



**Food and Agriculture
Organization of the
United Nations**



Crop Module 3

Creating crop files

Jorge Alvar-Beltrán
(December 14, 2022)



Day 1

- How do crop models work?
- AquaCrop interface
- AquaCrop: climate and crop modules (AquaCrop modules 1 and 2)

Day 2

- AquaCrop: management and soil modules (AquaCrop modules 3 and 4)
- Run simulations and interpret outputs

Days 2-3

- Input requirements
- Create/import climatic files on AquaCrop

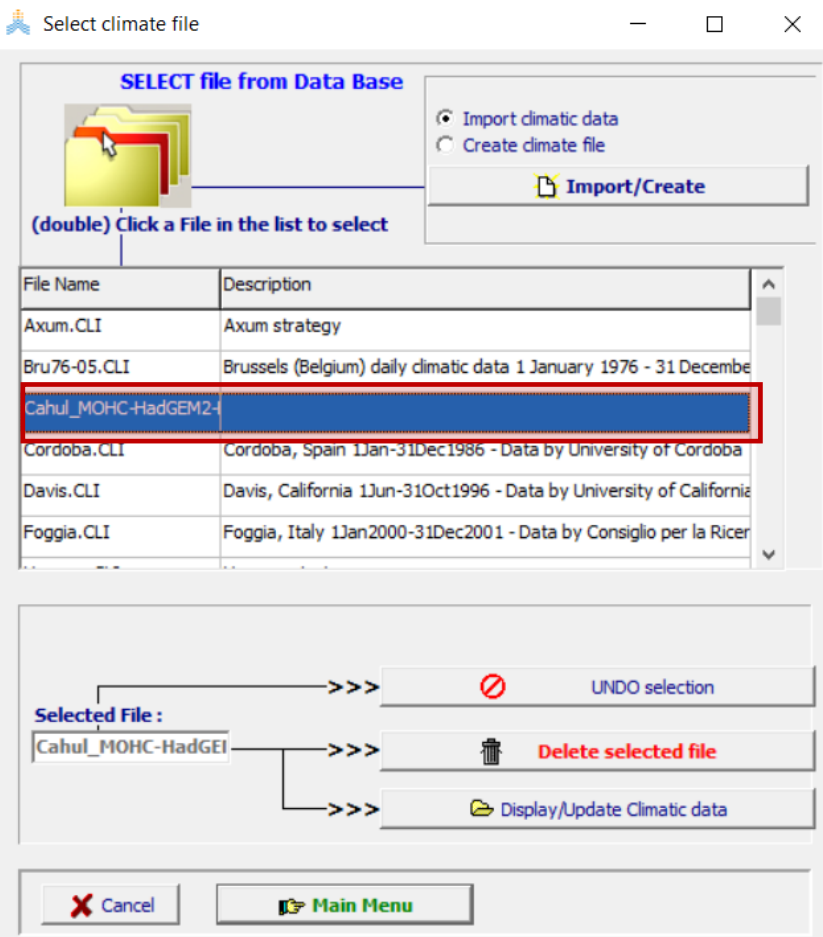
Day 3

- Create a crop file
- Run simulations for maize in Moldova (Cahul)

Create a crop file: maize

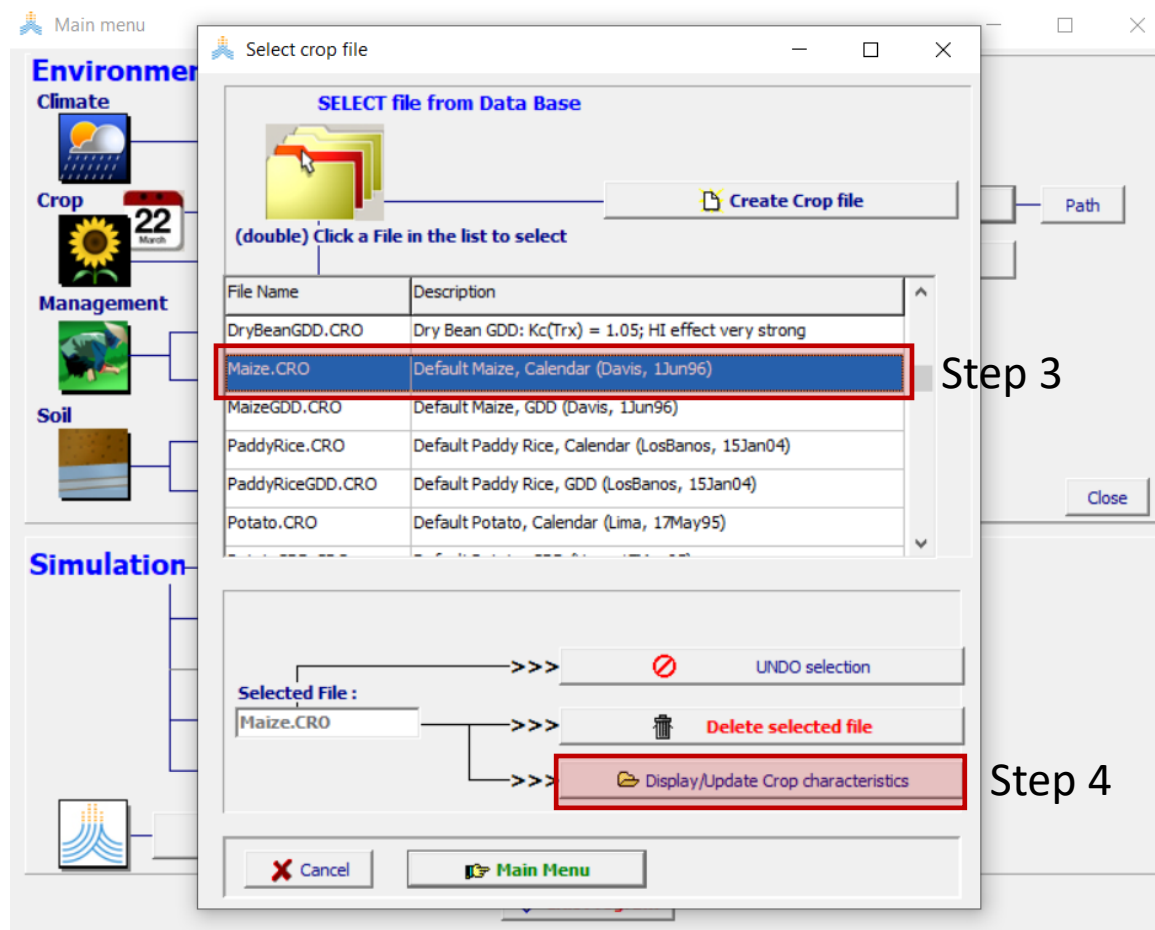
Step 1. Open **AquaCrop**

Step 2. Open the climatic file **Cahul_MOHC-HadGEM2-ES_rcp26**



Step 3. Open the default file **Maize.CRO**

Step 4. Click on **Display/Update Crop Characteristics**





Create a crop file: maize

Step 1. Click on **Description** and select **Full Set**

Crop characteristics

Response to stresses

Description Mode Development ET Production Water Temperature Salinity Fertility Calendar

Display crop parameters

☐ **Limited set**
Crop development and production parameters
(mainly phenology and life cycle length)

☒ **Full set**
All crop parameters

File description Protected file Type of edit fields (cells)

Protected file (with default crop parameters)

to adjust to local conditions

1. Adjust cultivar specific or less conservative parameters (limited set of crop parameters)

2. Use Save as in tool bar to save adjustments

Cancel Program settings Protected file Save as

Step 2. Click on **Mode** and select **Calendar days**

Crop characteristics

Response to stresses

Description Mode Development ET Production Water Temperature Salinity Fertility Calendar

Crop canopy development

☒ **Calendar days**

☐ **Growing degree-days (GDDay)**
canopy development adjusted to
temperature regime of distinctive years

Threshold temperatures
for crop development

Base temperature: 9.0 °C
Upper temperature: 30.0 °C

Temperature file: (None)

Assumed conditions in growing cycle
Tmin: 12.0 °C Tmax: 28.0 °C GDD = 11.0 °C day

