2013

R I D E V

USER MANUAL

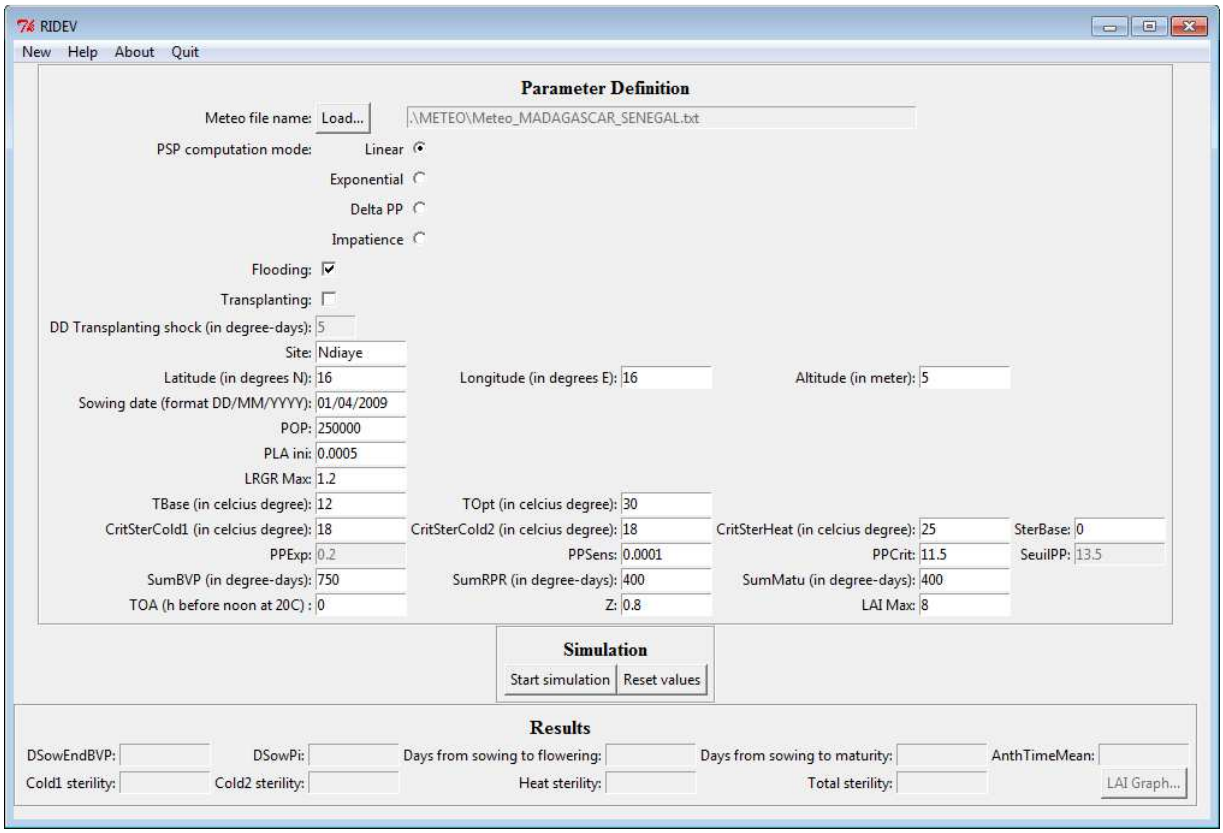
Step by step guide on how to use RIDEV, along with several pointers regarding input file templates.

[Type the company name]
3/25/2013

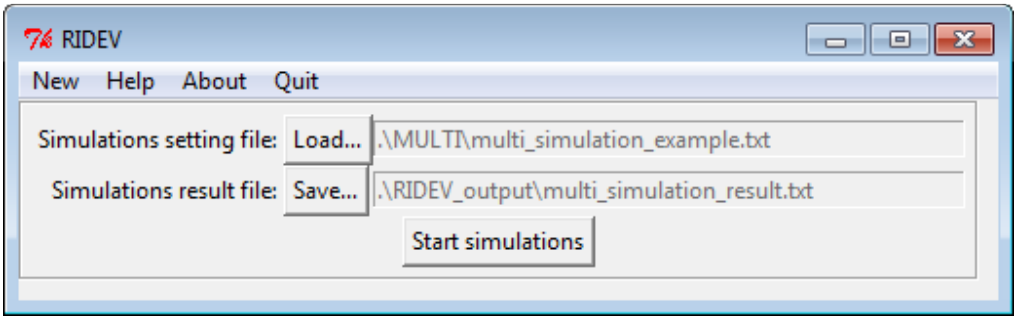
THE INTERFACE

The Main Interface

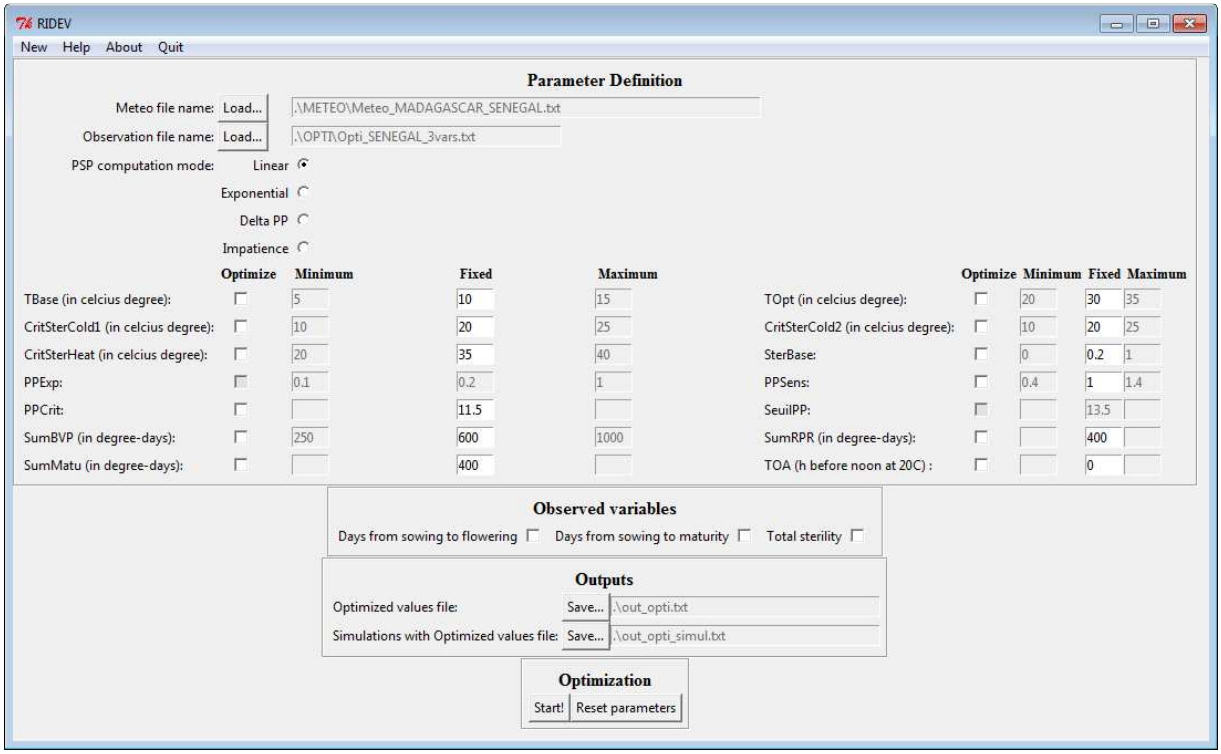
The Simple Simulation Interface



The Multiple Simulation Interface:



The Optimization Interface:



FILES

INPUT FILE: Meteorology File

	A	B	C	D	E	F	G	H	I	J	K	L
1	CodeStation	Jour	Tmax	Tmin	Tmoy	HMax	HMin	HMoy	Vt	Ins	Rg	ETP
2	Ivory	01/01/2009	32.1	20.5		96	40		1.956019		27.85	6.389361
3	Ivory	02/01/2009	29.9	19.2		96	46		1.909722		31.94	6.562051
4	Ivory	03/01/2009	33.1	21.1		94.5	36		1.585648		26.56	6.205506
5	Ivory	04/01/2009	30.3	18.2		96	46		1.736111		22.58	5.155222
6	Ivory	05/01/2009	30.2	19.7		96	45.5		1.539352		27.28	5.815871
7	Ivory	06/01/2009	29.8	20.7		95.5	51.5		1.481481		18.17	4.323205
8	Ivory	07/01/2009	30.7	19		96	46.5		1.62037		31.34	6.457493
9	Ivory	08/01/2009	31.3	19.7		94.5	46		1.458333		23.7	5.346216
10	Ivory	09/01/2009	31.6	19.8		96	40		1.585648		24.8	5.677612
11	Ivory	10/01/2009	30.3	17.9		96	42		1.979167		33.7	6.970835

