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A STUDY ON CROP WATER REQUIREMENT FROM THE MANUAL METHOD

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ABSTRACT

The total quantity of water required by a crop from the instant of sowing till it comes to harvesting is known as water requirement of crop. Crop water requirements are normally expressed by the rate of evapo transpiration (ET) in mm day-1. From an agricultural point of view, ET determines the amount of water to be applied through artificial means. The water required for the crops from field preparation to its harvest using available data with penman method using *FAO 56, FAO 25, FAO 24*

The area taken for the study is Hunasagi. Hunasagi is a village in the Shorapur taluk of Yadgir district in Karnataka state, India. A number of early Paleolithic sites were found in Hunasagi. Hunasagi is 48 km southwest of the distinct headquarters, Yadgiri. 31 KM from Shorapur. 473 KM from State capital Bangalore.

Keywords*: Crop Water Requirement, evapo transpiration, Penman method, FAO 56.*

I. INTRODUCTION

Crop evapotranspiration can be calculated from climatic data and by integrating directly the crop resistance, albedo and air resistance factors in the penman - monteith approach. As there is still a considerable lack of information for different crops, the penman - monteith method is used for the estimation of the standard reference crop to determine its evapotranspiration rate, i.e., Eto. Experimentally determined ratios of Etc/Eto, called crop coefficients (Kc), are used to relate Etc to Eto or Kc = Etc/Eto

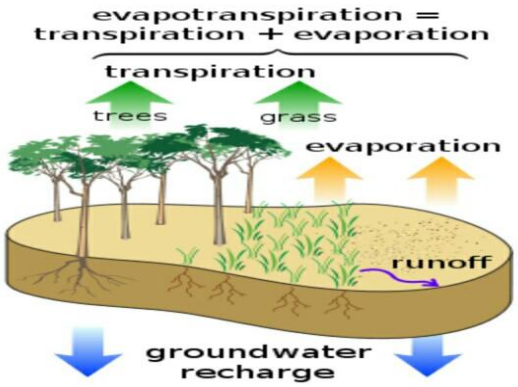

Figure 1:Evapotranspiration

Study Area

The area taken for the study is Hunasagi. Hunasagi is a village in the Shorapur taluk of Yadgir district in Karnataka state, India. A number of early Palaeolithic sites were found in Hunasagi. Hunasagi is 48 km southwest of the distinct headquarters, Yadgiri. 31 KM from Shorapur. 473 KM from State capital Bangalore. And the nearest railhead is in Yadgiri. It belongs to Gulbarga Division. Hunasagi is surrounded by Lingsugur Taluk towards South,

Muddebihal Taluk towards west, Shahapur Taluk and Devadurga Taluk towards East. Talikota, Sholapur, Lingsugur Shahpur are the nearby Cities to Hunasagi.

The Hunasagi village is located at latitude 75.71^{O} N and longitude 16.81^{O} E and at an altitude of 594 m... The area is of moderate climate with an average temperature of 26.43°C. The average rainfall in the command is of the order of 48cms to 64 cms and unevenly distributed resulting in failure of crops. The soil of this region is fertile and good. Assured crops can be raised in the region by providing irrigation facilities.

GROSS COMMAND AREA = 38006.7 Hectares
CULTIVABLE COMMAND AREA = 7725.65 Hectares

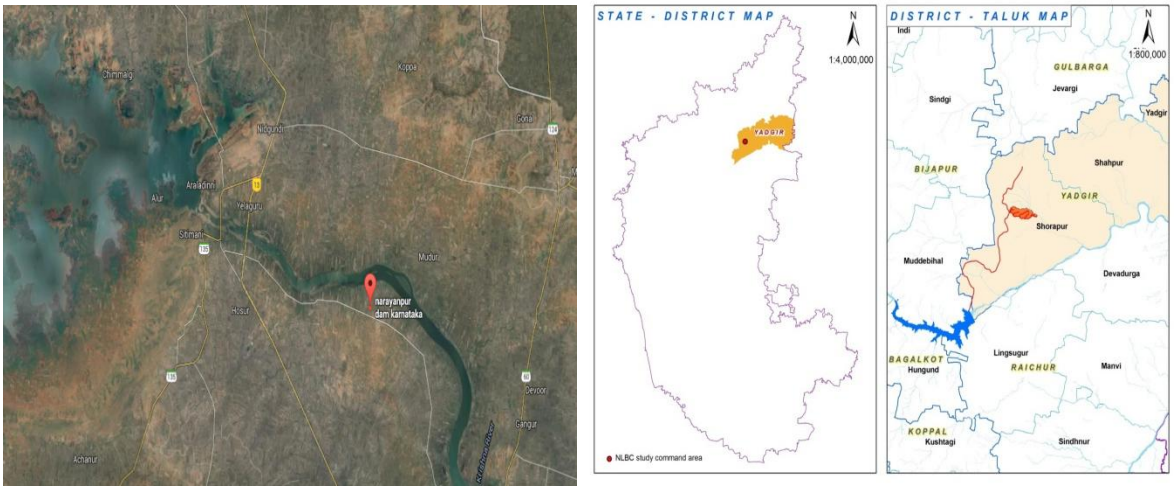

Figure 2: Map of Narayanapura left bank canal and hunasagi village in Yadagiri district

II. METHOD

- **Calculation of Crop Water Requirement**
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1. Water Requirement of Crops

The Quantum of water required for raising a crop in its base period during a cropping season is called crop water requirement.

