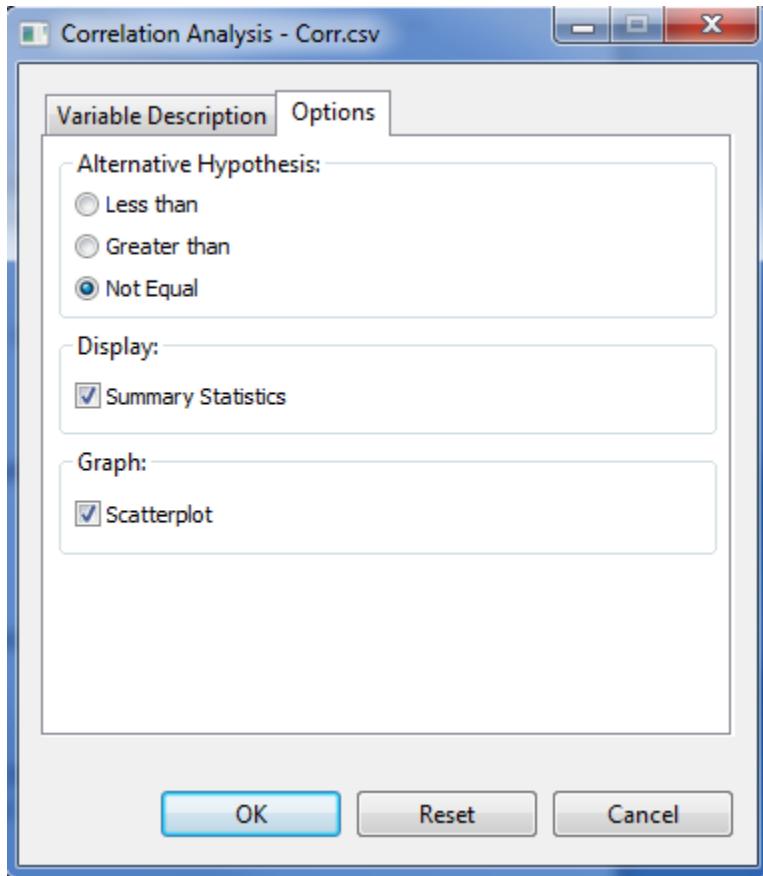
### Scatterplot

If this option is selected, scatter plot for all pair of variables listed in the **Test Variable(s)** list box will be created.

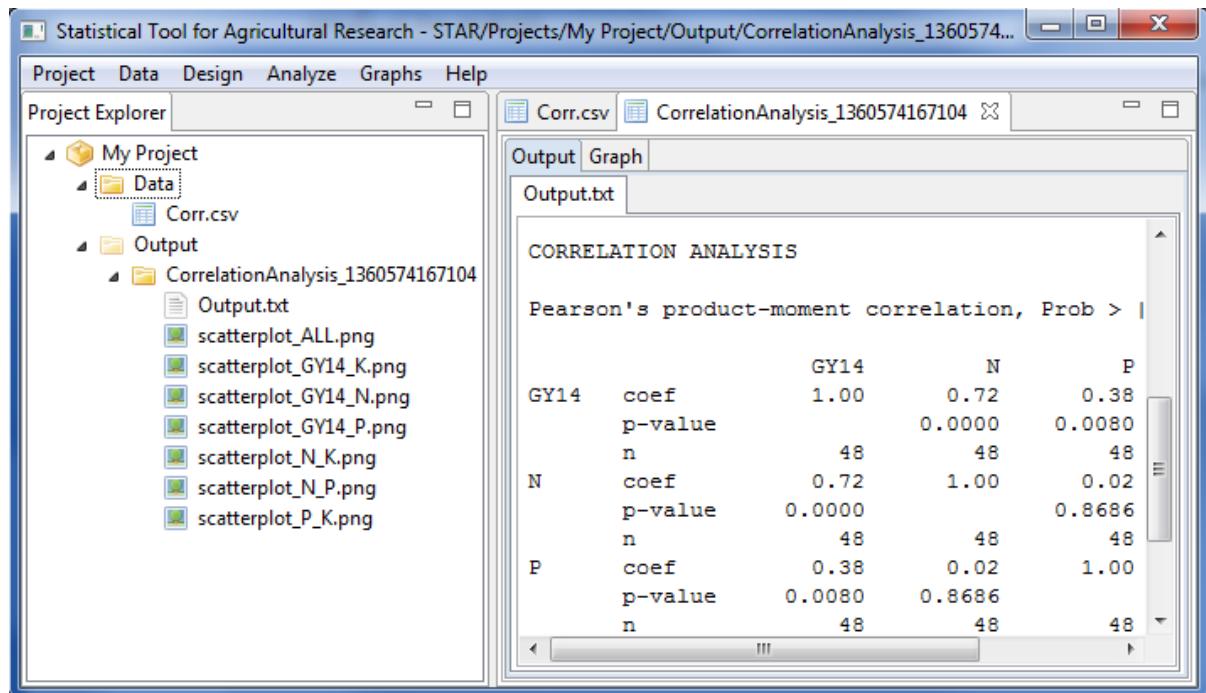
For the example, the completed **Variable Description** tab should appear as illustrated below:



The completed **Option** tab should appear as illustrated below:



- Once all options have been specified, click the **OK** button. The Correlation Analysis dialog box will be minimized and STAR activates the Output Viewer which shows the results of the analysis.