Figure 1 A Sample meteo file with correct formatting of data and headers

- **ALL** Header names and character strings / text are **case-sensitive** , meaning "***N****diaye*" will be regarded as a different site from "***n****diaye*" , and "***V****ariety_1*" is of a different variety from "***v****ariety_1*" ; take special care in ensuring that the strings are in the exact same cases

CodeStation
Site_1
Site_1
Site_1
Site_1
site_1
site_1
site_1
site_1
site_1

CodeStation
Site_1
Site_1
Site_1
Site_1
Site_1
Site_1
Site_1
Site_1
Site_1

Figure 2 Station names on the left may produce errors, names on the right ensure that there is only one site considered

- The first column, "**CodeStation**" Lists the names for the available sites in the meteorology file.

- The “Jour” column refers to the day of the observations to be found in the corresponding row, it follows the format **dd/MM/YYYY** , this is usually found in time region EN-Australia . Using other formats MAY produce errors.

Jour
01/01/2009

- The next parameters are the observed data, some of these such as the “**Tmoy**” and “**HMoy**” (Temperature Mean and Humidity Mean respectively) can be skipped given that both “**Tmax**” and “**Tmin**” or “**HMax**” and “**HMin**” are both present since they can be derived from the two corresponding maxima and minima.

Tmax	Tmin	Tmoy	HMax	HMin	HMoy	Vt	Ins	Rg	ETP
32.1	20.5		96	40		1.956019		27.85	6.389361

INPUT FILE: Multiple Simulation Settings File

	A	B	C	D	E	F	G	H	I	J
1	Simulatio	Site	Latitude	Longitude	Altitude	PSPComputationMode	Flooding	Transplanting	DDTransplantingShock	SowingDate
2	Sim1	CINZANA	13.25	-7.56	319	Linear	0	0	0	10/06/2009
3	Sim2	CINZANA	13.25	-7.56	319	Exponential	0	0	0	10/06/2009
4	Sim3	CINZANA	13.25	-7.56	319	DeltaPP	0	0	0	10/06/2009
5	Sim4	CINZANA	13.25	-7.56	319	Impatience	0	0	0	10/06/2009

K	L	M	N	O	P	Q	R	S	T
POP	PLAini	LRGRMax	TBase	TOpt	CritSterCold1	CritSterCold2	CritSterHeat	SterBase	PPExp
250000	0.0001	1.15	12	30	18	10	33	0.2	0.25
250000	0.0001	1.15	12	30	18	10	33	0.2	0.25
250000	0.0001	1.15	12	30	18	10	33	0.2	0.25
250000	0.0001	1.15	12	30	18	10	33	0.2	0.25

U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ
PPSens	PPCrit	SeuilPP	SumBVP	SumRPR	SumMatu	HrAnthBefNoon20C	Z	LAIMax	MeteoFileName						
0.3	11.5	13.5	400	400	400	11	0.8	6	D:\Projets Cirad\RIDEV\METEO\Meteorologie_sorghum_test.txt						
0.3	11.5	13.5	400	400	400	11	0.8	6	D:\Projets Cirad\RIDEV\METEO\Meteorologie_sorghum_test.txt						
0.3	11.5	13.5	400	400	400	11	0.8	6	D:\Projets Cirad\RIDEV\METEO\Meteorologie_sorghum_test.txt						
0.3	11.5	13.5	400	400	400	11	0.8	6	D:\Projets Cirad\RIDEV\METEO\Meteorologie_sorghum_test.txt						

Figure 3 A full working sample of a properly formatted multiple simulation settings file

- Contains exactly the same information as the one found on the simple simulation interface plus the simulation name to identify runs ; as always, entries are **CASE-SENSITIVE,** the date formatting of EN-Au is also followed here (**dd/MM/YYYY**)

- The checkboxes from the interface are changed into "Boolean switches" here, meaning they take either a value of **1 (true, ticked)** or **0 (false, unticked)**

Flooding	Transplanting
1	0

Flooding: ☑
Transplanting: ☐

Figure 4 text file input (left) and interface equivalent (right)

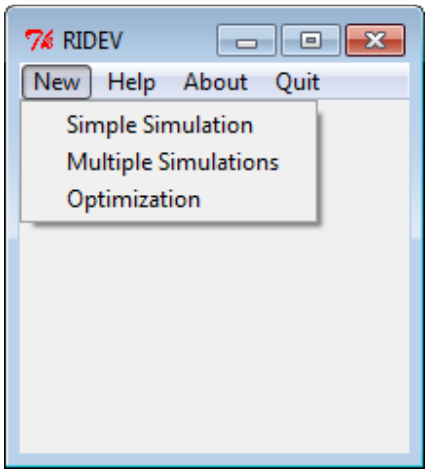
- The "**MeteoFileName**" column must contain the full path to the file which will contain the simulation results for each row , it is better to use a filename which is not in use yet to avoid access privilege related errors such as read-only files.

MeteoFileName
D:\Projets Cirad\RIDEV\METEO\Meteorologie_sorghum_test.txt

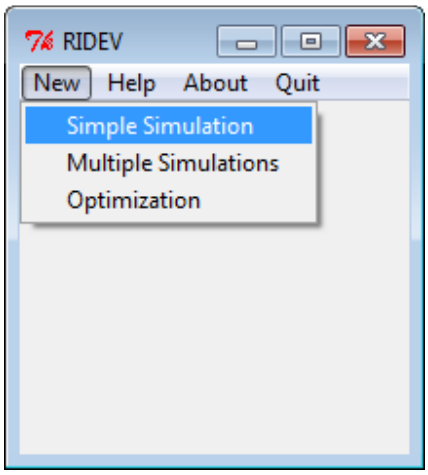
HOW-TOs

How to run a simple simulation:

1.) From the main interface , choose '**New**'