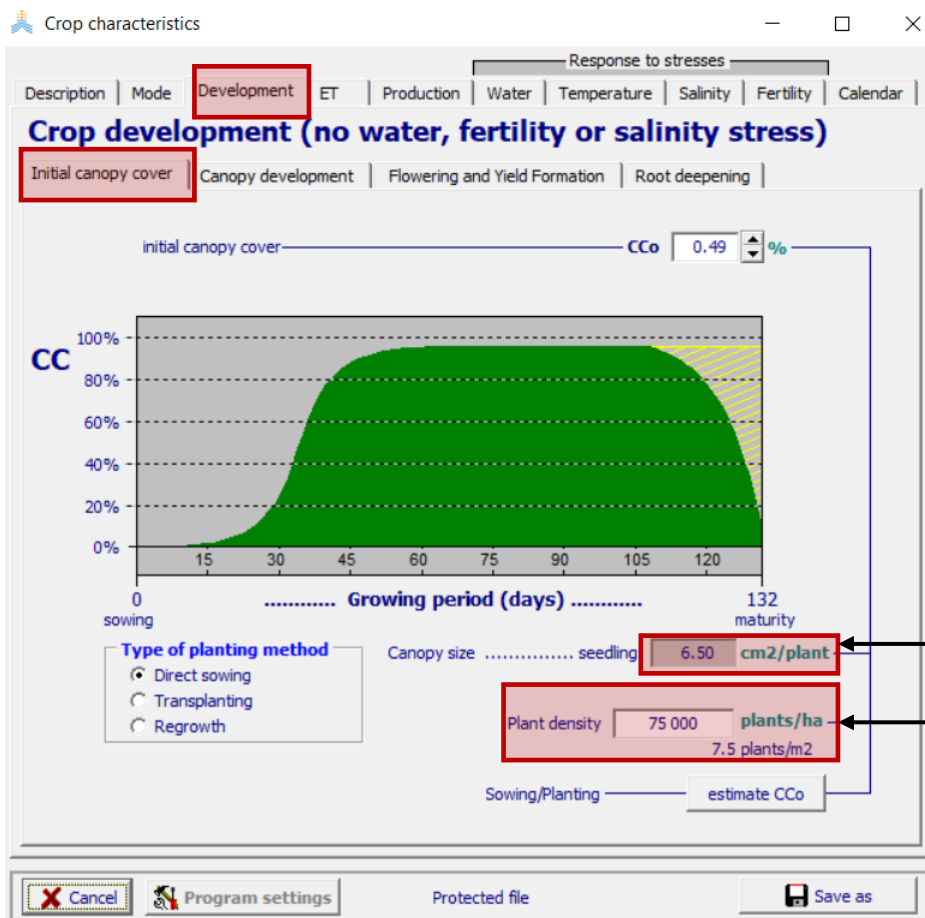
Number of distinctive years:
only 1 year

GDDays variation in years

Cancel Program settings Main Menu Save as

Create a crop file: development

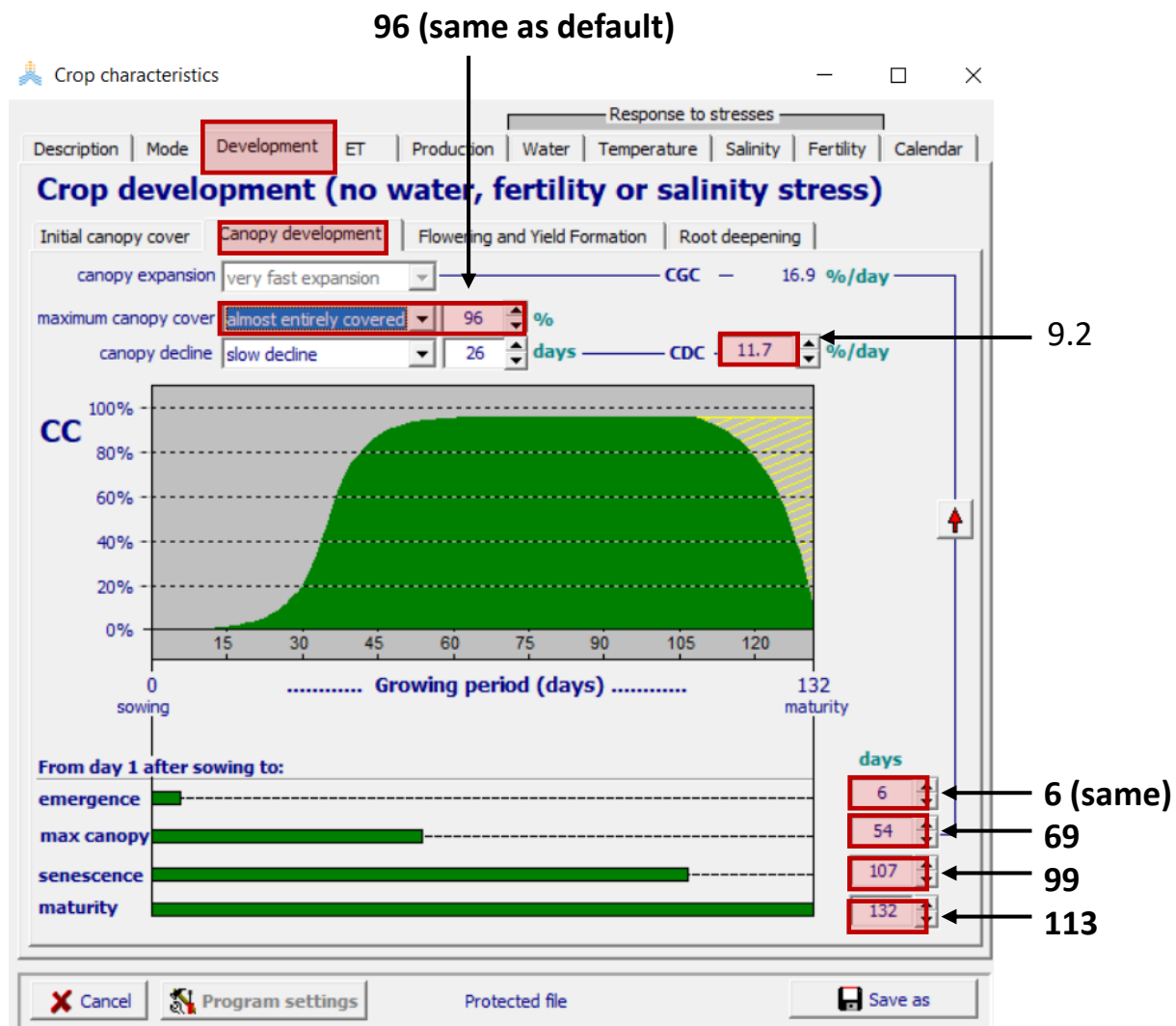
Step 1. Click on **Development** and modify the following **Initial canopy cover** parameters:



6.5 (same)

55,000

Step 2. Click on **Canopy Development** and modify the following parameters:



96 (same as default)

9.2

6 (same)