- Sample output of the Correlation Analysis using Pearson's product-moment correlation is shown below.

#### Result of Correlation Analysis

##### DESCRIPTIVE STATISTICS

Variable	N_NonMissObs	Min	Max	Mean	StdDev
GY14	48	1678.00	7860.00	4788.67	1552.27
N	48	0.10	1.80	1.23	0.33
P	48	0.10	0.30	0.23	0.08
K	48	0.20	0.40	0.31	0.06

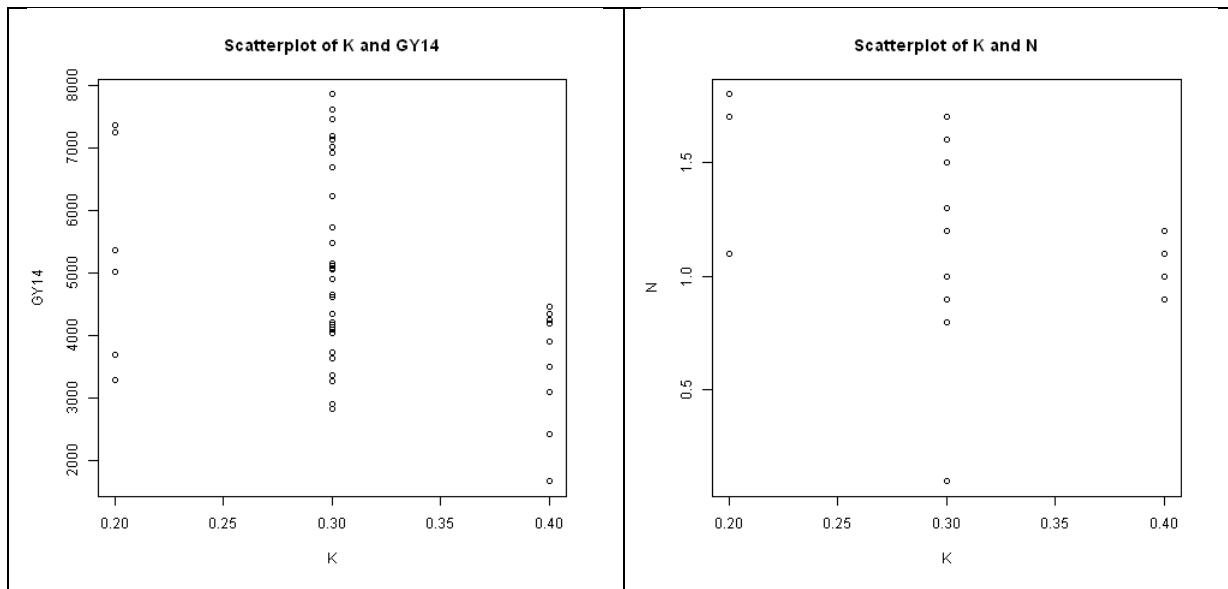
##### CORRELATION ANALYSIS

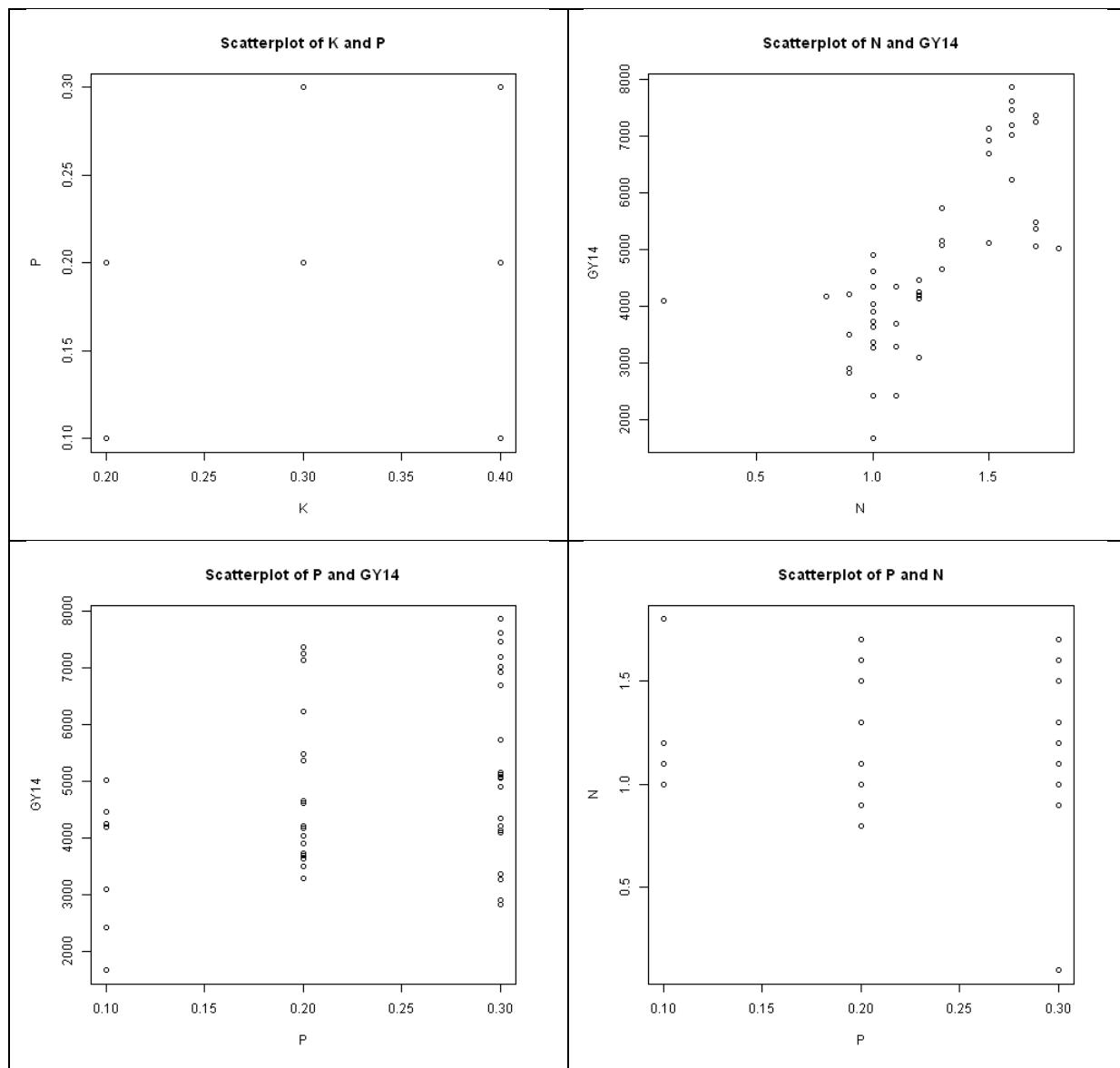
Pearson's product-moment correlation, Prob > |r|