2.) Click on '**Simple Simulation**' , the simulation window should appear



3.) Load the Meteo File and fill up the simulation parameters window

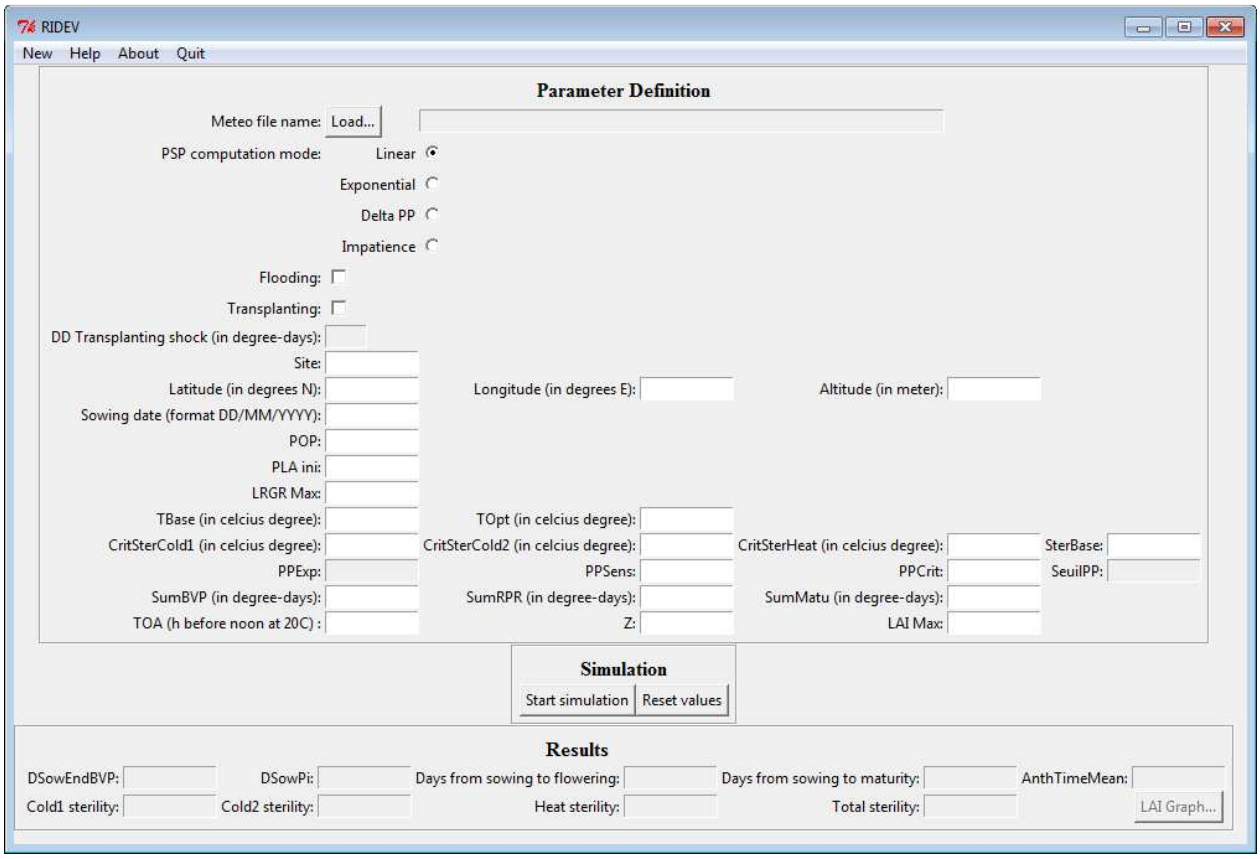


Figure 5 Empty Simulation Window

a.) Load the meteorology file; it should strictly follow the data format and header names like the one below

A	B	C	D	E	F	G	H	I	J	K	L
CodeStation	Jour	Tmax	Tmin	Tmoy	HMax	HMin	HMoy	Vt	Ins	Rg	ETP
Ivory	01/01/200	32.1	20.5		96	40		1.956019		27.85	6.389361
Ivory	02/01/200	29.9	19.2		96	46		1.909722		31.94	6.562051
Ivory	03/01/200	33.1	21.1		94.5	36		1.585648		26.56	6.205506
Ivory	04/01/200	30.3	18.2		96	46		1.736111		22.58	5.155222
Ivory	05/01/200	30.2	19.7		96	45.5		1.539352		27.28	5.815871

Table 1 Correct Formatting of a Meteo file

b.) Select the model you wish to use in the simulation

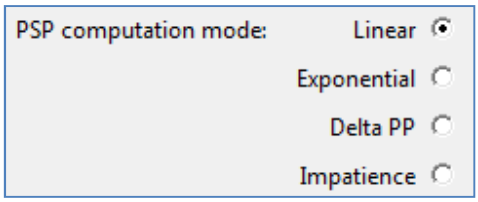


Figure 6 Model Selection

c.) Select whether the simulation includes Flooding and/or transplanting

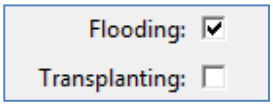


Figure 7 Transplanting / Flooding checkboxes

d.) Fill up the rest of the parameters

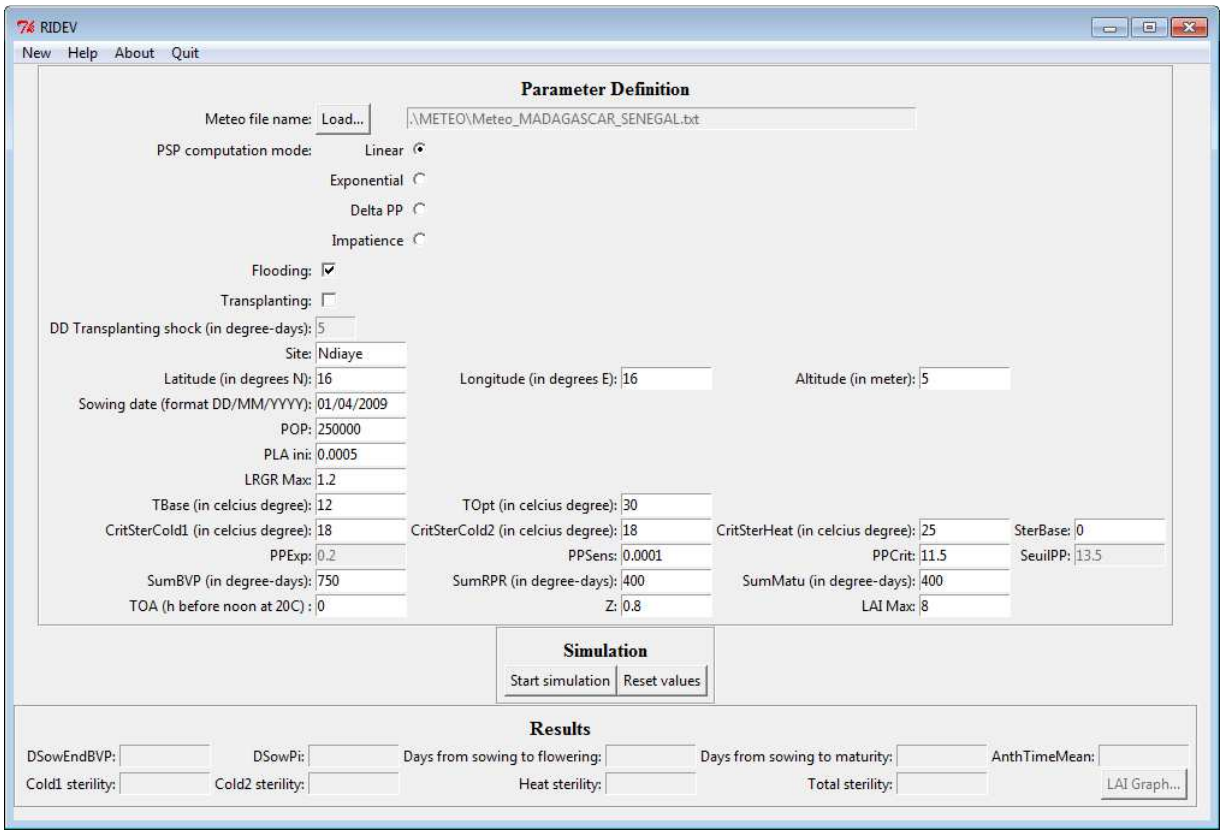


Figure 8 Filled-up Simulation Window

4.) Click on the Start simulation button located below the inputs, results will be displayed at the bottom frame almost instantaneously

