

# Introduction to CropWat

R. Balaghi\*

The screenshot displays the CropWat software interface with the following panels and data:

**Climate/ETo**  
 ETo station: KURNOOL  
 Rain station: KURNOOL

**Scheme Supply**

	Jan
Precipitation deficit	
1. Rice	0.0
2. Rice	0.0
3. Rice	0.0
4. Rice	0.0
5. Rice	145.0
6. Rice	141.3
7. Rice	138.5
8. COTTON	84.2
9. Groudnut Kharif	0.0
10. Groudnut Kharif	0.0
11. Groudnut Kharif	0.0
12. Groudnut Rabi	92.1
13. Groudnut Rabi	57.0
14. Groudnut Rabi	28.4
15. SORGHUM (Grain)	0.0
16. SORGHUM (Grain)	0.0
17. Sugarcane (Ratoon)	50.0
<b>Net scheme irr.req.</b>	
in mm/day	2.5
in mm/month	79.0
in l/s/h	0.29

**Crop Water Requirements**  
 ETo station: KURNOOL  
 Rain station: KURNOOL  
 Crop: Rice  
 Planting date: 28/02

Month	Decade	Stage	Kc coeff	ETc mm/day	ETc mm/dec	Eff rain mm/dec	Irr. Req. mm/dec
Jan	3	Nurs	1.20	0.52	1.5	0.0	1.5
Feb	1	Nurs/LPr	1.16	1.86	18.6	1.1	108.4
Feb	2	Nurs/LPr	1.06	5.23	52.3	1.6	50.7
Feb	3	Init	1.07	5.61	44.9	1.3	225.4
Mar	1	Init	1.10	6.15	61.5	0.5	61.0
Mar	2	Deve	1.10	6.53	65.3	0.1	65.2
Mar	3	Deve	1.12	6.93	76.3	1.1	75.2
Apr	1	Deve	1.16	7.43	74.3	1.4	72.8
Apr	2	Mid	1.19	7.92	79.2	1.9	77.3
Apr	3	Mid	1.20	8.49	84.9	5.6	79.3
May	1	Mid	1.20	9.16	91.6	9.9	81.7
May	2	Mid	1.20	9.75	97.5	13.3	84.2
May	3	Late	1.20	9.36	102.9	15.9	87.0
Jun	1	Late	1.17	8.67	86.7	18.5	68.2
Jun	2	Late	1.13	8.09	80.9	21.2	59.8
Jun	3	Late	1.09	7.33	51.3	16.5	27.7
					<b>1069.6</b>	<b>109.8</b>	<b>1225.4</b>

**Cropping pattern** KURNOOL

Oct	Nov	Dec
83.2	20.2	0.0
86.6	54.7	0.0
88.4	99.8	0.0
88.4	111.3	24.6
0.0	128.8	264.3
0.0	95.1	254.3
0.0	0.0	309.1
78.3	118.4	120.2
41.3	2.5	0.0
70.9	34.9	0.0
80.3	78.0	4.3
0.0	0.0	23.4
0.0	0.0	0.0
0.0	0.0	0.0
49.7	16.5	0.0
61.2	61.9	0.0
79.1	89.1	83.4
2.5	2.8	2.8
77.6	84.4	85.5
0.29	0.33	0.32

**File Information:**  
 ETo file: kurnool.pen | Rain file: kurn-av.crm | Crop file: kurn-rice.cro | Soil file: black clay soil soi | Planting date: 28/02 | Crop pat file: rajolibanda.pat | Schedule file:

\* FAO consultant ([riad.balaghi@gmail.com](mailto:riad.balaghi@gmail.com))

National Institute for Agricultural Research, Morocco ([www.inra.org.ma](http://www.inra.org.ma))

Measuring and Coping With Climate Change And Its Impacts on Water and Agriculture in Northeast China, 01 March 2010.

# CropWat

**CropWat is a decision support system developed by FAO, having as main functions:**

- ❑ to calculate: reference evapotranspiration, crop water requirements, crop irrigation requirements;
- ❑ to develop: irrigation schedules under various management conditions, Scheme water supply;
- ❑ to evaluate: rainfed production and drought effects, efficiency of irrigation practices.

# CropWat

The water balance method is used for calculation of irrigation schedules in CROPWAT, which means that the incoming and outgoing water flows from the soil profile are monitored.