		GY14	N	P	K
GY14	coef	1.00	0.72	0.38	-0.40
	p-value		0.0000	0.0080	0.0053

	n	48	48	48	48
N	coef	0.72	1.00	0.02	-0.34
	p-value	0.0000		0.8686	0.0180
P	n	48	48	48	48
	coef	0.38	0.02	1.00	-0.35
P	p-value	0.0080	0.8686		0.0161
	n	48	48	48	48
K	coef	-0.40	-0.34	-0.35	1.00
	p-value	0.0053	0.0180	0.0161	
	n	48	48	48	48

- If a scatter plot is requested, the graph can be viewed in the **Graph Viewer**. Sample generated graphs are shown below:





# Linear Regression Analysis

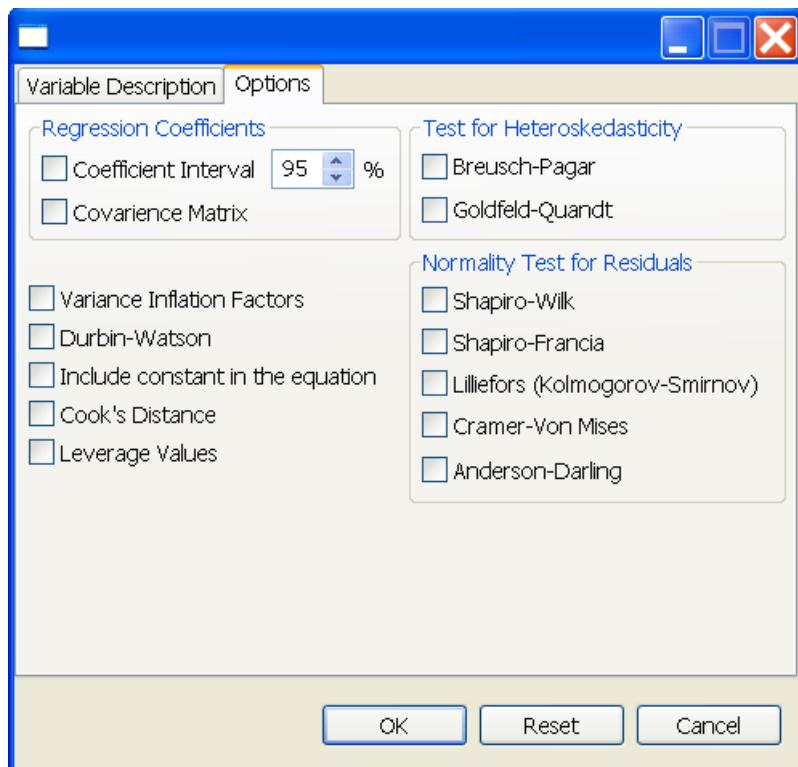
Regression Analysis is the statistical technique used to determine the strength of linear relationship between variables.

The steps to perform Linear Regression Analysis are listed below:

- On the Project Explorer, locate the dataset *plantHeight.csv* in the *Data* folder of the project named *SampleProject*. Double-click the file to open and view it in the Data Viewer tab. The file contains the data of number of days after seeding (DAS) as independent variable and plant height as dependent variable. Based on this data, simple linear regression analysis is to be conducted to assess how the days after seeding linearly affects plant height, on the average.

	DAS	Height
1	0	0
2	10	12
3	30	55
4	60	80
5	90	110

- Click **Analyze | Regression Analysis** from the main window of STAR. The **Regression** dialog box will appear.