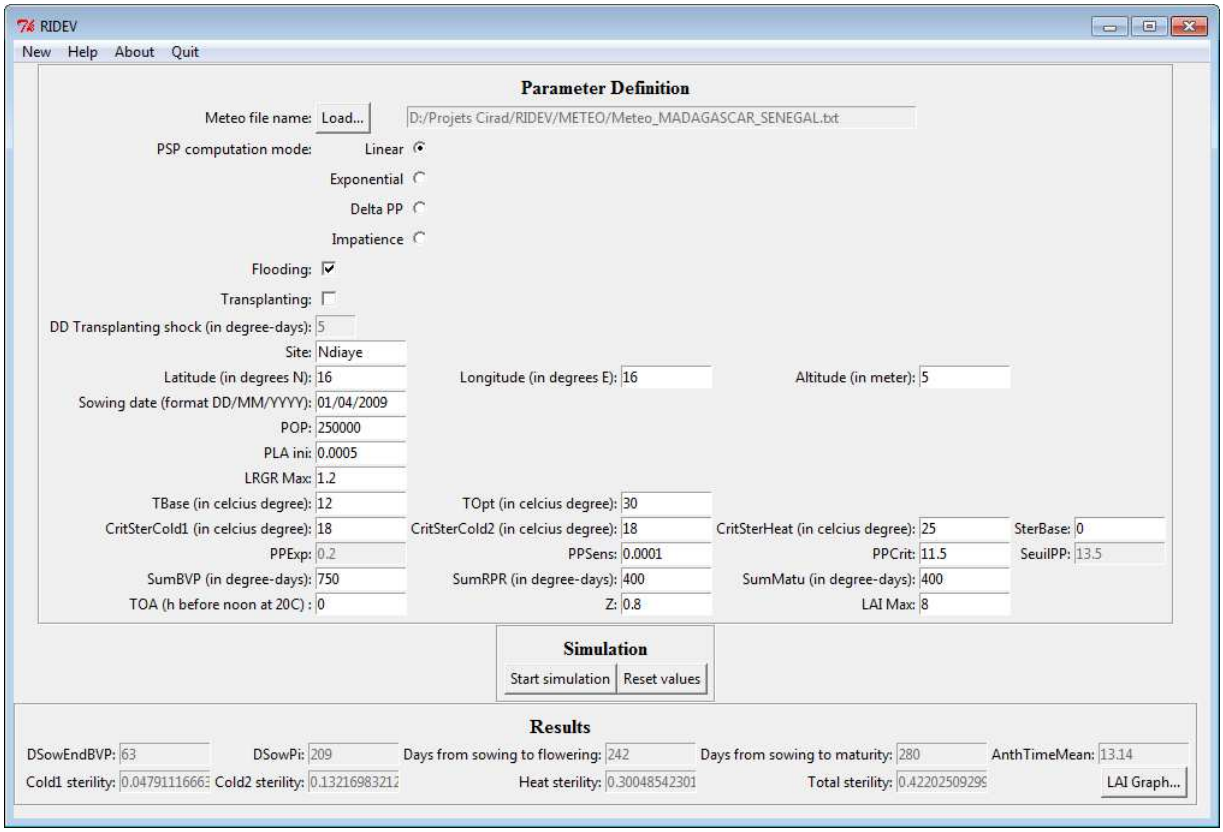


Figure 9 Simulation Window With Results

5.) A Button with the label ‘LAI Graph’ will also be present, clicking this will display the progression of LAI during the progression of the days simulated, you can also save the LAI into a text file

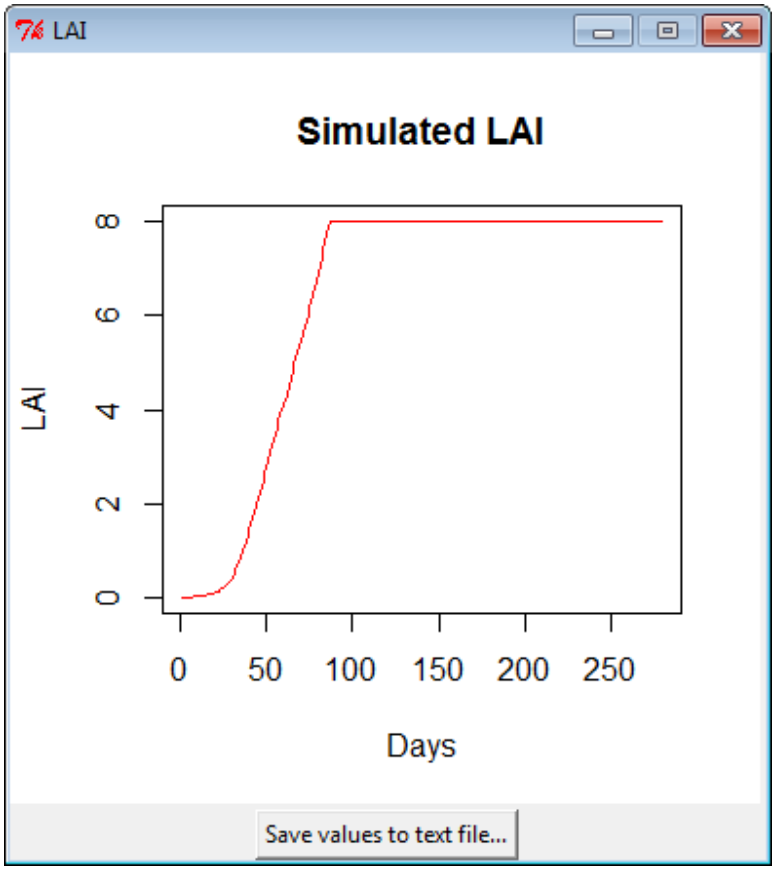
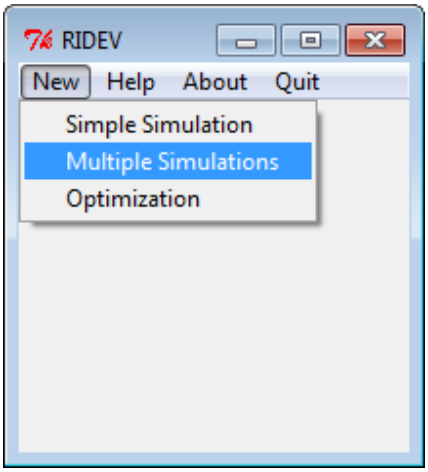


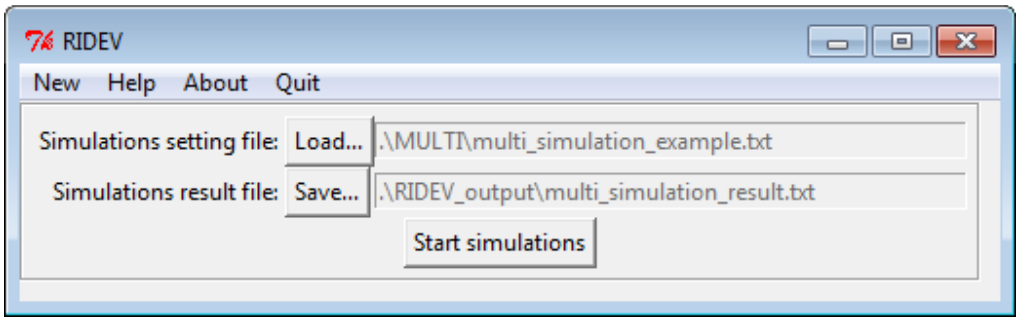
Figure 10 Graphical display of LAI progression

How to run a multiple simulation

1. Select **'New' -> 'Multiple Simulations'** from the main interface



2. The multiple simulations interface will appear, simply load the simulations setting file and point to the location of the output to be produced



a.) Load the simulations setting file – the data should be in the correct format and character cases (like the example below)

	A	B	C	D	E	F	G	H	I	J
1	Simulatio	Site	Latitude	Longitude	Altitude	PSPComputationMode	Flooding	Transplanting	DDTransplantingShock	SowingDate
2	Sim1	CINZANA	13.25	-7.56	319	Linear	0	0	0	10/06/2009
3	Sim2	CINZANA	13.25	-7.56	319	Exponential	0	0	0	10/06/2009
4	Sim3	CINZANA	13.25	-7.56	319	DeltaPP	0	0	0	10/06/2009
5	Sim4	CINZANA	13.25	-7.56	319	Impatience	0	0	0	10/06/2009

K	L	M	N	O	P	Q	R	S	T
POP	PLAini	LRGRMax	TBase	TOpt	CritSterCold1	CritSterCold2	CritSterHeat	SterBase	PPExp
250000	0.0001	1.15	12	30	18	10	33	0.2	0.25
250000	0.0001	1.15	12	30	18	10	33	0.2	0.25
250000	0.0001	1.15	12	30	18	10	33	0.2	0.25
250000	0.0001	1.15	12	30	18	10	33	0.2	0.25

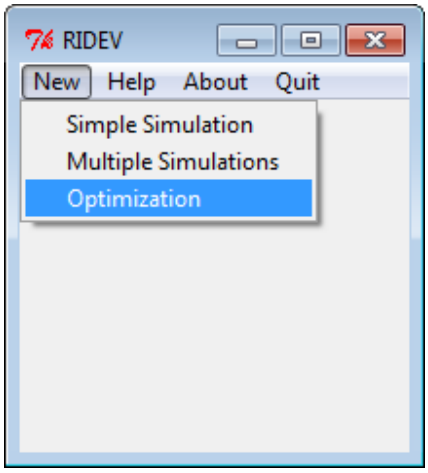
U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ
PPSens	PPCrit	SeuilPP	SumBVP	SumRPR	SumMatu	HrAnthBefNoon20C	Z	LAIMax	MeteoFileName						
0.3	11.5	13.5	400	400	400	11	0.8	6	D:\Projets Cirad\RIDEV\METEO\Meteorologie_sorghum_test.txt						
0.3	11.5	13.5	400	400	400	11	0.8	6	D:\Projets Cirad\RIDEV\METEO\Meteorologie_sorghum_test.txt						
0.3	11.5	13.5	400	400	400	11	0.8	6	D:\Projets Cirad\RIDEV\METEO\Meteorologie_sorghum_test.txt						
0.3	11.5	13.5	400	400	400	11	0.8	6	D:\Projets Cirad\RIDEV\METEO\Meteorologie_sorghum_test.txt						