Data	Input	Output
Climatic	<ul style="list-style-type: none"> <li>▪ Monthly means of min. and max. temperature, relative humidity, sunshine duration, wind speed</li> <li>▪ Rainfall data Monthly</li> </ul>	<ul style="list-style-type: none"> <li>✓ Reference Evapotranspiration</li> <li>✓ crop water requirement</li> <li>irrigation requirement</li> </ul>
Crop	<ul style="list-style-type: none"> <li>▪ Kc, crop description, max. rooting depth, % area covered by plant</li> </ul>	<ul style="list-style-type: none"> <li>✓ Actual crop Evapotranspiration</li> </ul>
Soil	<ul style="list-style-type: none"> <li>▪ Initial soil moisture condition and available soil moisture</li> </ul>	<ul style="list-style-type: none"> <li>✓ Soil moisture deficit</li> <li>✓ Estimated yield reduction due to crop</li> </ul>
Irrigation	<ul style="list-style-type: none"> <li>▪ Irrigation scheduling Criteria</li> </ul>	<ul style="list-style-type: none"> <li>Stress</li> <li>✓ Irrigation scheduling</li> </ul>

# CropWat

- ❑ **Crop evapotranspiration or crop water requirements:** This is defined as the daily water needs of the crop ;
- ❑ **Rainfall:** Depending on the objective of the irrigation scheduling, monthly rainfall averages, rainfall at different levels of probability, historical data or actual data are used ;
- ❑ **Crop data:** Data on rooting depth and allowable depletion are required. To assess the effect of water stress on yield, the yield response factor is also required ;

# CropWat

□ **Soil data:** The soil parameters important for irrigation scheduling and required for irrigation scheduling using the FAO CROPWAT program are described below:

- Total available soil moisture content (SMta), defined as the difference in soil moisture content between field capacity (FC) and wilting point (PWP). This is the total amount of water available to the crop and depends on texture, structure and organic matter content ;
- Initial soil moisture depletion indicates the dryness of the soil at the start of irrigation. This is expressed as a depletion percentage from FC ;
- Maximum rooting depth will in most cases be determined by the genetic characteristics of the plant. In some cases the root depth can be restricted by limiting layers ;
- Maximum rain infiltration rate allows for an estimate of the surface runoff for the effective rain calculation. This is a function of rain intensity, soil type and slope class.

# CropWat

The screenshot shows the CROPWAT software interface. The main window is titled 'CROPWAT - Session: untitled'. The menu bar includes File, Edit, Calculations, Charts, Settings, Window, Language, and Help. The toolbar contains icons for New, Open, Save, Close, Print, Chart, and Options. The left sidebar has icons for Climate/ETo, Rain, Crop, Soil, CWR, Schedule, Crop Pattern, and Scheme. The main workspace is currently empty. An 'Ouvrir' (Open) dialog box is open, showing a list of files in the 'rain' folder. A blue arrow points to the file 'KURN-NOR.CRM'. Below the file list is a table with the following data:

	August	September	October	November	December	Total

The taskbar at the bottom shows several open applications: Gmail - Boite de réc..., CROPWAT8.0Examp..., CropWat presentati..., and FAO Tools. The system tray on the right shows the date and time as 20:41.

## **Rainfall in wet, normal and dry years:**

Defined as the rainfall with a respectively 20, 50 and 80% probability of exceedance, representing a wet, normal and dry year. The three values are useful for the programming of irrigation supply and simulation of irrigation management conditions. The rainfall in normal years (50% probability) is, in general, well approached by the average rainfall.

# Rainfall file

## *Effective rainfall:*

Defined as that part of the rainfall which is effectively used by the crop after rainfall losses due to surface run off and deep percolation have been accounted for. The effective rainfall is the rainfall ultimately used to determine the crop irrigation requirements.

Monthly rain - C:\ProgramData\CROPWAT\data\rain\KURN-AV.CRM

Station: KURNOOL      Eff. rain method: Fixed percentage

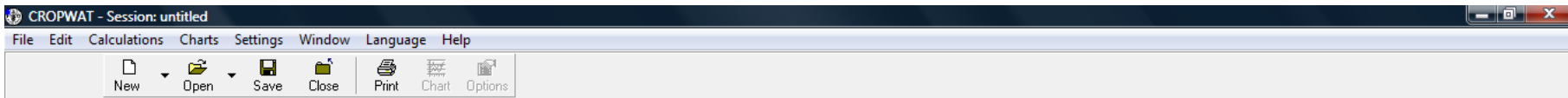
	Rain	Eff rain
	mm	mm
January	0.0	0.0
February	5.1	4.1
March	2.0	1.6
April	11.0	8.8
May	49.0	39.2
June	79.0	63.2
July	106.0	84.8
August	109.0	87.2
September	128.0	102.4
October	99.0	79.2
November	26.0	20.8
December	2.0	1.6
<b>Total</b>	<b>616.1</b>	<b>492.9</b>