- Specify the required field and appropriate options for the analysis:

#### **Variable Description Tab**

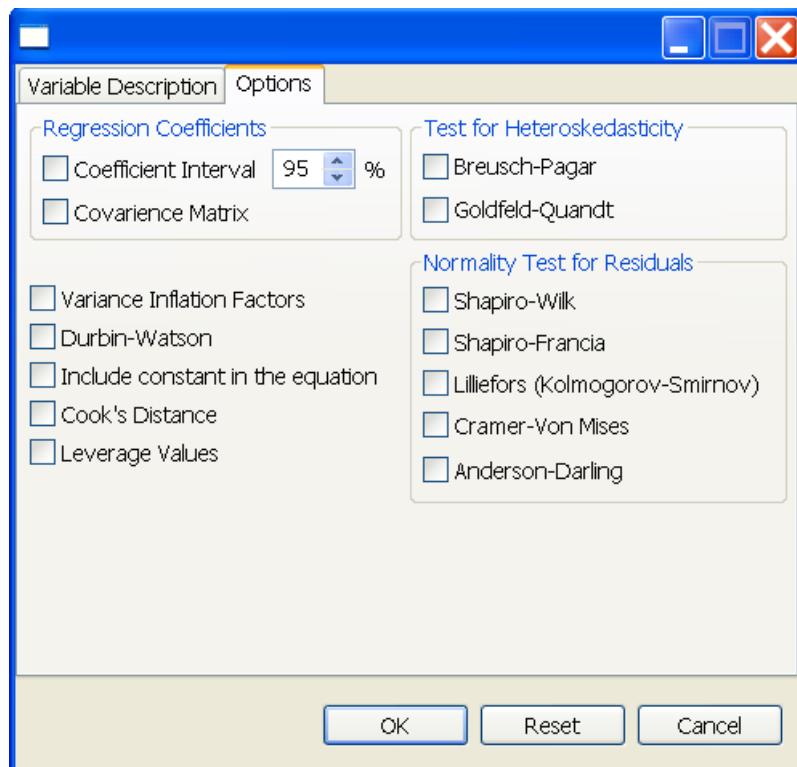
##### Dependent Variable

This field is required. For the analysis to proceed, this list box should have at least one entry.

##### Independent Variables

This field is required. For the analysis to proceed, this list box should have at least one entry.

#### **Option Tab**



### Regression Coefficients

User can choose to display the confidence interval and the covariance matrix. If any of this is selected, the results is embedded in the table of parameter estimates. For the confidence interval, the default value is 95%. Valid value is between 90% to 99%.

### Test for Heteroskedasticity

There are two available procedures namely: Breusch-Pagar and Goldfeld-Quandt.

### Normality Test

If this option is selected, it will perform normality test for the residuals. There are five procedures available, namely: Shapiro-Wilk, Shapiro-Francia, Lilliefors, Cramer-Von Mises and Anderson-Darling.

### Variance Inflation Factors

If this is selected, it displays the variance inflation factors (VIF) which measures the Collinearity (or multicollinearity).

### Durbin-Watson

If this is selected, it displays the Durbin-Watson test for serial correlation of the residuals.

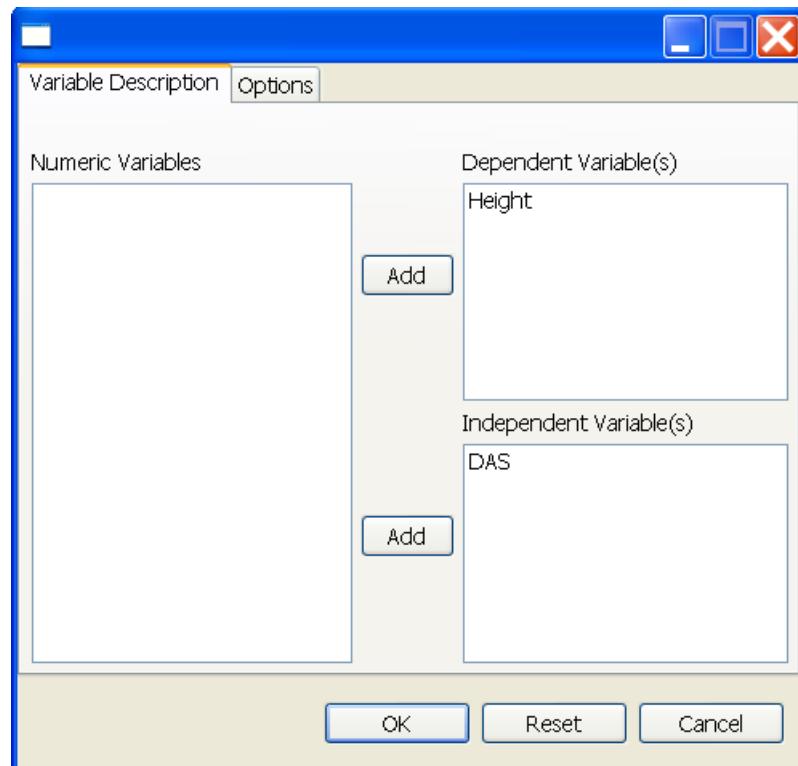
### Include constant in the equation

By default, the regression model includes a constant term in the equation. Deselecting this option forces regression through the origin, this is rarely done.