Table 2 Sample of Correct input format for Multiple Simulations

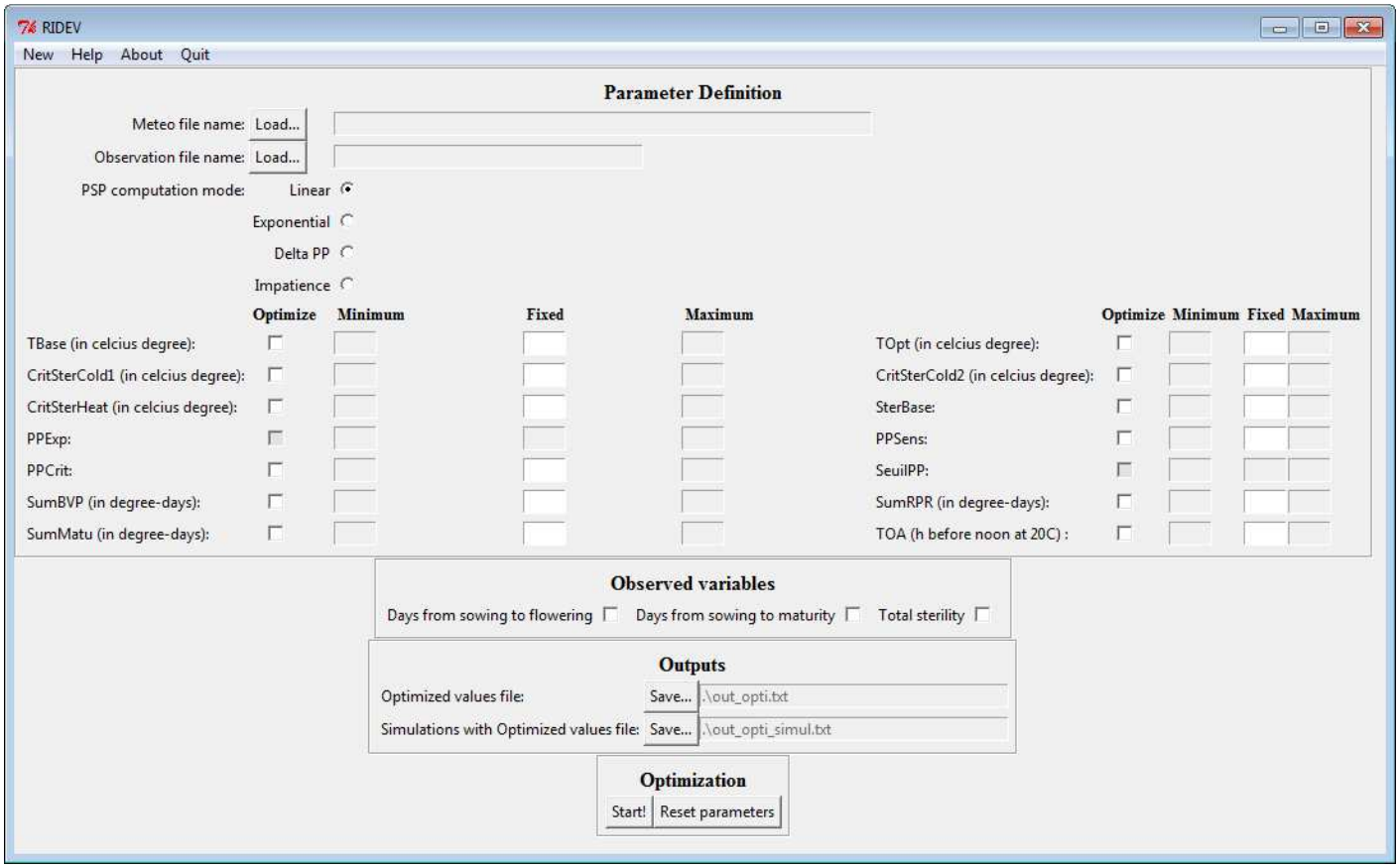
3. Click on the 'Start Simulations' button and after a while, if all goes well, you should see a message like the one below signaling the end of a successful multiple simulation; The results will be in the file you specified earlier in the interface

How to run an optimization

1. Select **'New' -> 'Optimization'** from the main interface



2. Load the Meteo file and target file, define the location of the outputs and fill-up the parameters windows accordingly, ticking the checkboxes beside parameters that you wish to optimize and the variables you wish to consider when fitting



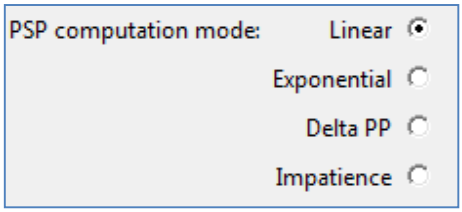
a.) Load the meteo file and the observation file, the format of the observation file should be like the one below

A	B	C	D	E	F	G	H
Site	Latitude	Longitude	Altitude	Variety	Flooding	Transplanting	DDTransplantingShock
Ndiaye	13.25	-7.56	8	6	1	0	0
Ndiaye	13.25	-7.56	8	6	1	0	0
Ndiaye	13.25	-7.56	8	6	1	0	0
Ndiaye	13.25	-7.56	8	6	1	0	0
Ndiaye	13.25	-7.56	8	6	1	0	0
Ndiaye	13.25	-7.56	8	6	1	0	0
Ndiaye	13.25	-7.56	8	9	1	0	0
Ndiaye	13.25	-7.56	8	9	1	0	0

I	J	K	L	M	N	O	P	Q
Z	LAIMax	POP	PLAini	LRGRMax	SowingDate	DAS_Flowering	DAS_Maturity	SterTot
0.8	6	600000	0.0001	1.2	07/02/2009	107		
0.8	6	600000	0.0001	1.2	07/03/2009	95		
0.8	6	600000	0.0001	1.2	07/04/2009	104		
0.8	6	600000	0.0001	1.2	17/07/2009	70		
0.8	6	600000	0.0001	1.2	17/09/2009	74		
0.8	6	600000	0.0001	1.2	19/10/2009	88		
0.8	6	600000	0.0001	1.2	07/02/2009	85		
0.8	6	600000	0.0001	1.2	07/03/2009	76		

Table 3 Correct formatting and header names of an observation file

b.) Select the model of choice



c.) Tick the checkboxes of the parameters which you wish to optimize and provide the min and max range for each in their respective boxes, otherwise provide the fixed value for the parameter

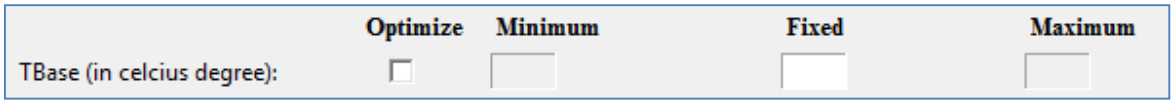
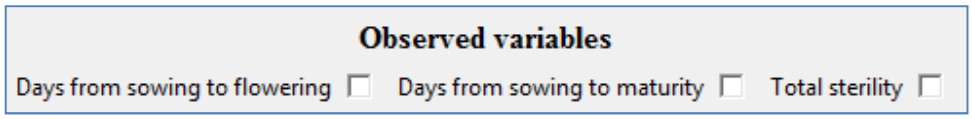


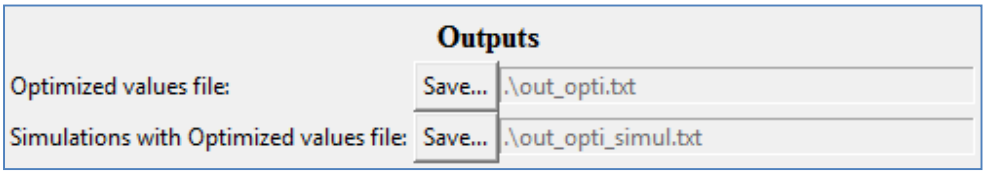
Figure 11 Fixed parameter input display (min and max boxes disabled)