# Effective rainfall

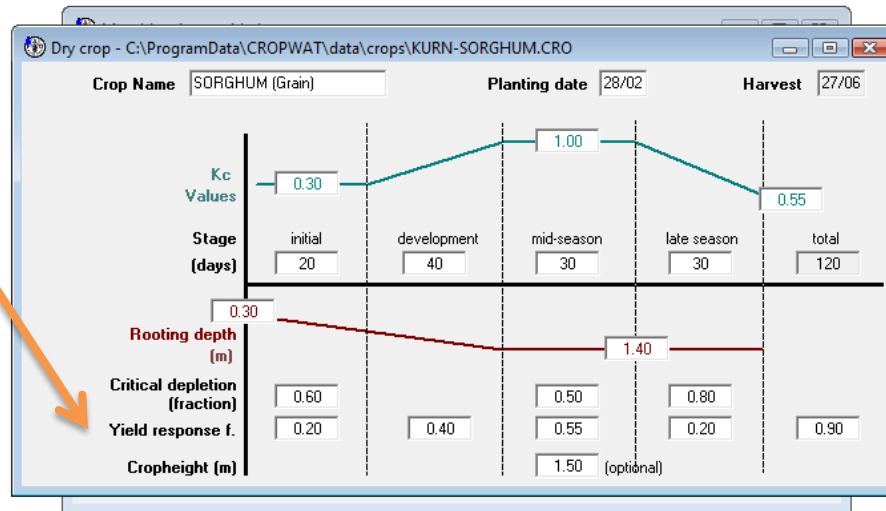
- To account for the losses due to runoff or percolation, a choice can be made of one of the four methods given in CROPWAT 8.0 (Fixed percentage, Dependable rain, Empirical formula, USDA Soil Conservation Service).
- In general, the efficiency of rainfall will decrease with increasing rainfall. For most rainfall values below 100 mm/month, the efficiency will be approximately 80%. Unless more detailed information is available for local conditions, it is suggested to select the Option “Fixed percentage” and give 80% as requested value.
- In the water balance calculations included in the irrigation scheduling part of CROPWAT, a possibility exists to evaluate actual Efficiency values for different crops and soil conditions.