2. Base Period of Crops

The Base period of Crops is considered from IMD station inputs for Agro climatic Zone-VIII (Refer Agro climatic zone Map).

3. Estimation of Water Requirement of Crops

"Modified Penman Method" is adopted for of crop water requirement on a fortnightly basis during the crop period. The total water requirement is estimated considering the following:

Consumptive use:

a) The monthly potential evapo-transpiration (ETo) for each crop is computed from agro-climatologically data
b) Datas of calculating Evapo-transpiration needs temprature maximum and minimum, humidity, windspeed, and sunshine hours.
c) 30 years Rainfall data's of Hunasagi station collected from WRDO department.
d) The Crop co-efficient is also taken from IMD station for Agro climatic zone-VIII.
e) Effective rainfall data's are calculated from according to the FAO guidelines.

4. Net Irrigation Requirement (NIR)

The net irrigation requirement is arrived by deducting the monthly effective rainfall contribution from monthly water requirement

5. Gross Irrigation requirement (GIR)

The Gross Irrigation Requirement is arrived with a project efficiency of 50%

$$GIR = \frac{NIR \times 100}{50}$$

- **Cropping patterns and the cropping periods of Narayanapura left bank canal region**

i. Khariff (total area-7725.66 acres-100%) (Area of crops)

Paddy – 90% (6991.53 acres) – 122 days (June II to November I)
Groundnut – 1% (20.93 acres) - 122 days (June II to Oct I)
Maize – 9% (713.20 acres) - 122 days (June II to October I)

ii. Rabi (17.41%)

Maize – 15.5% (1200.03 acres) – 120 days (November II to March I)
Paddy – 1.9% (144.65 acres) – 120 days (November II to March I)

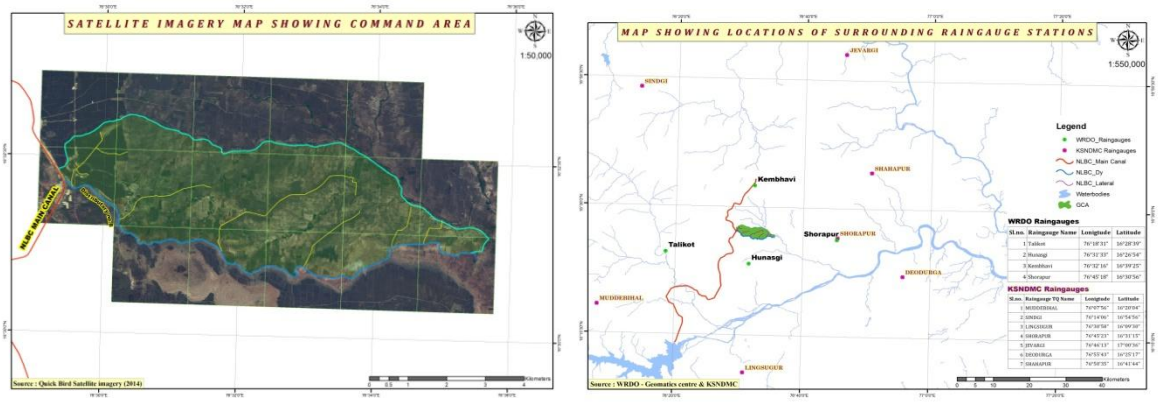

Figure 3: Satellite image of map showing command area and locations of surrounding rain gauge stations

III. DATA ANALYSIS

Table 1: Data products and their sources

Sl.no	Data Product	Sources
1)	Cropping pattern	As per records from Village wise or Command area parcel wise
2)	Evapotranspiration values	Arrived from Indian meteorological data
3)	Crop co-efficient for the cropping pattern	IMD data for different Agro-climatic zones & seasons
4)	Rainfall data	As per Department of statistics / WRDO