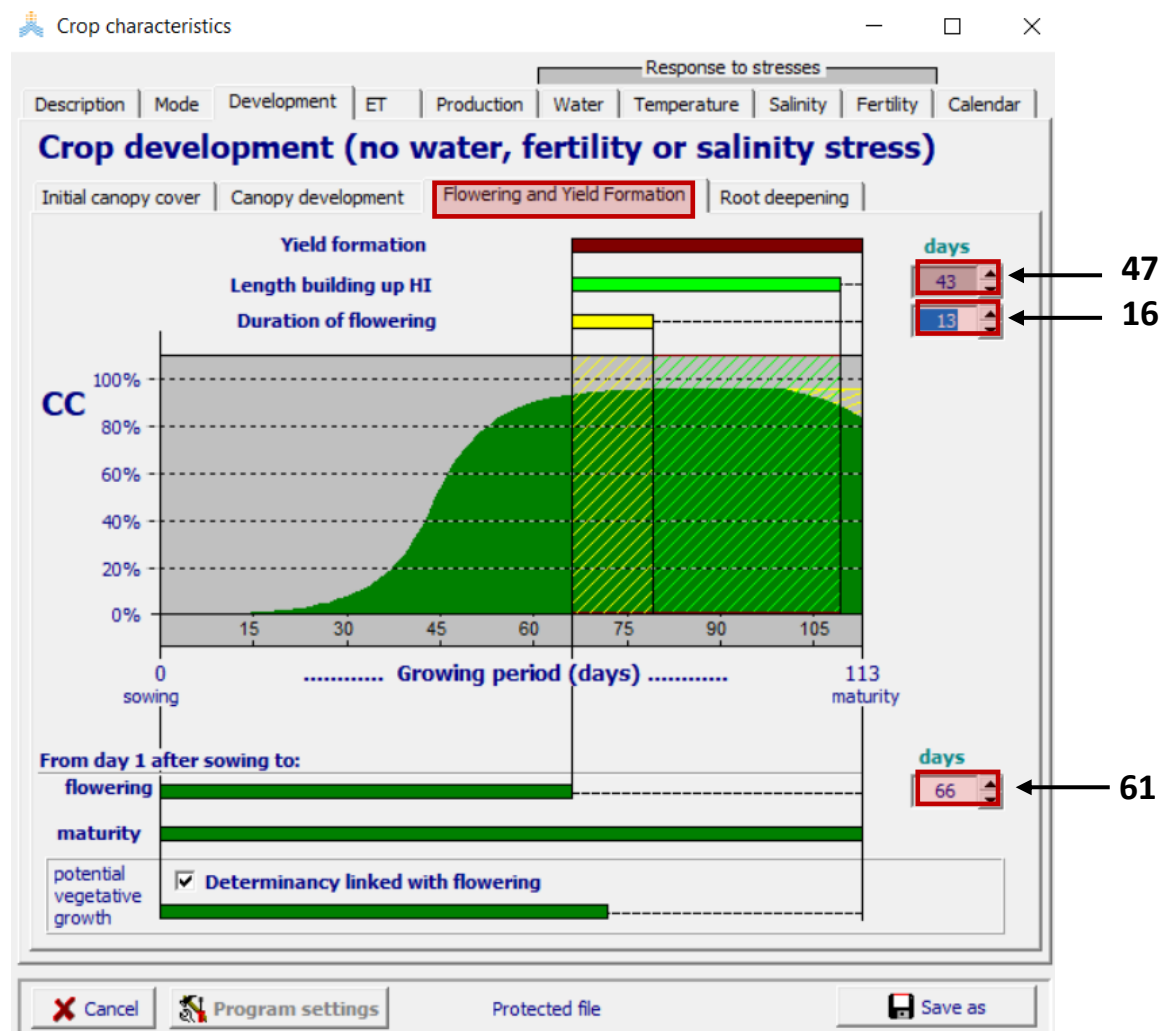
69

99

113

Create a crop file: flowering & yield formation

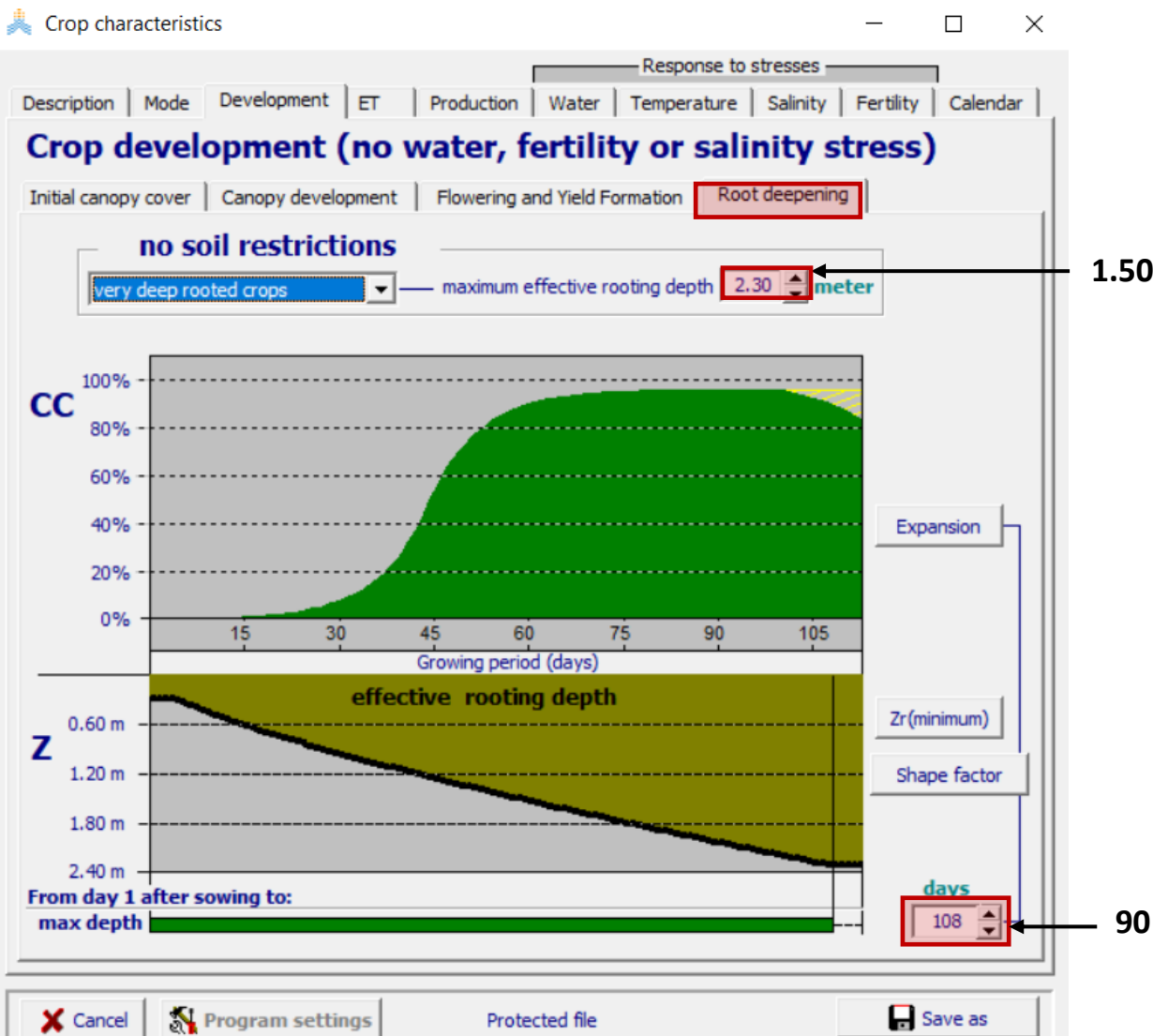
Step 1. Click on **Flowering and Yield Formation** and modify the following parameters:





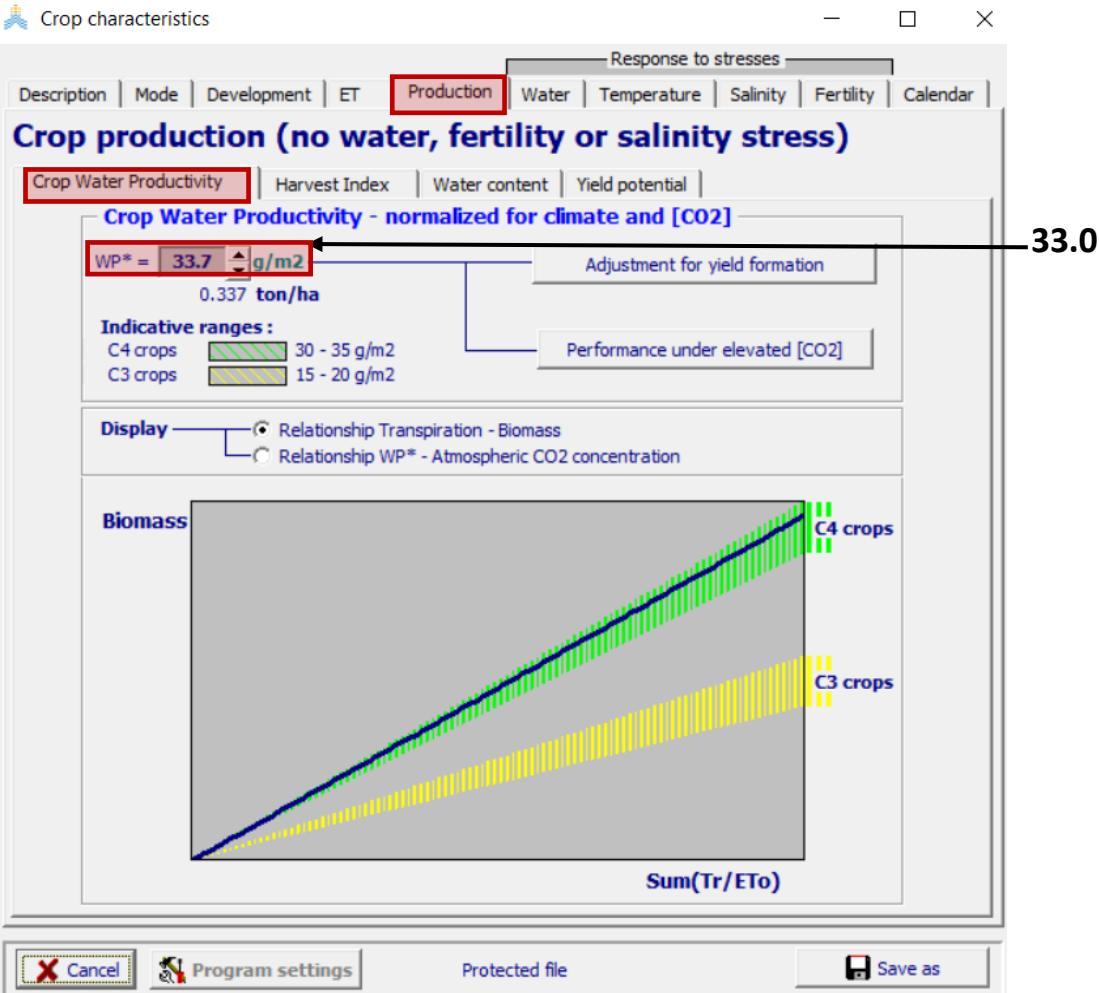
Create a crop file: root deepening

Step 1. Click on **Root Deepening** and modify the following parameters:

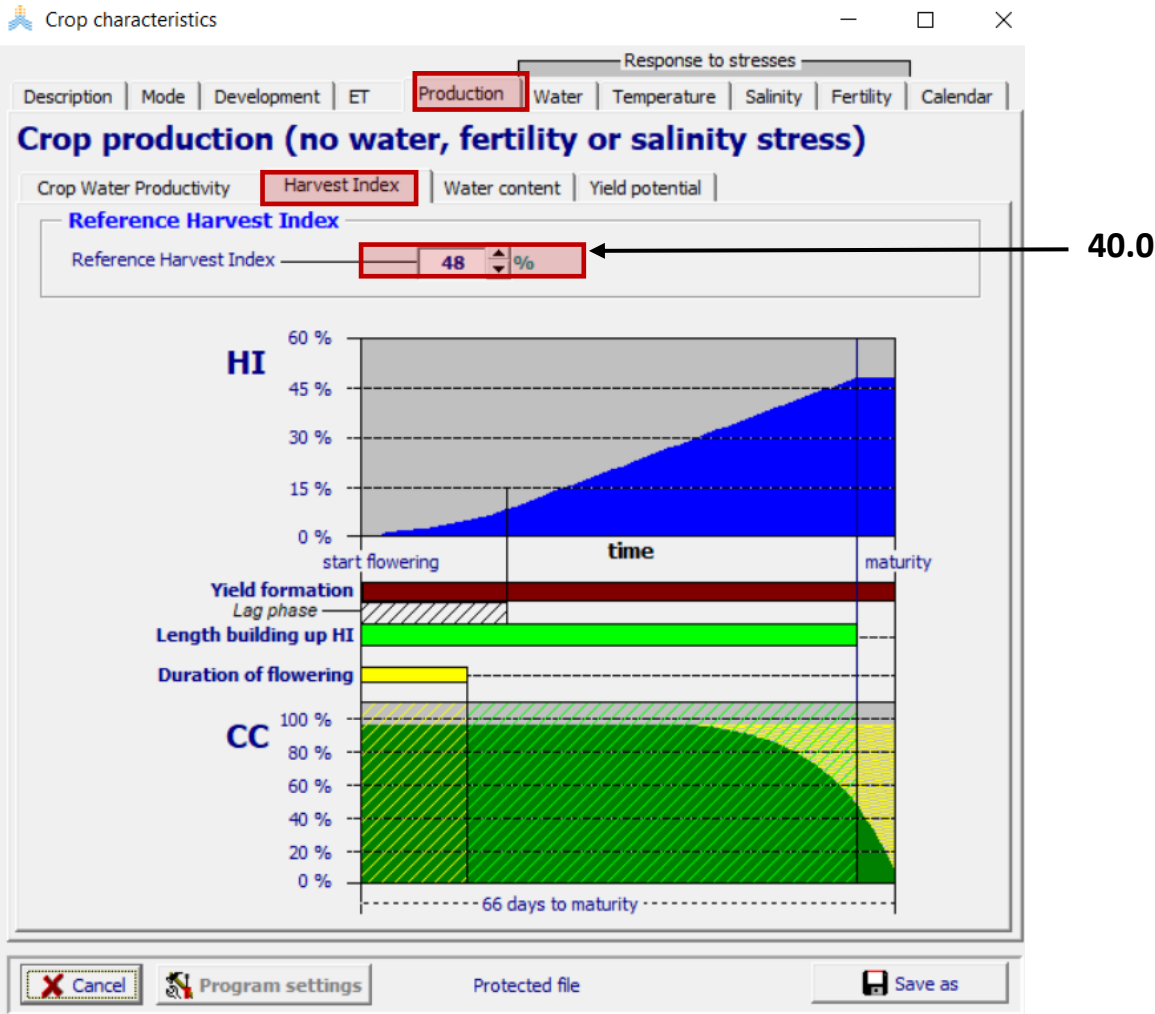


Create a crop file: production

Step 1. Click on **Production** and modify the following **Crop Water Productivity** parameters:

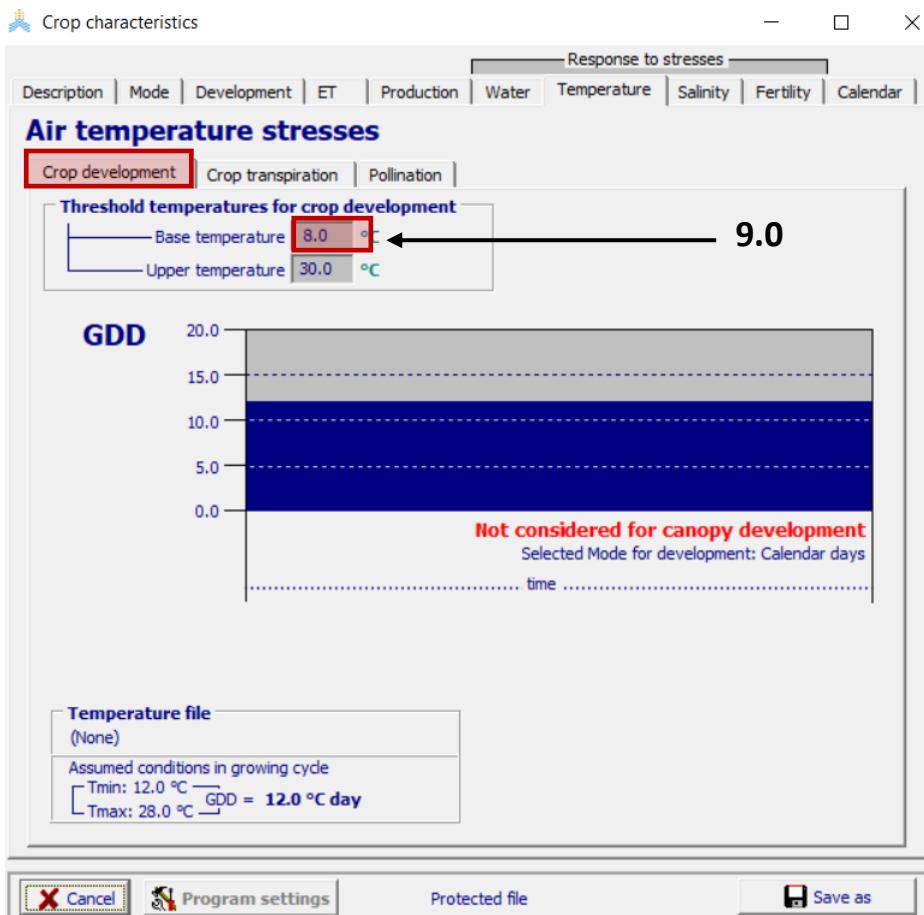


Step 2. Click on **Harvest Index** and modify the following **Reference Harvest Index** parameters:

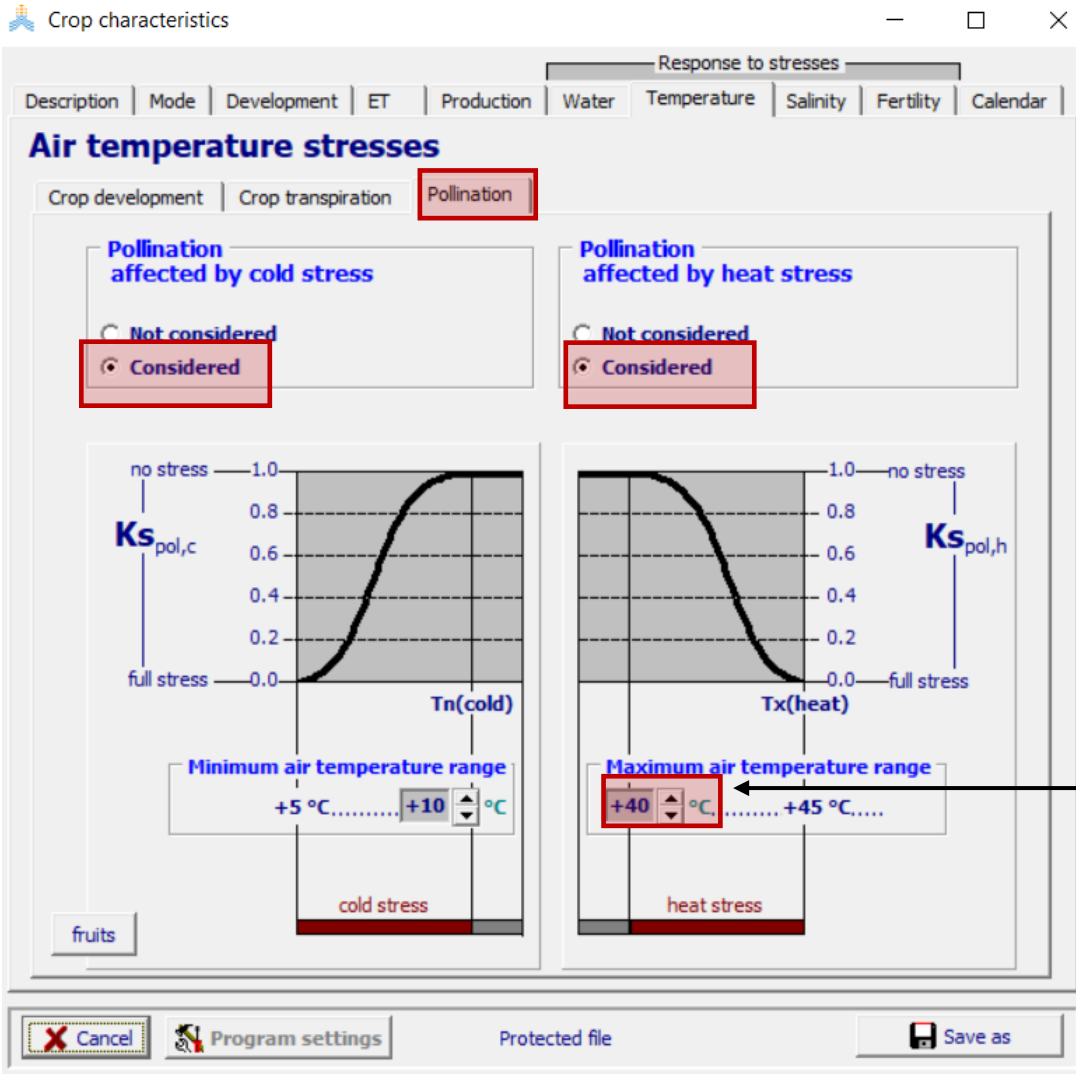


Create a crop file: air temperature stresses

Step 1. Click on **Crop Development** and modify the following **Base temperature** parameters:



Step 2. Click on **Pollination**, select **consider** (both for cold/heat-stress) and modify **Max. air temp. range**





Save the crop file

Step 1. Click on **Save as** (bottom of the screen) and enter the following **File name “Maize-short”** and in **Description “Maize-Cahul”**

Crop characteristics

Response to stresses

Description | Mode | Development | ET | Production | Water | Temperature | Salinity | Fertility | Calendar

Air temperature stresses

Crop development | Crop transpiration | Pollination

Pollination affected by cold stress

☐ Not considered
☒ Considered

Pollination affected by heat stress

☐ Not considered
☒ Considered

Save as

Existing File name: Maize.CRO

File name:

Save as >> CRO

Description: Default Maize, Calendar (Davis, 1Jun96)

Cancel Save

Minimum air temperature range: +5 °C.....+10 °C

Maximum air temperature range: +40 °C.....+45 °C

cold stress

heat stress

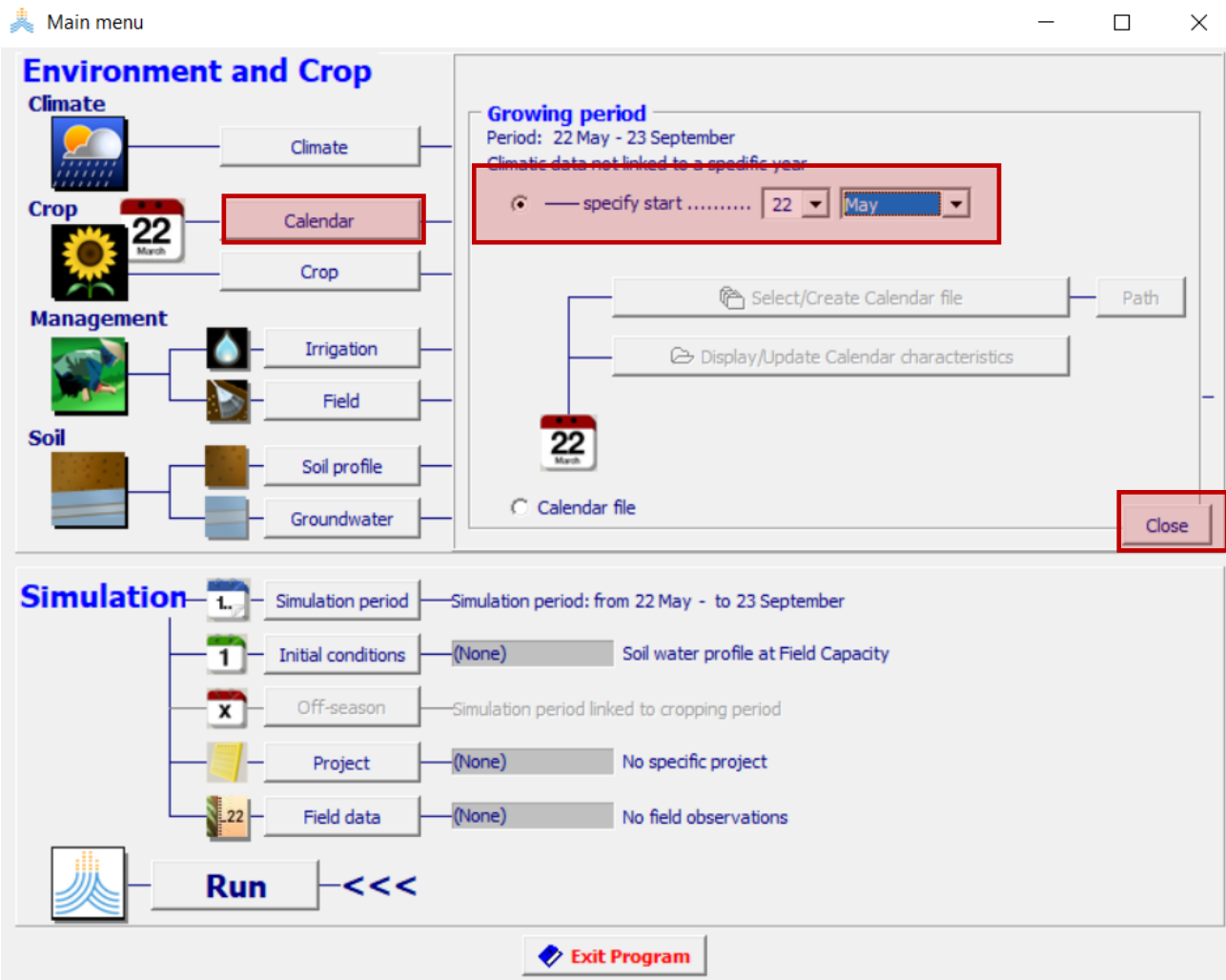
fruits

Cancel Program settings Protected file Save as



Crop Calendar: sowing date

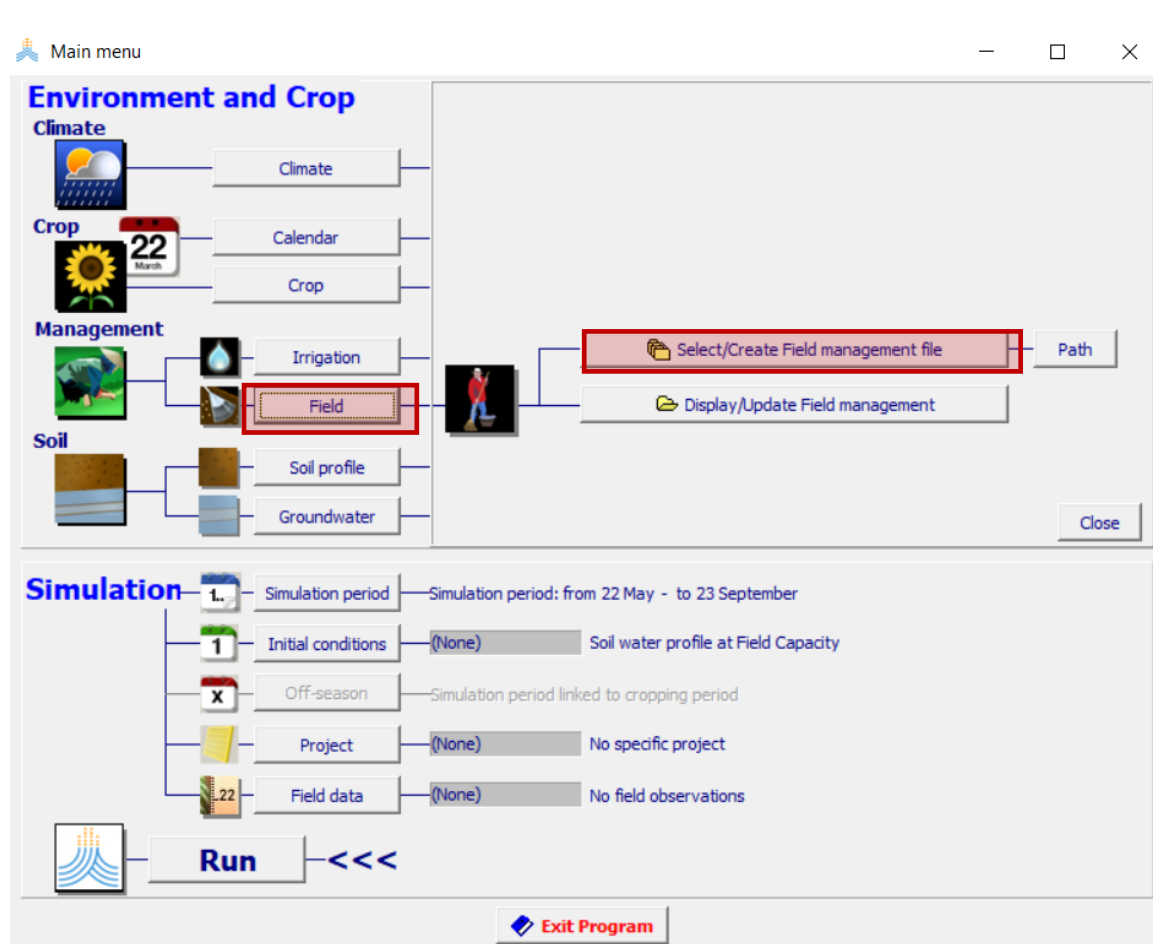
Step 1. Click on **Calendar**, specify the sowing date “**22nd May**” and click on **Close**