Figure 12 Optimized parameter input display (min and max boxes enabled)

d.) Select the observed variables you wish to consider when finding a fit for the parameters, at least one must be chosen at all times



e.) Define the names of the output files (optimized parameters, simulated values from optimized parameters) and the folder wherein they will be saved



3. Click on the ‘Start!’ button located near the bottom of the interface, you should notice that the command line window will display messages notifying that the process of optimization is ongoing

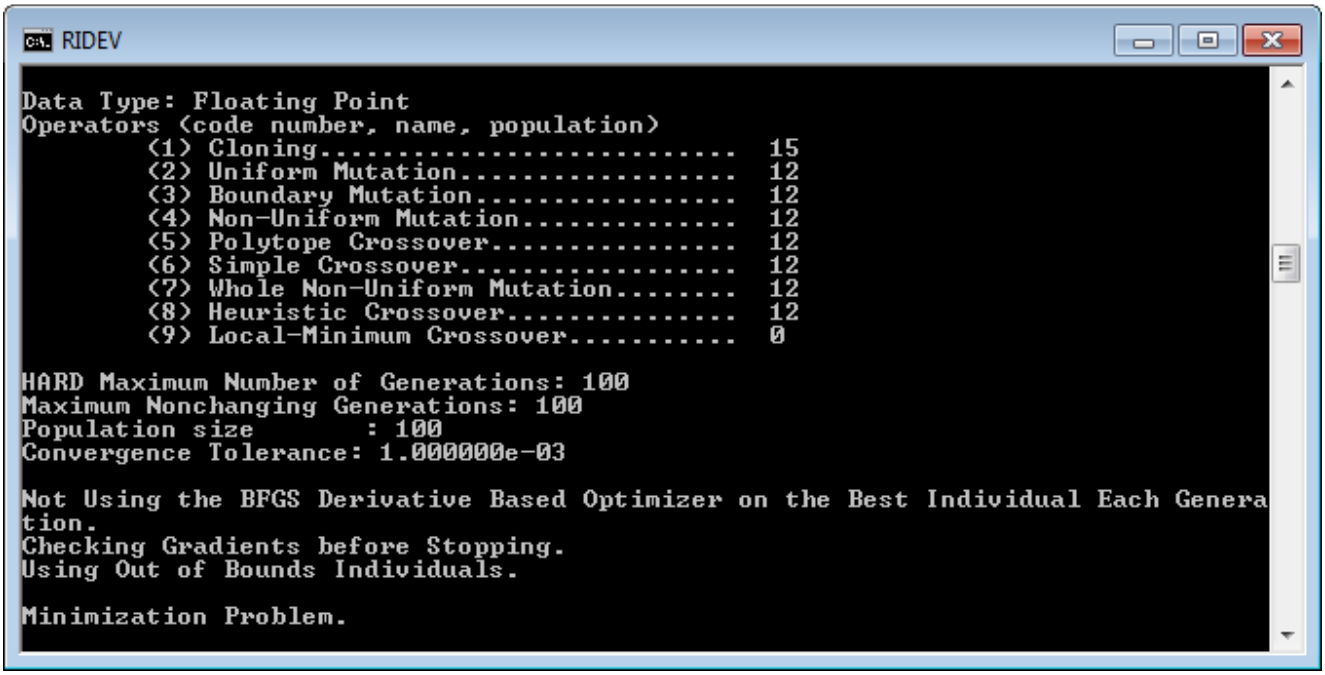


Figure 13 Command Line window while starting optimization on one variety

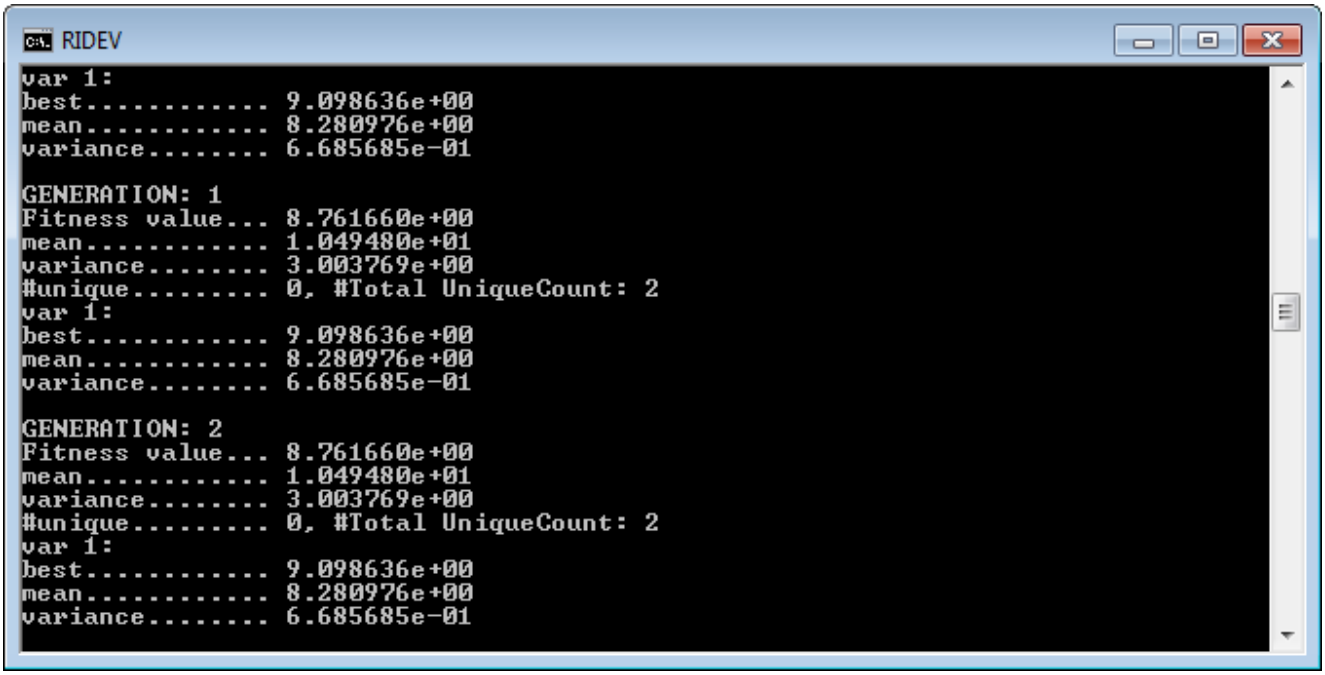


Figure 14 Command Line window while processing generations of each variety up to 100 generations per variety

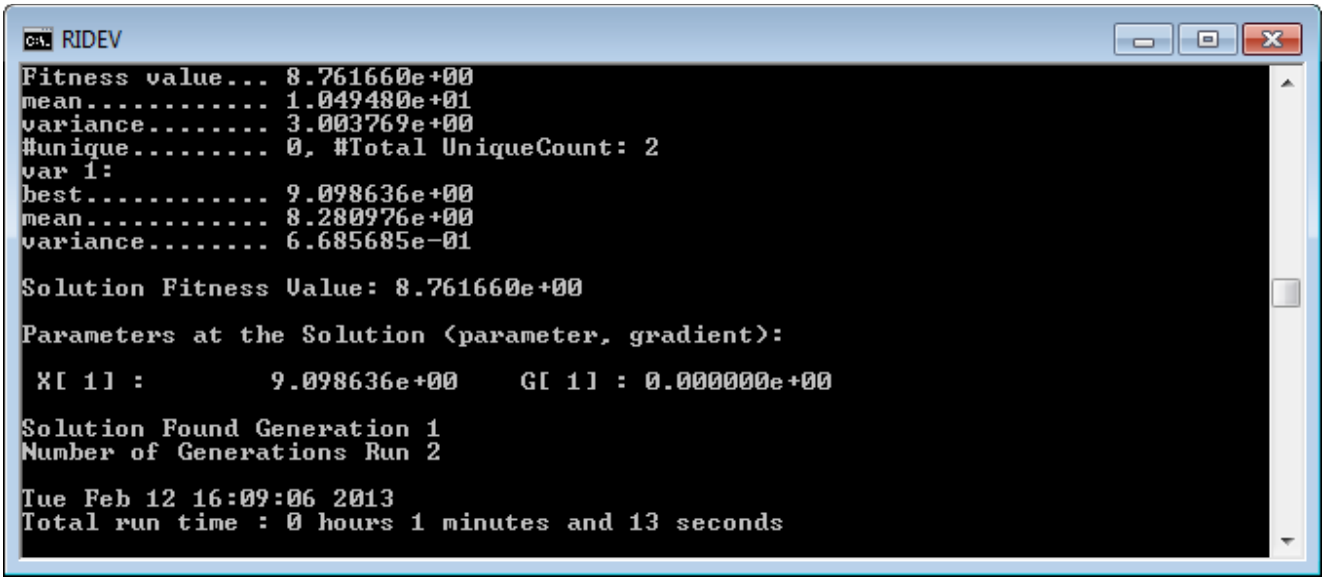


Figure 15 Command Line window displaying various statistics at the end of each optimization of a variety