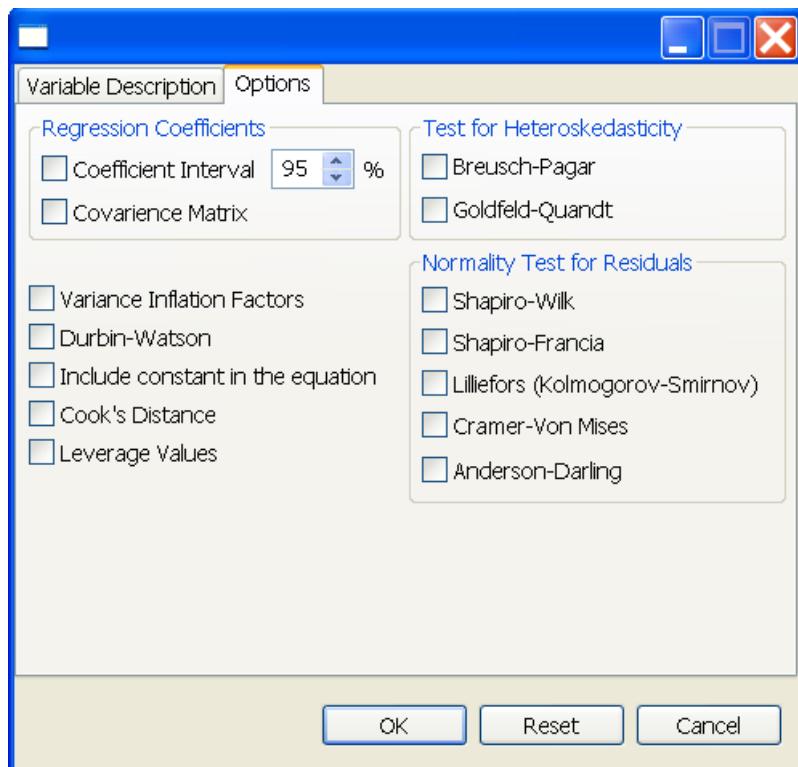
Cook's Distance

Leverage Values

For the example, the completed **Variable Description** tab should appear as illustrated below:



The completed **Option** tab should appear as illustrated below:



- Once all options have been specified, click the **OK** button. The Regression Analysis dialog box will be minimized and STAR activates the **Output Viewer** which shows the results of the analysis.

### Output Viewer

The default output of the Regression Analysis procedure in STAR includes the Analysis of Variance table, a table of model summary and the parameter estimated. The output starts with the descriptive statistics, if this option was specified in the **Options** tab.

### Graph Viewer

The tab displays two diagnostics plots. The left plot, entitled *Residuals vs. Fitted* is for assessing the distribution of the residuals. An ideal plot should reveal that the points are distributed around 0. The residuals should not be affected by the size of the fitted values. Problematic data may result to a plot wherein the points increase as the fitted values increase, thus forming a “funnel-shaped” distribution. This will indicate a violation of the homogeneity of variances requirement for analysis of variance. The *Normal Q-Q* plot is used for assessing normality. The points should lie about the line.

- Sample output of the Regression Analysis is shown below.

## DESCRIPTIVE STATISTICS

---

Variable	N	NonMissObs	Mean	StdDev	SE_Mean
Height	5	5	51.40	45.99	20.57
DAS	5	5	38.00	37.01	16.55

---

## LINEAR REGRESSION ANALYSIS

Model Fitted: Height ~ DAS

### Analysis of Variance Table

---

Source	DF	Sum of Square	Mean Square	F Value	Pr > F
Model	1	8201.3898	8201.3898	95.44	0.0023
DAS	1	8201.3898	8201.3898	95.44	0.0023
Error	3	257.8102	85.9367		
Total	5	16660.5898			

---

### Model Summary:

---

Root MSE	Height	Mean	Coeff Var	R-Square	Adj R-Sq
9.27	51.40	89.47	0.9695	0.9594	

---

### Parameter Estimates:

---

Variable	Estimate	Std. Error	t value	LL CI*	UL CI*	Pr(> t )
Intercept	4.91	6.31	0.78	-15.17	25.00	0.4931
DAS	1.22	0.13	9.77	0.82	1.62	0.0023

---

\* At 95% Confidence Interval

## TEST FOR NORMALITY

---

Variable	Method	Stat	Value	p Value

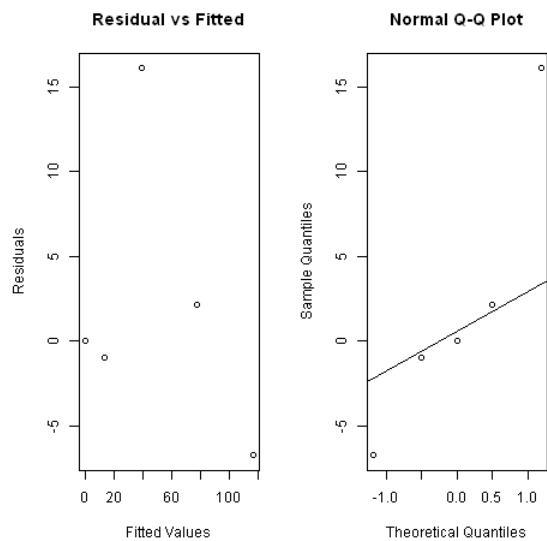
---

residual Shapiro-Wilk W 0.7532 0.0319

---

Durbin Watson Test for Autocorrelation  
lag Autocorrelation D-W Statistic p-value  
1 -0.1143968 2.037653 0.494  
Alternative hypothesis: rho != 0

- The graph can be viewed in the **Graph Viewer**. Sample generated graphs are shown below:





# Nonparametric Tests

Nonparametric Tests procedure provides several tests that do not require assumptions about the shape of the underlying distribution.