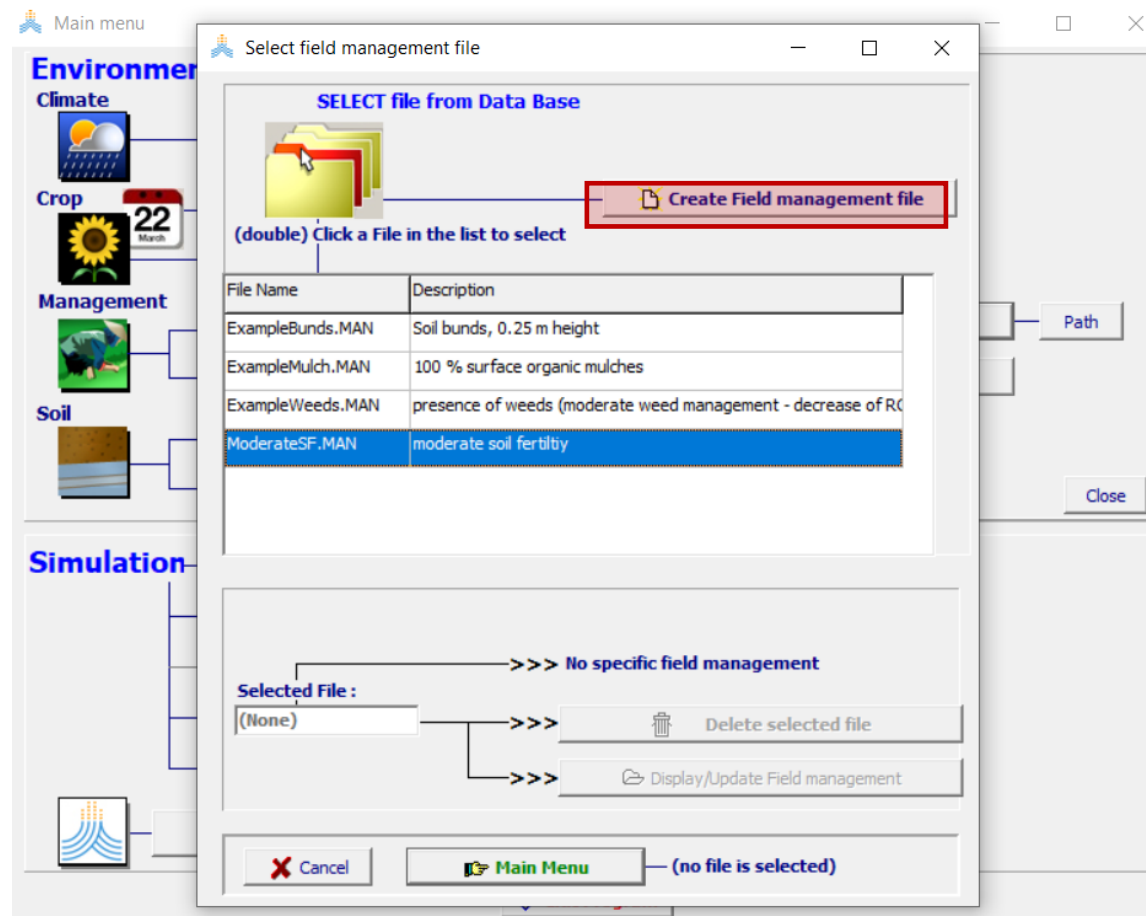


Create a Field management file

Step 1. Click on **Field** and then **Select/Create Field Management file**

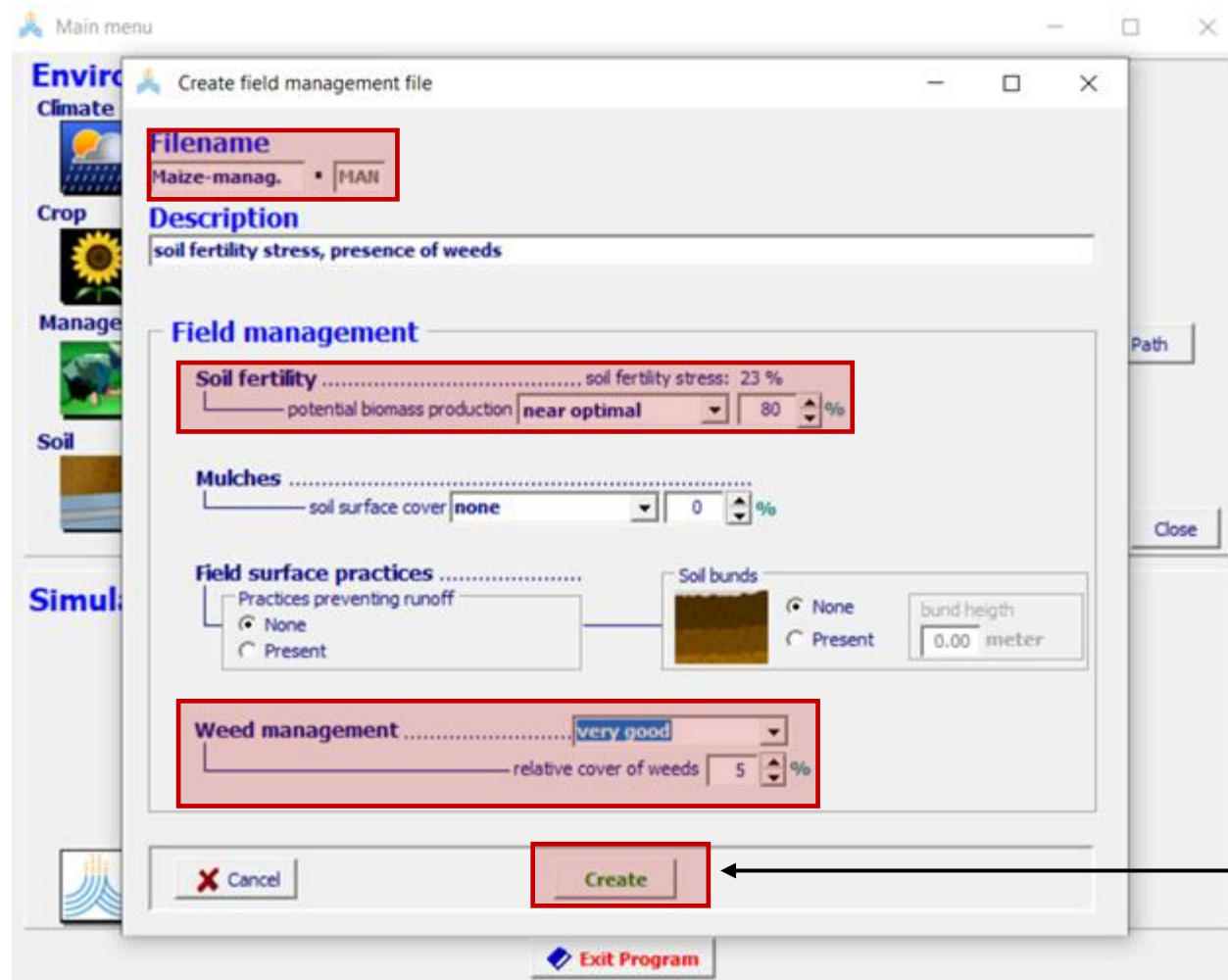


Step 2. Click on **Create Field Management file**



Create a field management file

Step 1. Name the file **“Maize-manag.”** and change the **soil fertility conditions** to **“near optimal (80%)”** and **weed management** to **“very good (5%)”**



Main menu

Enviro

Climate

Crop

Manage

Soil

Simulation

Create field management file

Filename
Maize-manag. MAN

Description
soil fertility stress, presence of weeds

Field management

Soil fertility soil fertility stress: 23 %
potential biomass production near optimal 80 %