4. Once it is done optimizing, a message will pop up and the results can be found at the directories you specified in the interface

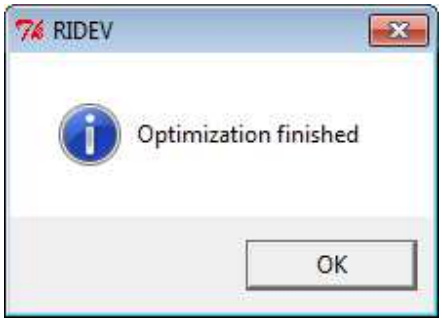


Figure 16 Optimization is done

BASIC TROUBLESHOOTING

Where will the errors be displayed?

Upon opening, a command line window will appear along with the RIDEV main interface, the initial display will be like the image below

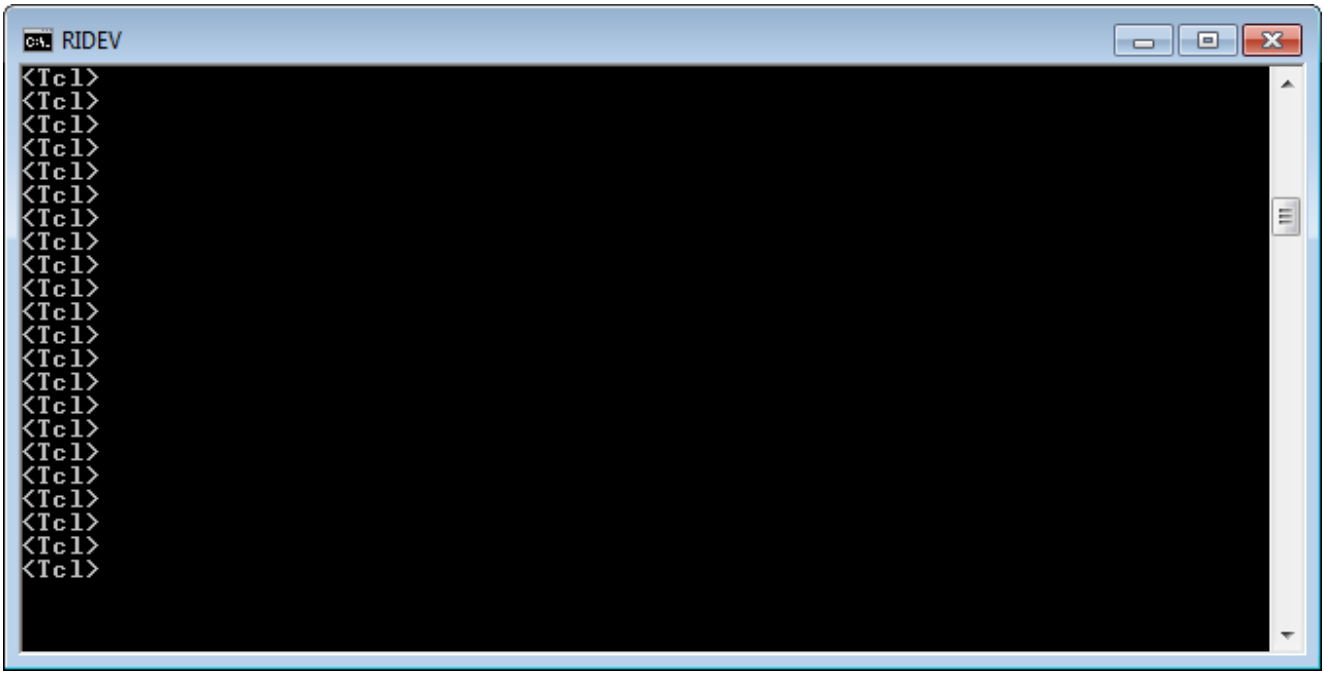


Figure 17 Command Line window on newly opened RIDEV instance

Once RIDEV encounters an error, it will display an error message such as:

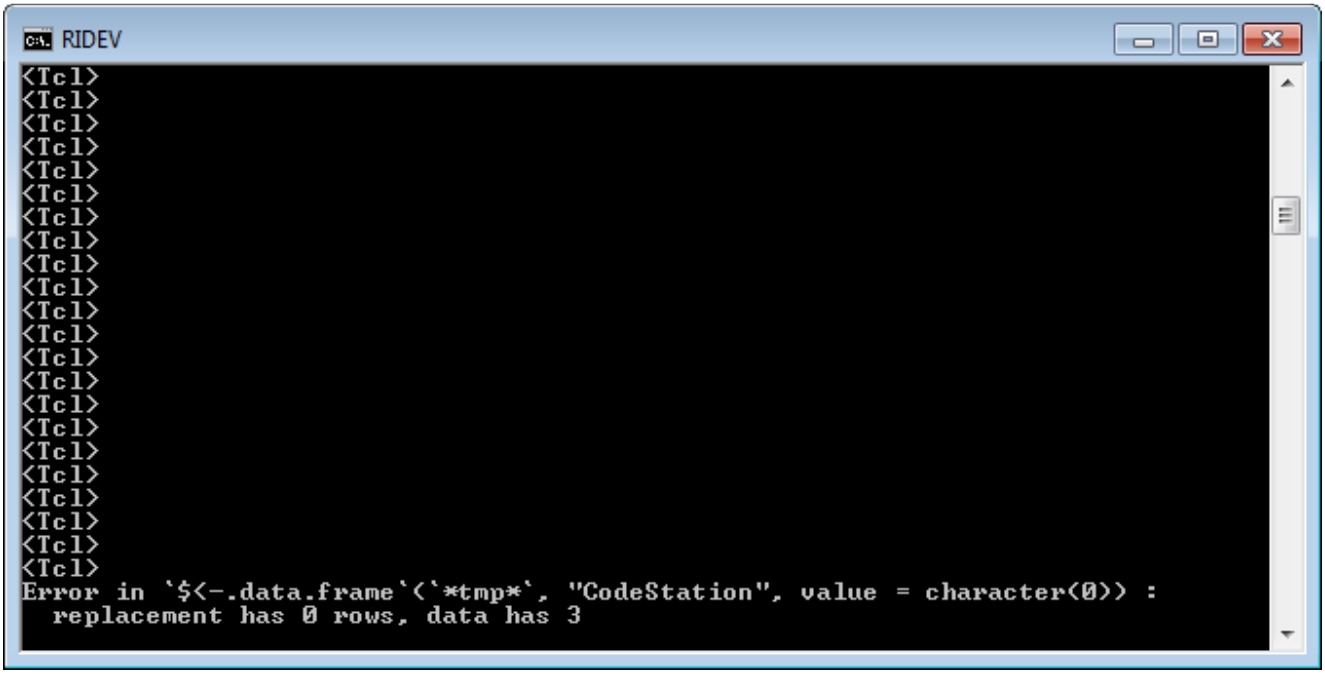


Figure 18 Command Line window once RIDEV encounters an error, displayed is a sample error message

List of Common Errors

```
Error in ridevSimulation.r(meteo, PSPComputationMode, Site, Flooding,  :
  NA/NaN/Inf in foreign function call (arg 17)
```

1. Missing value for a parameter / parameters in the simple simulation interface

- **Fix : Look for and fill in missing parameter values**

```
Error in `$<-.data.frame`(`*tmp*`, "CodeStation", value = character(0)) :
  replacement has 0 rows, data has 3197
```

2. Error in input file, usually when the format is erroneous i.e. missing data header and rows for CodeStation usually occurs when simulation is being done

- **Fix : Build a properly completed meteo input file**

```
Error in positions[1]:positions[2] : NA/NaN argument
```