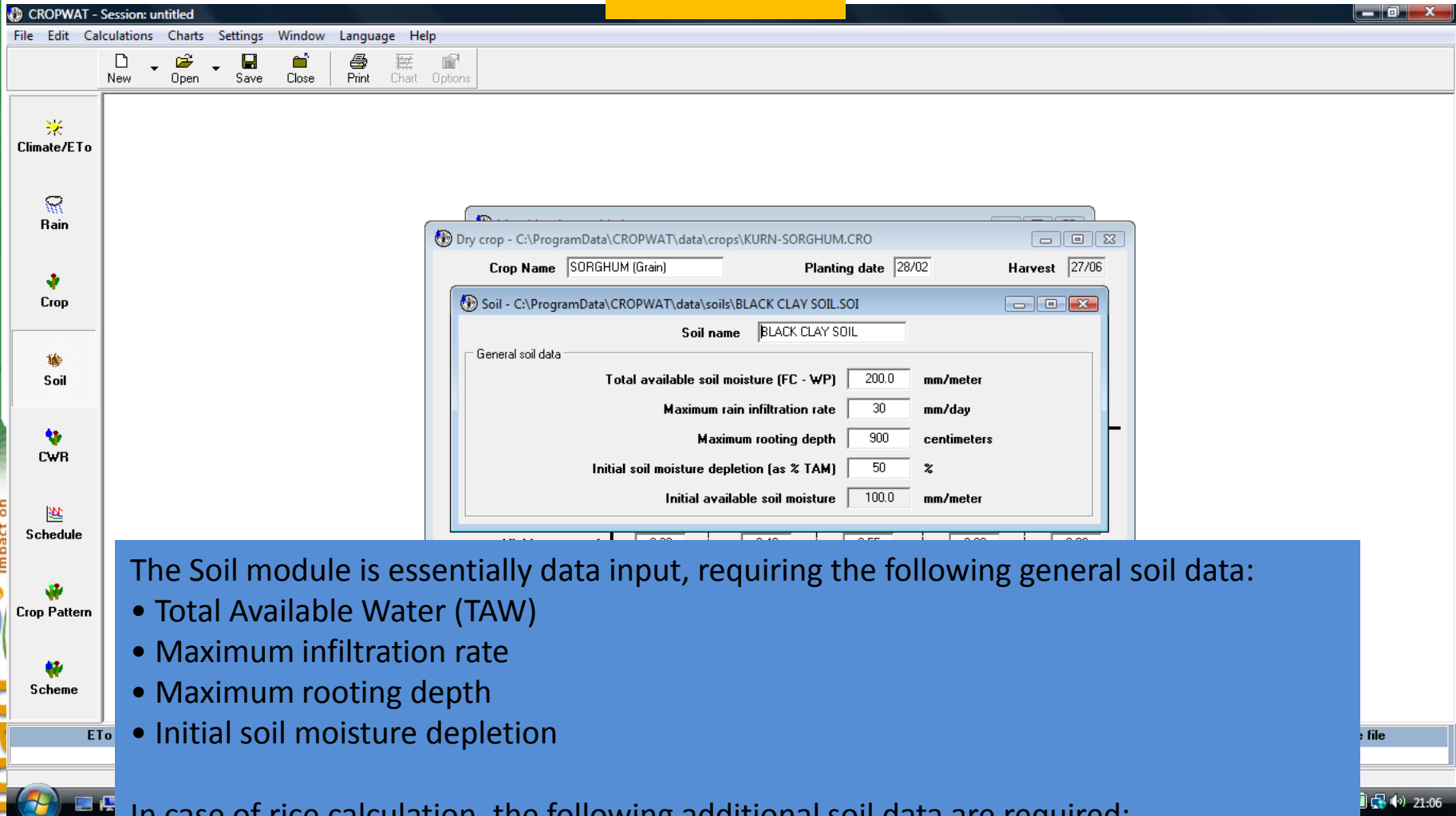


$$1 - Y_a / Y_m = K_y \times (1 - E_{Tc} / E_{tc})$$



CROPWAT 8.0 has crop data for several common crops taken from selected FAO publications. However, the most reliable crop data remain the data obtained from local agricultural research stations.

# Soil file



The Soil module is essentially data input, requiring the following general soil data:

- Total Available Water (TAW)
- Maximum infiltration rate
- Maximum rooting depth
- Initial soil moisture depletion


In case of rice calculation, the following additional soil data are required:

- Drainable porosity
- Critical depletion for puddle cracking
- Water availability at planting
- Maximum water depth

http://www.fao.org/nr/water/infores\_databases.html

▶ text only version ▶ print friendly helping to build a world without hunger

NATURAL RESOURCES AND ENVIRONMENT DEPARTMENT



**FrontPage**  
**Topics**  
**Information Resources**  
Publications & CD-ROMs  
Graphs & Maps  
Multimedia  
Video  
**Databases & Software**  
AquaCrop  
CropWat  
ClimWat  
ETo Calculator  
Wastewater  
**Promotional & Educational Material**  
**Projects**  
**Hot Issues**  
**QUICKLINK TO** ▼  
Databases & Software  
Publications & CD-ROMs  
Educational Material  
Our Regional Offices

### Databases & Software

**AQUACROP**

AquaCrop is the FAO crop-model to simulate yield response to water of several herbaceous crops. It is designed to balance simplicity, accuracy and robustness, and is particularly suited to address conditions where water is a key limiting factor in crop production. AquaCrop is a companion tool for a wide range of users and applications.

▶ Read more

**AQUASTAT**

AQUASTAT is FAO's global information system on water and agriculture. It collects, analyses and disseminates data and information by country and by region. Its aim is to provide users interested in global, regional and national analyses with comprehensive information related to water resources and agricultural water management across the world, with emphasis on countries in Africa, Asia, Latin America and the Caribbean. Among the information available: main country database; Databases on African dams, on institutions, on river sediment yields, and on investment costs in irrigation

▶ View AQUASTAT Database

SEARCH  
**RELATED LINKS**  
Who We Are  
What We Do  
Topics: Irrigation  
Topics: Water Quality  
Topics: Water Productivity  
**CONTACT US**

*Demonstration on the computer !*



謝謝您  
Thank you