Mulches
soil surface cover none 0 %

Field surface practices
Practices preventing runoff
☒ None
☐ Present

Soil bunds
☒ None
☐ Present
bund height
0.00 meter

Weed management very good
relative cover of weeds 5 %

Cancel Create

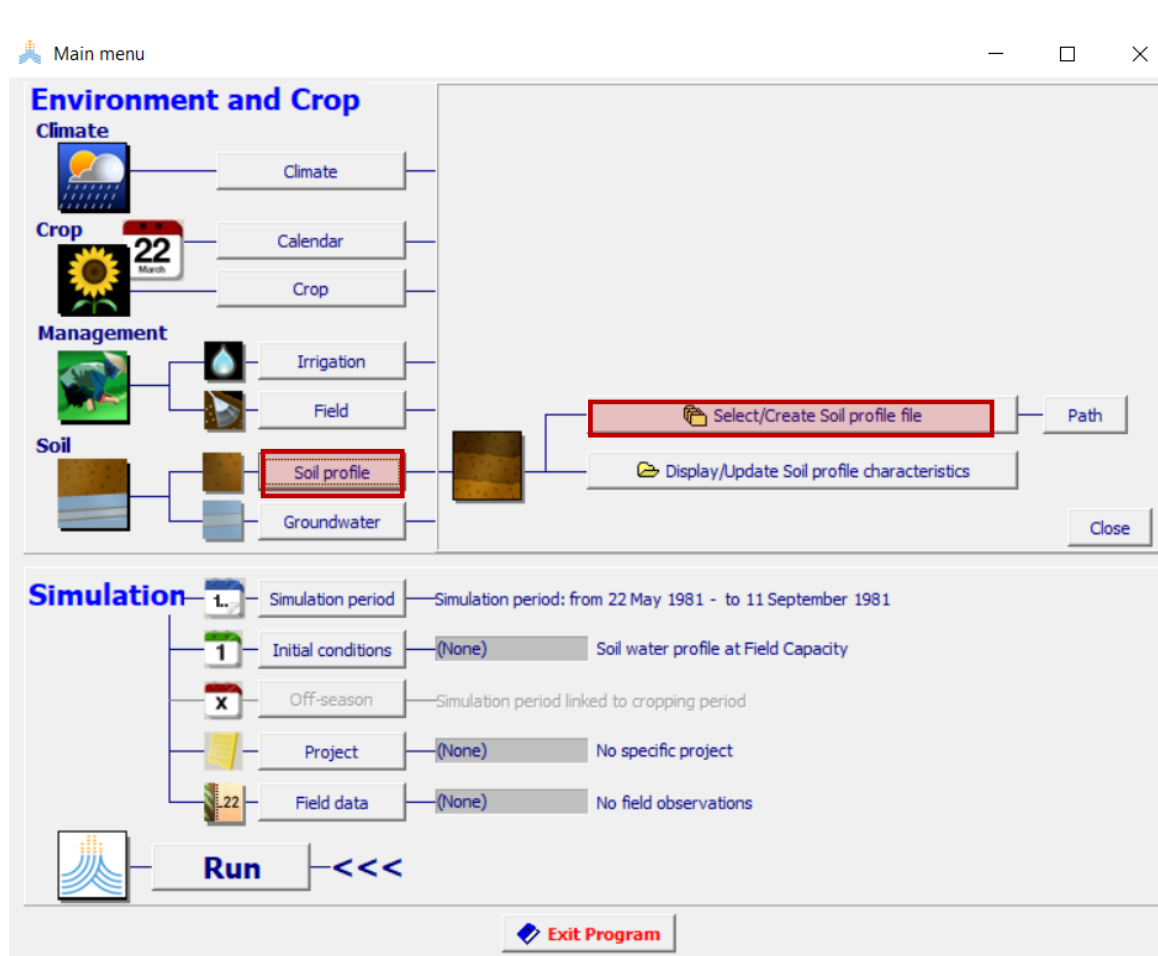
Exit Program

Step 2. Click on **Create**

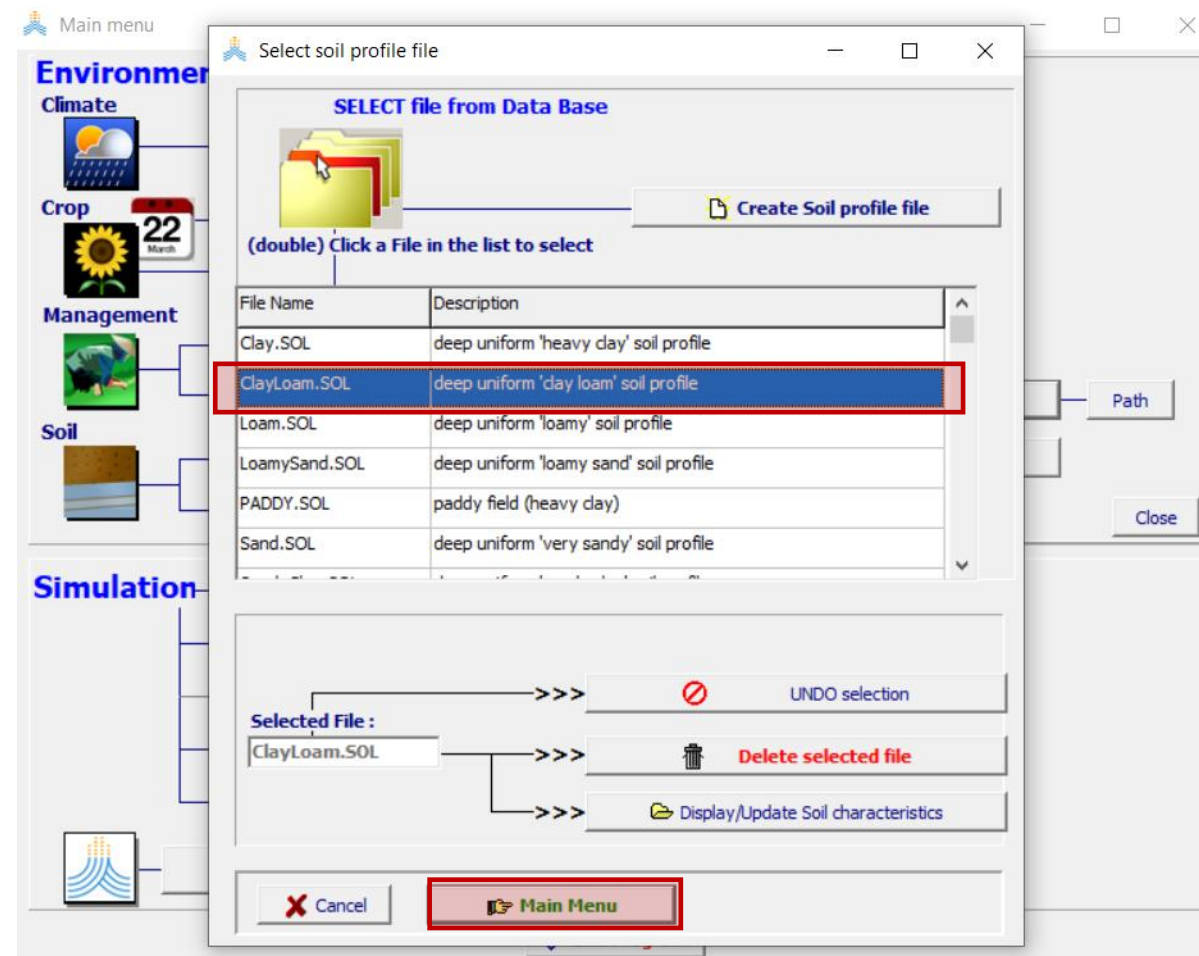


Soil: upload a soil file for Cahul

Step 1. Click on **Soil profile** and on **Select/Create Soil profile**



Step 2. Click on **Clay-Loam** and on **Main Menu**





Select a simulation period

Step 1. Click on **Simulation period** and double check that the simulation period is **linked to the growing period**, then click on **Main Menu**

Main menu

Environment and Crop

Climate

Climate Cahul_MOHC-HadGE

Crop

Calendar Period: 22 May 1981 - 11 September 1981
(None) No calendar for the Seeding/Planting year
Calendar mode
Crop Maize-short.CRO

Management

Irrigation (None) Rainfed cropping

Field Maize-manag.,MAN soil fertility stress, presence of weeds

Soil

Soil profile ClayLoam.SOL deep uniform 'clay loam' soil profile

Groundwater (None) no shallow groundwater table

Simulation

1. **Simulation period** Simulation period: from 22 May 1981 - to 11 September 1981

1 Initial conditions (None) Soil water profile at Field Capacity

X Off-season Simulation period linked to cropping period

Project (None) No specific project

22 Field data (None) No field observations

Run <<<

Exit Program

Simulation period

Growing cycle
113 days
From 22 May 1981 day 1 after sowing
To 11 September 1981 maturity

Simulation period
113 days

simulation period:
☒ linked to growing period

From 22 May 1981 ... day 1 after sowing
To 11 September 1981 .. at maturity

Graphical display (time axis)

Crop
Simulation.....
Climate.....

Available climatic data
From 1 January 1981
To 29 December 2099
File Cahul_MOHC-HadGEM2-ES_rcp26.CLI

Cancel **Main Menu**



Run the Simulations

Step 1. Click on **Run** and then click on **START**

Main menu

Environment and Crop

Climate

Climate: Cahul_MOHC-HadGE

Crop

Calendar: (None) No calendar for the Seeding/Planting year

Crop: Maize-short.CRO

Management

Irrigation: (None) Rainfed cropping

Field: Maize-manag..MAN soil fertility stress, presence of weeds

Soil

Soil profile: ClayLoam.SOL deep uniform 'clay loam' soil profile

Groundwater: (None) no shallow groundwater table

Simulation

Simulation period: Simulation period: from 22 May 1981 - to 11 September 1981

Initial conditions: (None) Soil water profile at Field Capacity

Off-season: Simulation period linked to cropping period

Project: (None) No specific project

Field data: (None) No field observations

Run <<<

Exit Program

Simulation run

START advance

to end of simulation (11 September 1981)

10 days to 1 June 1981

to date 11 September 1981

INPUT 22 May 1981

ETo 4.7 mm/day

Rain 0.0 mm/day

Irrig 0.0 mm/day

water quality 0.00 dS/m

Climate-Crop-Soil water | Rain | Soil water profile | Soil salinity | Climate and Water balance | Production | Environment

10 mm/day

Tr Legend

weeds

crop

Scale

96 %

CC Legend

weeds

crop

time (day)