## One Sample

## Two Related Samples

## Two Independent Samples

## Test for Several Related Samples

## Test for Several Independent Samples

This procedure perform Kruskal Wallis test.

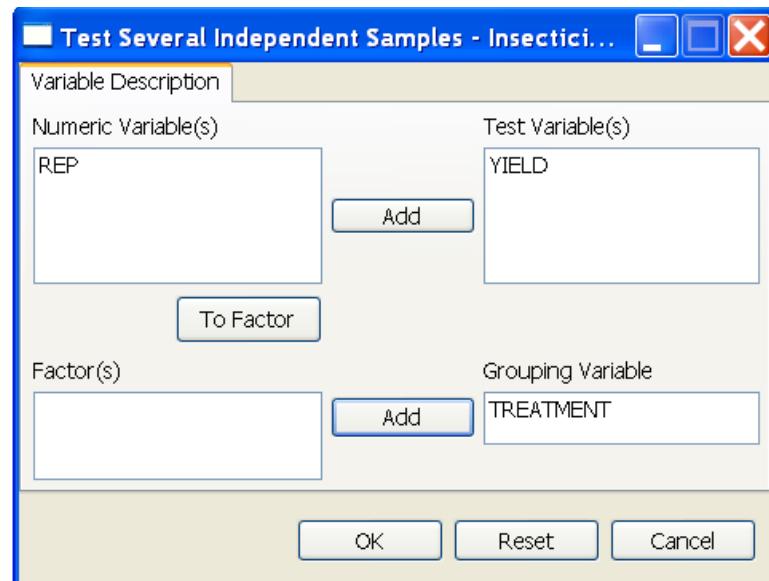
The steps to perform Kruskal Wallis test are listed below:

- Locate the dataset *Insecticides.csv* from the *Data* folder of the project named *SampleProject* in the Project Explorer.

The screenshot shows the Statistical Tool for Agricultural Research interface. The Project Explorer on the left lists files in the SampleProject folder, including Data files like Corr.csv, data1\_aggregate.csv, data1\_sorted.csv, data1\_subset\_sorted.csv, data1Sort.csv, Fertilizer.csv, Gerua.csv, Gerua\_sorted.csv, Insecticides.csv (which is selected), Maize.csv, plantHeight.csv, RCBD\_F2.csv, SeedingRate.csv, StatusAndAdoption.csv, strip.csv, and Output files. The main window on the right displays the contents of the Insecticides.csv file, which has columns TREATMENT, REP, and YIELD. The data is as follows:

	TREATMENT	REP	YIELD
1	Dol-Mix (1kg)	1	2537
2	Dol-Mix (1kg)	2	2069
3	Dol-Mix (1kg)	3	2104
4	Dol-Mix (1kg)	4	1797
5	Dol-Mix (2kg)	1	3366
6	Dol-Mix (2kg)	2	2591
7	Dol-Mix (2kg)	3	2211
8	Dol-Mix (2kg)	4	2544
9	DDT + phi...	1	2536
10	DDT + phi...	2	2459
11	DDT + phi...	3	2827
12	DDT + phi...	4	2385
13	Azodin	1	2387
14	Azodin	2	2453
15	Azodin	3	1556
16	Azodin	4	2116
17	Dimercon-B...	1	1997

- Click Analyze | Non-Parametric Test | Test for Several Independent Samples. The Test for Several Independent Samples dialog box will appear.
- Specify the required field and appropriate options for the analysis. The completed dialog box should appear as shown below:



- Sample output is shown below:

Rank Sums for Variable YIELD

Classified by Variable TREATMENT

---

TREATMENT	N	Sum of Ranks	Mean of Ranks
Azodin	4	64	16.00
Control	4	12	3.00
DDT + phi-BHC	4	91	22.75
Dimercon-Boom	4	41	10.25
Dimercon-Knap	4	35	8.75
Dol-Mix (1kg)	4	66	16.50
Dol-Mix (2kg)	4	97	24.25

---

\* Average scores are used for ties.

Kruskal-Wallis rank sum test

---

Chi-Square	20.8522
DF	6
Pr > Chi-Square	0.0020

---

# **Graphs**

**Bar Graph**

**Line Graph**

**Scatter Plot**

**Box Plot**

**Pie Chart**

# Appendix

## Data Description

### *Data From Sample Project*

### *Data From STAR Package*

#### **Corr**

#### **Description**

The example file contains data from an experiment conducted to investigate the relationship between grain yield (*GY14*, in kg/ha), the grain's nitrogen (*N*), phosphorus (*P*) and potassium (*K*) content in percent. The data were collected from 48 experimental plots with grains adjusted to 14% moisture content.

