Introduction to CropWat

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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.

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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	▪ Monthly means of min. and max. temperature, relative humidity, sunshine duration, wind speed ▪ Rainfall data Monthly	✓Reference Evapotranspiration ✓ crop water requirement irrigation requirement ✓ Actual crop Evapotranspiration ✓ Soil moisture deficit ✓ Estimated yield reduction due to crop Stress ✓ Irrigation scheduling
Crop	▪ Kc, crop description, max. rooting depth, % area covered by plant	
Soil	▪ Initial soil moisture condition and available soil moisture	
Irrigation	▪ Irrigation scheduling Criteria	

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❑ *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 ;

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❑ ***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.

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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

CROPWAT - Session: untitled

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Climate/ETo
Rain
Crop
Soil
CWR
Schedule
Crop Pattern
Scheme

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
Total	616.1	492.9

ETo file	Rain file	Crop file	Soil file	Planting date	Crop pat file	Schedule file
	kurn-av.crm					

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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.
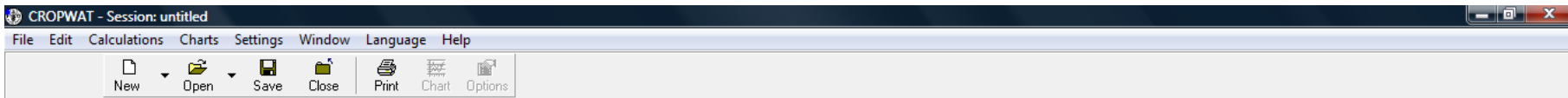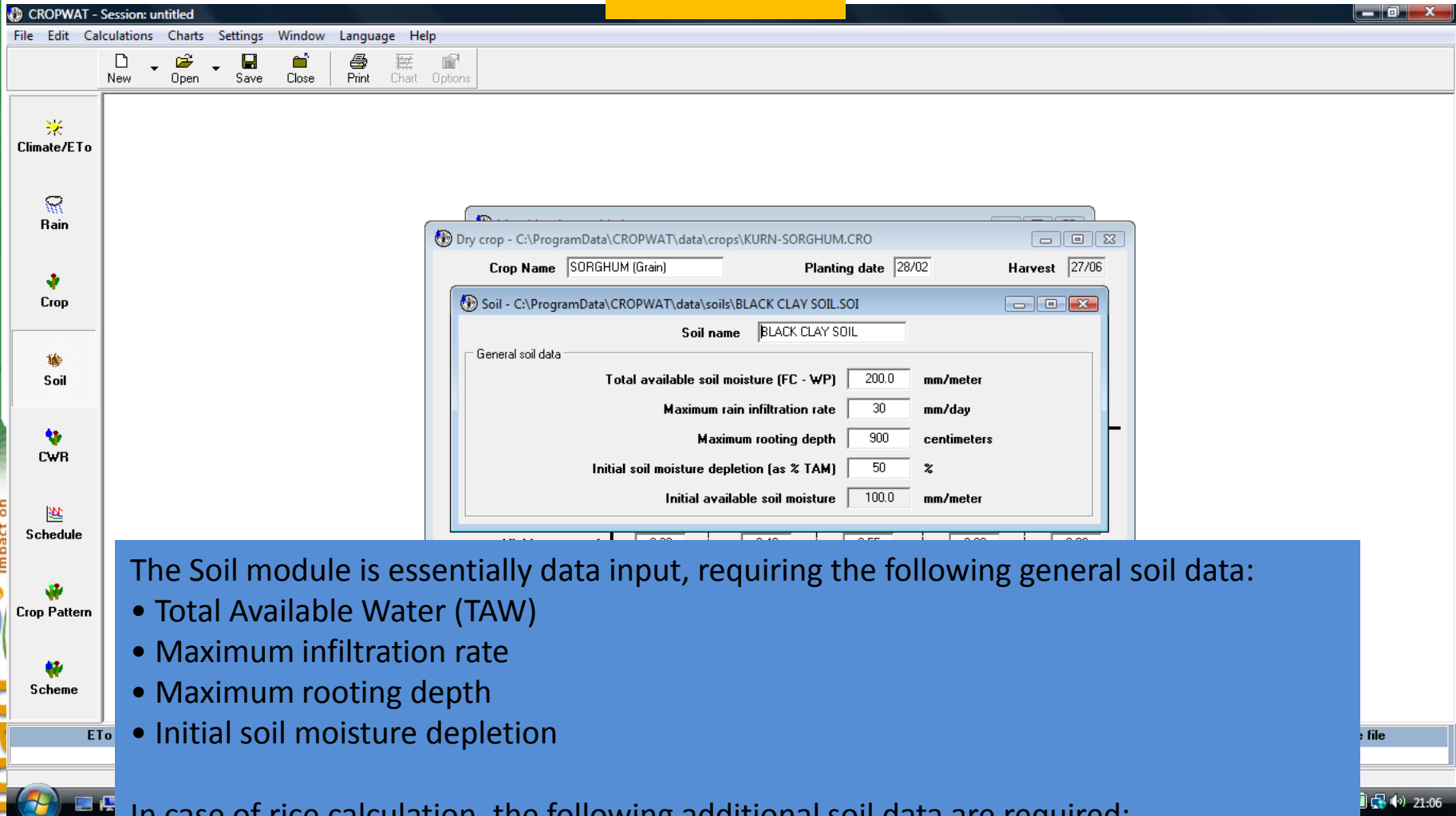
$$1 - Y_a / Y_m = K_y \times (1 - ET_c / Et_c)$$
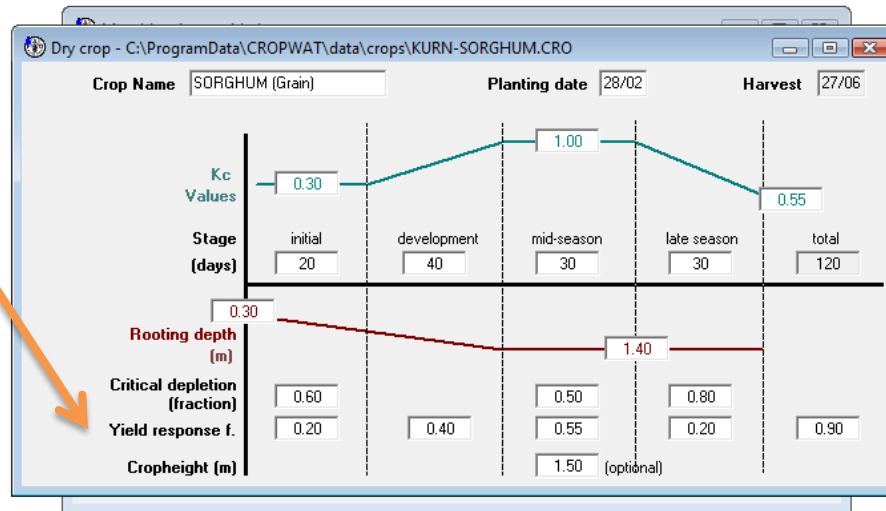
CROPWAT 8.0 has crop data for several common crops taken from selected FAO publications. However, the most reliable crop data remain the data obtained from local agricultural research stations.

Soil file

CROPWAT - Session: untitled

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Dry crop - C:\ProgramData\CROPWAT\data\crops\KURN-SORGHUM.CRO

Crop Name SORGHUM (Grain)   **Planting date** 28/02   **Harvest** 27/06

Soil - C:\ProgramData\CROPWAT\data\soils\BLACK CLAY SOIL.SOI

Soil name BLACK CLAY SOIL

General soil data

Total available soil moisture (FC - WP)	200.0	mm/meter
Maximum rain infiltration rate	30	mm/day
Maximum rooting depth	900	centimeters
Initial soil moisture depletion (as % TAM)	50	%
Initial available soil moisture	100.0	mm/meter

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

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http://www.fao.org/nr/water/infores_databases.html

Demonstration on the computer !

謝謝您
Thank you