3. Error usually concerning dates , it may be one/some of the reasons stated below :
   a.) Sowing date specified is not available in the meteo file
   b.) Sowing date format does not follow dd/mm/yyyy format
   c.) Duration of current simulation went over number of available dates of observed data
   d.) Sowing date input is left blank

- **Fix: check if the one or some of the errors above are present; if A, B, or D , simply fix the inputs; if C , consider getting additional observations to add to the meteo file or toggle the inputs in such a way that it will only simulate within the available dates**

```
Error in read.table(file = file, header = header, sep = sep, quote = quote,  :
  no lines available in input
In addition: Warning message:
In file(file, "rt") :
  file("") only supports open = "w+" and open = "w+b": using the former
```

4. Usually comes from a missing meteo input file

- **Fix : load a meteo file**

```
Error in Domains[i, 1] <- -1 * default.domains : subscript out of bounds
```

5. No checkbox is ticked in the Optimization window, thus nothing to optimize

- **Fix : Tick at least one checkbox / optimize at least one parameter**

```
Error in if (is.na(observedValuesForInputTraitI)) next :
  argument is of length zero
```

6. No Observed Variable checkbox is ticked in the optimization window, thus no basis for fitting of selected parameters

- **Fix : Tick at least one checkbox for the observed variables available**

```
Error in genoud(fn = minimizationFunction, nvars = numberOfParametersToBeEstimat
ed,   :
  Domains[,1] must be less than or equal to Domains[,2]
```

7. One or more of the range of values for a parameter has a min value which is larger than the max value (ex. min = 10 , max = 9)

- **Fix : Make sure the arrangement of values is correct, with Min < Max**

Additional Usage Guidelines

a. For RIDEV in General

- RIDEV accepts and produces tab delimited text (.txt) files , this means that the column contents are separated by a **TAB** (→) character, with each row ended by an **ENTER** (CRLF) at the end; This file type usually comes from and can be opened also by a spreadsheet program such as Excel for MSOffice and Calc for Ubuntu; furthermore, saving as a spreadsheet (.csv , .xlsx) and several other fomats is also possible once the data is opened in a spreadsheet

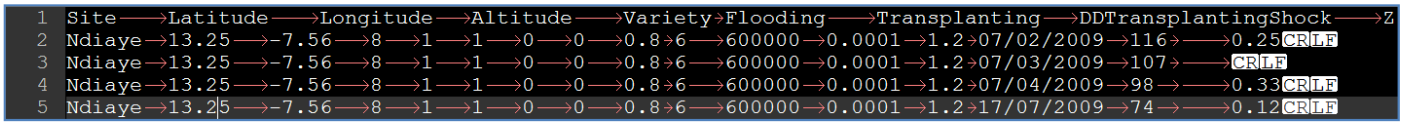


Figure 19 Proper Tab delimited text formatting, all symbols shown for visualization

- Primary inputs such as the Meteo file, Multiple simulations settings file, etc. can be made or edited on a spreadsheet and later on saved as tab delimited text for use with RIDEV

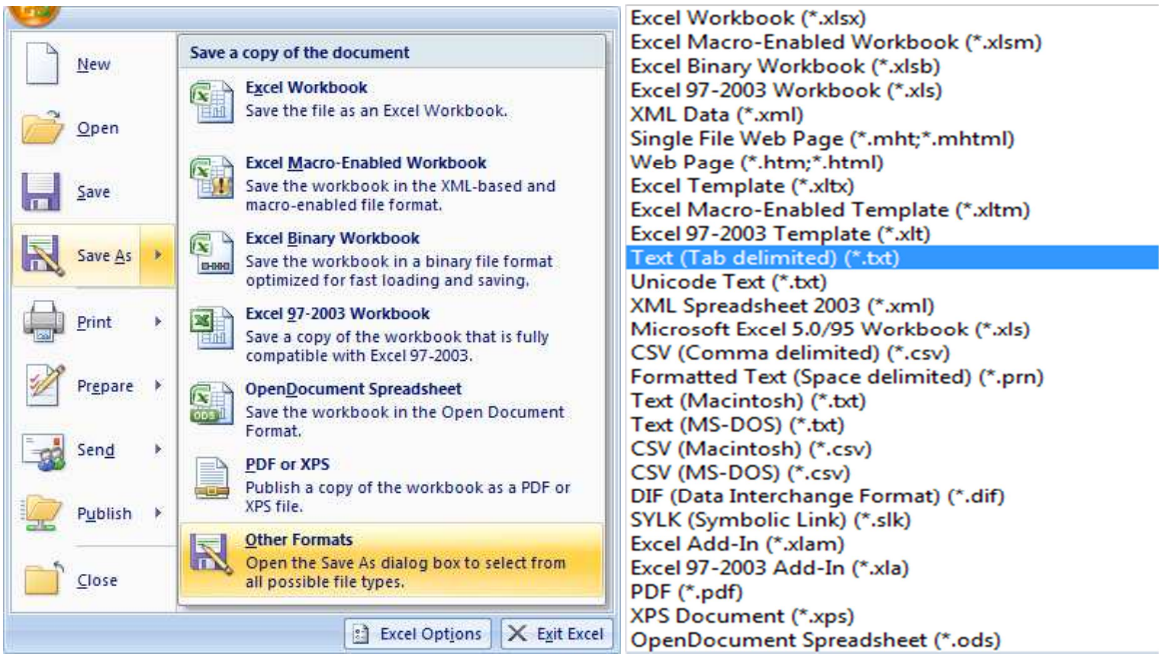


Figure 20 Saving a spreadsheet as a tab delimited text file

b. Simulation Results from Optimized Parameters

- The output of RIDEV, specifically the simulation results from the optimized parameters may contain erroneous results such as flowering, PI , maturity, etc. taking too long before happening (ex. Values >300 when it should be <100) ; We pinpointed the cause of this problem to choosing an observed variable which is not in the direct scope of the parameters being optimized, for example:

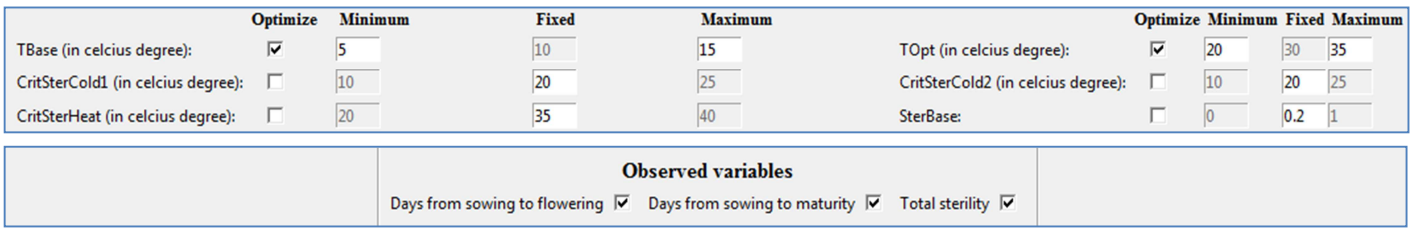


Figure 21 Sample of an optimization setup that will most likely yield erroneous results

Fig. 21 shows an optimization setup not involving sterility parameters, but Total Sterility is among the chosen observed variables; This will lead to errors in the calculation as it will also try to fit the sterility using the forced values, observed variables with static parameters will lead to a difficult and less accurate fitting, therefore it is advised to take note of the parameters you wish to optimize and only include observed variables which will be of use in the optimization. Generally, when optimizing phenological parameters we can consider both **'days from sowing to flowering'** and **'days from sowing to maturity'**, while for sterility related parameters, we consider **'Total Sterility'.** It is also noted that considering days from sowing to maturity without actually optimizing maturity related parameter **'SumMatu'** caused problematic results. To summarize, for best results it is recommended that the observed values to be taken into consideration be related or used by the parameters chosen to be optimized.

c. Scope of available Meteorological Data file

- The meteo file is the most important file in RIDEV, it is recommended that the observed data inside the file span several years; If data is scarce, the user must be sure that the number of days to be considered starting from the sowing date to be used (**offset**) when running simulations will not go over the available observation dates.

  For example: if the sowing date of the simulation is February 13, 2013, the data inside the meteo file must have observations up until September 7, 2013 (**at least**) since this is **200 days from the sowing date** which is the minimum span of sowing to maturity for usual cases of simulation, but as for experimental cases it is of course recommended that the data contains much more than the minimum, 500 offset or more to be safe.