#### **Formats**

This data contains the following columns:

*GY14*

*N*

*P*

*K*

#### **Source**

BEDDA Training

### ***CropStatRCBDOverSite***

#### **Description**

#### **Formats**

This data contains the following columns:

#### **Source**

CropStat

### ***Fertilizer***

#### **Description**

#### **Formats**

This data contains the following columns:

Fertilizer	a factor with two levels (A and B) denoting the fertilizer used
NumFruit	a numeric vector of number of fruits

#### **Source**

### ***Gerua***

#### **Description**

#### **Formats**

This data contains the following columns:

REP	a factor with three levels (1, 2 and B) denoting the blocks
TPL	a factor with two levels (D and N) denoting the transplanting method; considered as the main plot factor
CULT	a factor with 26 levels denoting the cultivar; considered as the subplot factor
DFF	a numeric vector denoting the number of days after flowering
PLHT	a numeric vector denoting the plant height in cm
PNCLE	a numeric vector denoting the panicle number
GRNYLD	a numeric vector denoting the grain yield in kg/ha

#### **Source**

BEDDA Training

### **GomezSplitRCBD**

#### **Description**

Grain Yield of Data of Four Rice Varieties Grown in Six Levels of Nitrogen in a Split-Plot Design with three replications.

#### **Formats**

This data contains the following columns:

Rep	a factor with 3 levels (1 to 3) denoting the blocks
Nitrogen	main plot factor with 6 levels (0, 60, 90, 120, 150 and 180, in kg N/ha) denoting the Nitrogen Levels
Variety	subplot factor with 4 levels (C4-63, IR5, IR8 and Peta) denoting the Rice Variety
Yield	a numeric vector of grain yield in kg/ha

#### **Source**

Gomez, Kwanchai A. and Arturo A. Gomez. (1984) *Statistical Procedures for Agricultural Research 2<sup>nd</sup> Edition*. John Wiley & Sons, Inc. Page 102.

## **GomezSplit2RCBD**

### **Description**

Grain Yield of Three Rice Varieties Grown under Three Management Practices and Five Nitrogen Levels; in a split-split plot design in RCBD with three replications.

### **Formats**

This data contains the following columns:

Rep	a factor with 3 levels (1 to 3) denoting the blocks
Nitrogen	main plot factor with 5 levels (N1, N2, N3, N4, and N5) denoting the Nitrogen Levels
	N1 0 kg N/ha
	N2 50 kg N/ha
	N3 80 kg N/ha
	N4 110 kg N/ha
	N5 140 kg N/ha
Management	subplot factor with 3 levels (M1, M2 and M3) denoting the Management Practices
	M1 Minimum
	M2 Optimum
	M3 Intensive
Variety	sub-subplot factor with 3 levels (V1, V2 and V3) denoting the Rice Variety
GY	a numeric vector of grain yield in t/ha

### **Source**

Gomez, Kwanchai A. and Arturo A. Gomez. (1984) *Statistical Procedures for Agricultural Research 2<sup>nd</sup> Edition*. John Wiley & Sons, Inc. Page 143.

## **GomezStrip**

### **Description**

Grain Yield of Six Varieties of Rice, Broadcast Seeded and Grown with Three Nitrogen Rates in a Strip-plot Design with Three Replications

### **Formats**

This data contains the following columns:

REP	a factor with 3 levels (1 to 3) denoting the blocks
NITROGEN	vertical factor with 3 levels (0, 60 and 120, kg N/ha) denoting the Nitrogen Levels
VARIETY	horizontal factor with 6 levels (V1, V2, V3, V4, V5 and V6) denoting the Rice Variety
	V1      IR8
	V2      IR127-80
	V3      IR305-4-12
	V4      IR400-2-5
	V5      IR665-58
	V6      Peta
GRNYLD	a numeric vector of grain yield in kg/ha

### **Source**

Gomez, Kwanchai A. and Arturo A. Gomez. (1984) *Statistical Procedures for Agricultural Research 2<sup>nd</sup> Edition*. John Wiley & Sons, Inc. Page 110.

### ***GomezStripSplit***

#### **Description**

Grain yield of six rice varieties tested under two planting methods and three nitrogen rates in a Strip-Split plot Design with three replicates.

### **Formats**

This data contains the following columns:

REP	a factor with 3 levels (1 to 3) denoting the blocks
NITROGEN	vertical factor with 3 levels (0, 60 and 120, kg N/ha) denoting the Nitrogen Levels

VARIETY	horizontal factor with 6 levels (V1, V2, V3, V4, V5 and V6) denoting the Rice Variety
V1	IR8
V2	IR127-80
V3	IR305-4-12
V4	IR400-2-5
V5	IR665-58
V6	Peta
PLANTING	subplot factor with two levels (Broadcast and Transplanted) denoting the planting methods
YIELD	a numeric vector of grain yield in kg/ha

### **Source**

Gomez, Kwanchai A. and Arturo A. Gomez. (1984) *Statistical Procedures for Agricultural Research 2<sup>nd</sup> Edition*. John Wiley & Sons, Inc. Page 155.

### **grp\_pss**

#### **Description**

Three (3) varieties, a traditional variety (A) and two new varieties B and C, were tested to determine if their yield means are equal. Analysis of variance showed that difference among the varieties exists. The researcher would like to know the nature of the differences among the groups.

#### **Formats**

This data contains the following columns:

VARIETY	a factor with three levels denoting the variety
A	traditional variety
1	
REP	a numeric vector of number of fruit set for the period of 45 days
YIELD	a numeric vector of fruit weight in kilograms (kg)
syp	a numeric vector of seed yield per plant in grams

sl                    a numeric vector of seedling length in cm

### **Source**

Tomar, B.S. Descriptive Statistics: Design Resources Server. *Indian Agricultural Statistics Research Institute (ICAR)*, New Delhi 110 012, India. [www.iasri.res.in/design](http://www.iasri.res.in/design) (accessed lastly on January 28, 2013).