Dr Legend

Flowering

SAT

FC

PWP

Numerical output

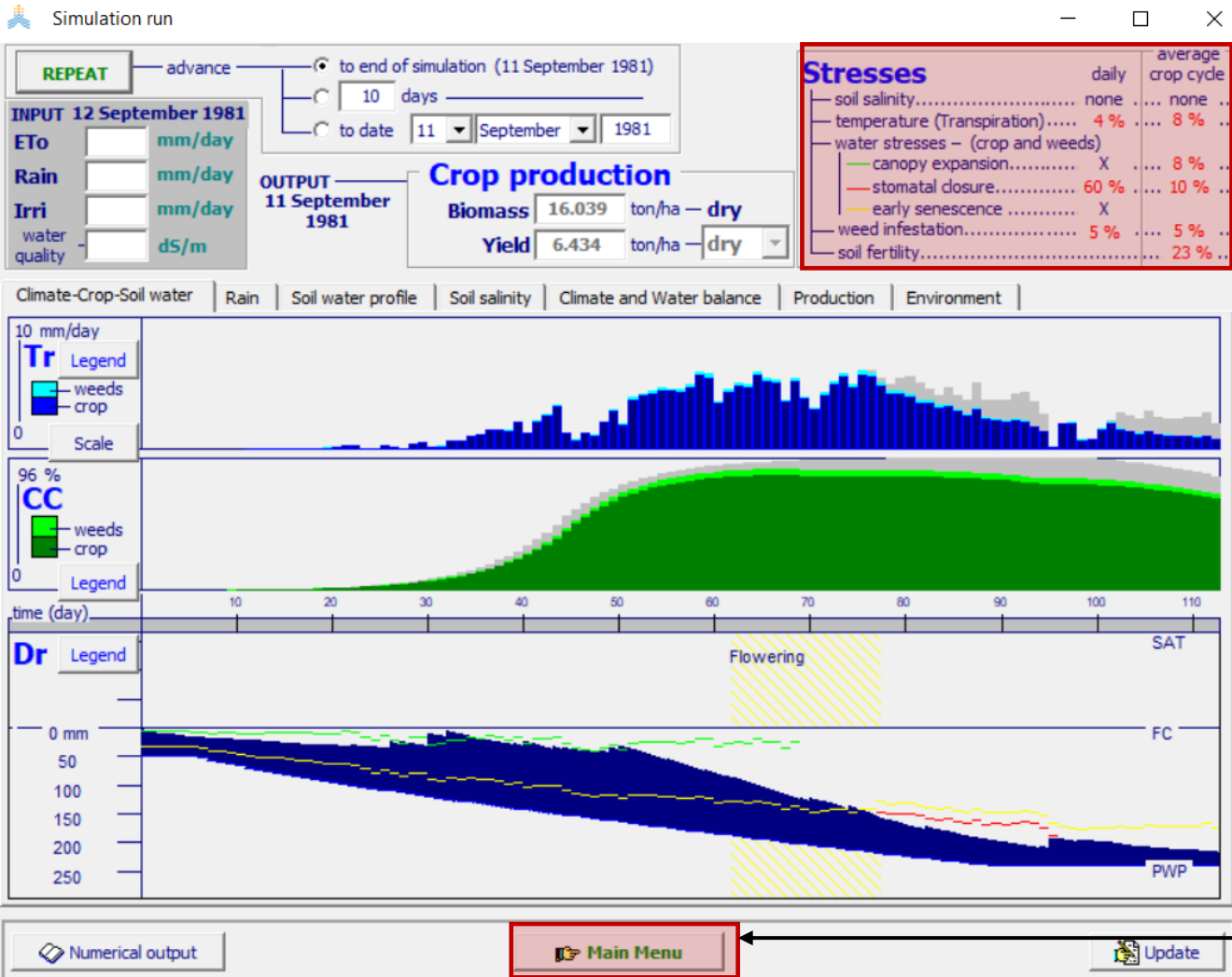
Main Menu

Update



Results visualization

In this section, we will look at the yield results emerging for Cahul in 1981, particularly water and temperature stresses



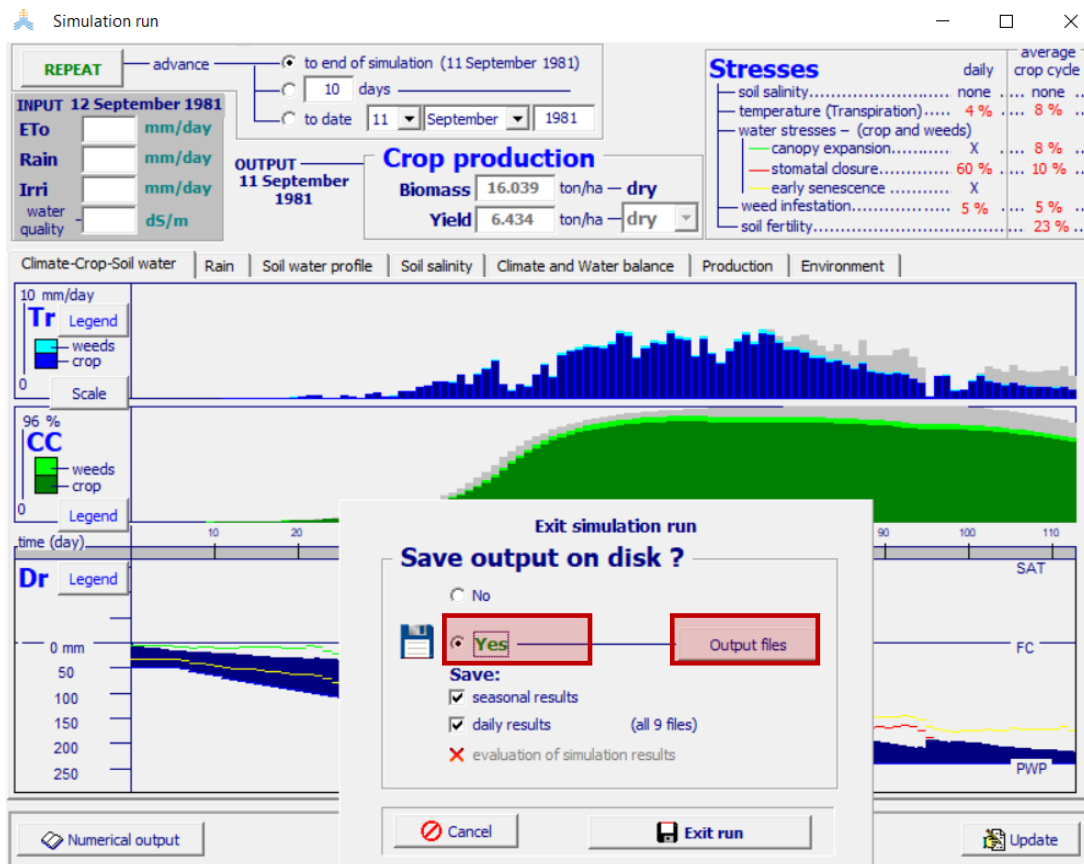
Step 1. Click on **Main Menu** to save the results



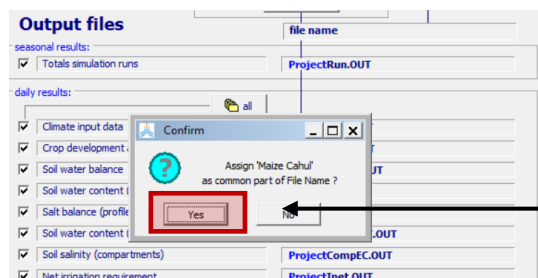
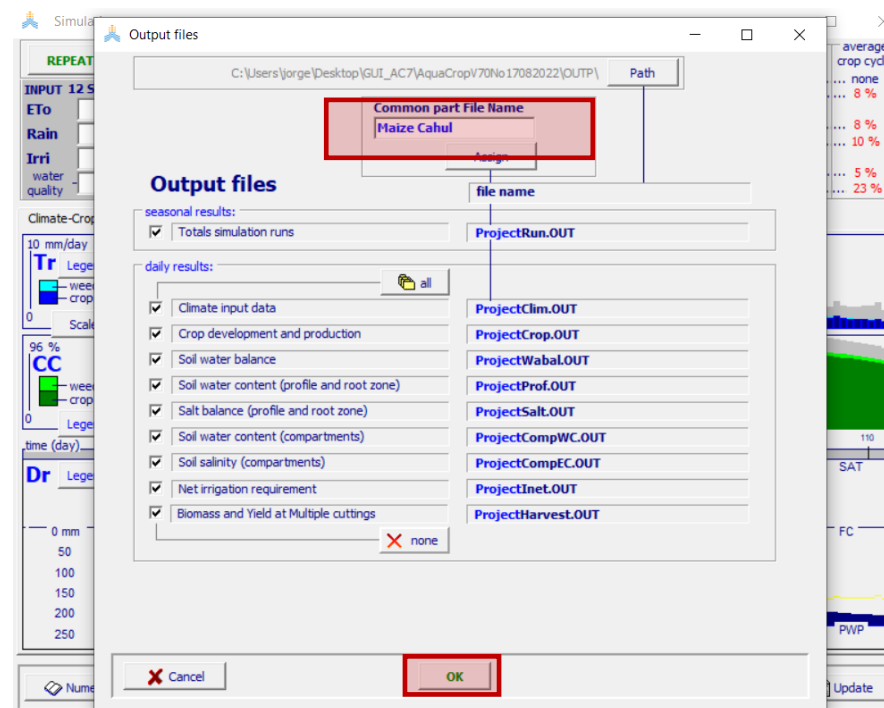
Save the simulation results

Step 1. Click on **Yes** (make sure that seasonal and daily results are ticked).

Step 2. Click on **Output files**



Step 3. Under **Common part File Name** save the file as **"Maize Cahul"** (make sure that all the output files are ticked) and then click on **OK**



Step 4. Click on **Yes**

Thank you!

Contact details:

jorge.alvarbeltran@fao.org

riccardo.soldan@fao.org