## **IASRITomar**

### **Description**

An experiment was conducted to study compare the effect of natural pollination and hand pollination under open field conditions.

### **Formats**

This data contains the following columns:

group	a factor with two levels (1 and 2) denoting the type of pollination used
	2        natural pollination
	3        hand pollination
fs45	a numeric vector of number of fruit set for the period of 45 days
fw	a numeric vector of fruit weight in kilograms (kg)
syp	a numeric vector of seed yield per plant in grams
sl	a numeric vector of seedling length in cm

### **Source**

Tomar, B.S. Descriptive Statistics: Design Resources Server. *Indian Agricultural Statistics Research Institute (ICAR)*, New Delhi 110 012, India. [www.iasri.res.in/design](http://www.iasri.res.in/design) (accessed lastly on January 28, 2013).

## **IASRITomar2**

### **Description**

An experiment was conducted to study compare the effect of hand pollination on hybrid of seed production in bottle gourd under open field and poly house conditions.

## **Formats**

This data contains the following columns:

Group	a factor with two levels (2 and 3) denoting the type of conditions
	2 hand pollination in open field condition
	4 hand pollination in poly house condition
nmfp	a numeric vector of total number of male flowers per plant
fs45	a numeric vector of number of fruit set for the period of 45 days
fweight	a numeric vector of fruit weight in kilograms (kg)
flength	a numeric vector of fruit length in centimeter (cm)
slyp	a numeric vector of seed yield per plant in grams
sl	a numeric vector of seedling length in centimeter

## **Source**

Tomar, B.S. Descriptive Statistics: Design Resources Server. *Indian Agricultural Statistics Research Institute (ICAR)*, New Delhi 110 012, India. [www.iasri.res.in/design](http://www.iasri.res.in/design) (accessed lastly on January 28, 2013).

## ***Inoculation***

### **Description**

An experiment was conducted on the effect of 6 times of inoculation of *S. linicola* on the oil content of Redwing Flaxseed. The experiment was conducted using an RCB design with 4 replications.

## **Formats**

This data contains the following columns:

Rep	a factor with three levels (1, 2 and 3) denoting the blocks
InoculationTime	a factor with six levels (Seedling, Early Bloom, Full Bloom, Full Bloom (1/100), Ripening and Uninoculated) denoting the time of inoculation
OilContent	a numeric vector denoting the oil content

## **Source**

Steel, R.G.D., J.H. Torrie, and D.A. Dickey. Principles and Procedures of Statistics: A Biometrical Approach.

## **Insecticides**

### **Description**

Grain yield of rice resulting from use of different foliar and granular insecticides for the control of brown planthoppers and stem borers from a Completely Randomized Design Experiment with Four Replicates and 7 treatments. The data contains 28 rows and 3 columns.

### **Formats**

This data contains the following columns:

Treatment	a factor with 7 levels (Azodin, DDT + $\gamma$ -BHC, Dimercon-Boom, Dimercon-Knap, Dol-Mix (1 kg), Dol-Mix (2 kg) and Control) denoting the Different Foliar and Granular Insecticides
Rep	a factor with 4 levels (1 to 4) denoting the replicates
GrainYield	a numeric vector of grain yield in kg/ha

### **Source**

Gomez, Kwanchai A. and Arturo A. Gomez. (1984) *Statistical Procedures for Agricultural Research 2<sup>nd</sup> Edition*. John Wiley & Sons, Inc. Page 14.

## **Maize**

### **Description**

Grain yield of three promising maize hybrids and a check variety from an experiment using Latin Square design. The data contains 24 rows and 3 columns.

### **Formats**

This data contains the following columns:

Maize	a factor with 4 levels denoting the Maize Hybrids (A, B, and D) and a Check Variety (C)
Row	a factor with 4 levels (1 to 4) denoting the row blocking factor

Column	a factor with 4 levels (1 to 4) denoting the column blocking factor
GrainYield	a numeric vector of grain yield in kg/ha

### **Source**

Gomez, Kwanchai A. and Arturo A. Gomez. (1984) *Statistical Procedures for Agricultural Research 2<sup>nd</sup> Edition*. John Wiley & Sons, Inc. Page 33.

## **SeedingRate**

### **Description**

Grain yield of three promising maize hybrids and a check variety from an experiment using Latin Square design. The data contains 24 rows and 3 columns.

### **Formats**

This data contains the following columns:

Maize	a factor with 4 levels denoting the Maize Hybrids (A, B, and D) and a Check Variety (C)
Row	a factor with 4 levels (1 to 4) denoting the row blocking factor
Column	a factor with 4 levels (1 to 4) denoting the column blocking factor
GrainYield	a numeric vector of grain yield in kg/ha

### **Source**

Gomez, Kwanchai A. and Arturo A. Gomez. (1984) *Statistical Procedures for Agricultural Research 2<sup>nd</sup> Edition*. John Wiley & Sons, Inc. Page 33.

## **Description**

### **Formats**

This data contains the following columns:

REP	a factor with three levels (1, 2 and B) denoting the blocks
GRNYLD	a numeric vector denoting the grain yield in kg/ha

**Source**

BEDDA Training

**Description**

**Formats**

This data contains the following columns:

REP	a factor with three levels (1, 2 and B) denoting the blocks
GRNYLD	a numeric vector denoting the grain yield in kg/ha

**Source**

BEDDA Training