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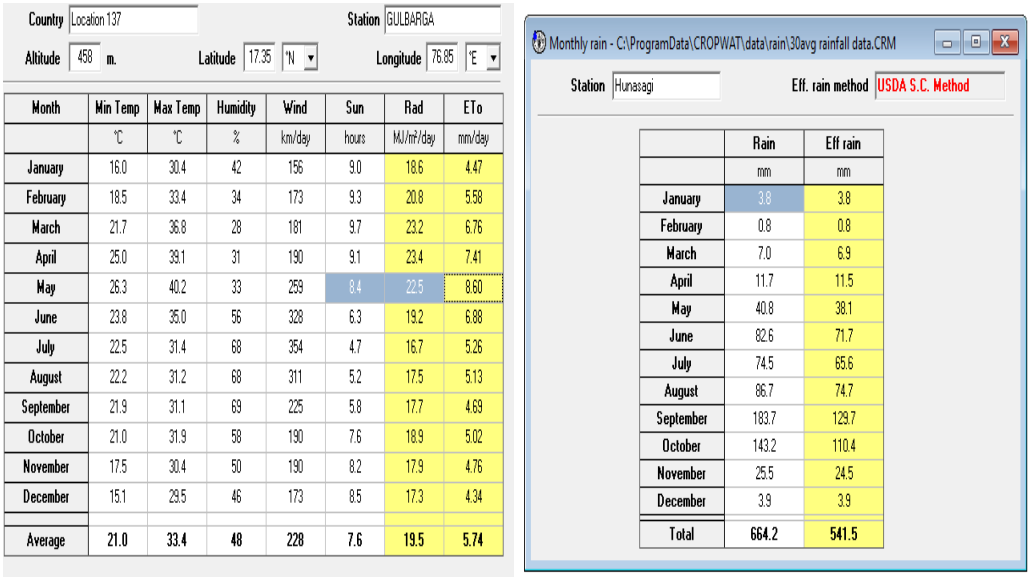


Country: Location 137 — Station: GULBARGA
Altitude: 458 m. — Latitude: 17.35 °N — Longitude: 76.85 °E

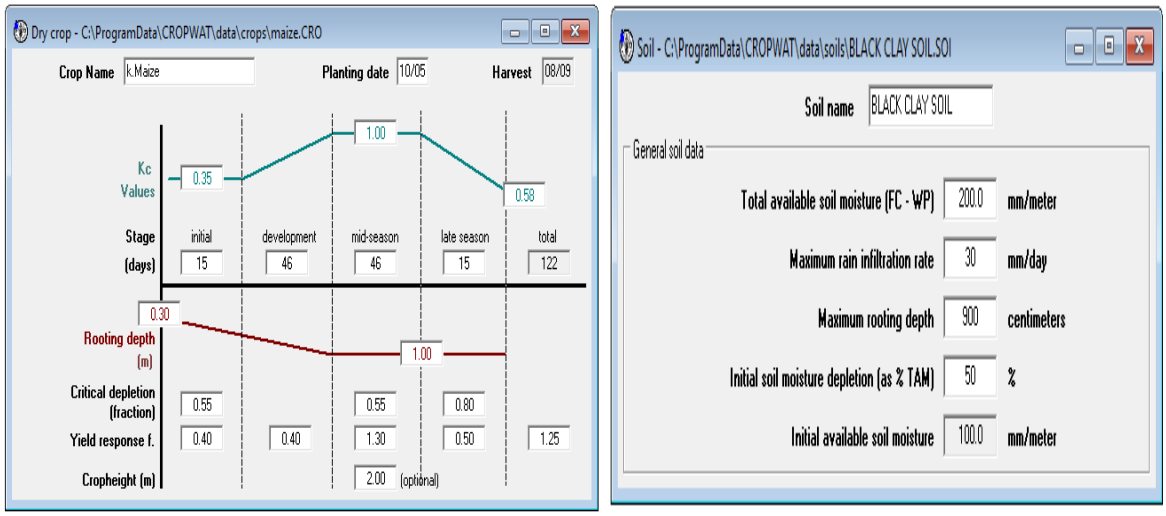
Month	Min Temp	Max Temp	Humidity	Wind	Sun	Rad	ETo
	°C	°C	%	km/day	hours	MJ/m²/day	mm/day
January	16.0	30.4	42	156	9.0	18.6	4.47
February	18.5	33.4	34	173	9.3	20.8	5.58
March	21.7	36.8	28	181	9.7	23.2	6.76
April	25.0	39.1	31	190	9.1	23.4	7.41
May	26.3	40.2	33	259	8.4	22.5	8.60
June	23.8	35.0	56	328	6.3	19.2	6.88
July	22.5	31.4	68	354	4.7	16.7	5.26
August	22.2	31.2	68	311	5.2	17.5	5.13
September	21.9	31.1	69	225	5.8	17.7	4.69
October	21.0	31.9	58	190	7.6	18.9	5.02
November	17.5	30.4	50	190	8.2	17.9	4.76
December	15.1	29.5	46	173	8.5	17.3	4.34
Average	21.0	33.4	48	228	7.6	19.5	5.74

Monthly rain - C:\ProgramData\CROPWAT\data\rain\30avg rainfall data.CRM

Station: Hunasagi — Eff. rain method: USDA S.C. Method

	Rain	Eff rain
	mm	mm
January	3.8	3.8
February	0.8	0.8
March	7.0	6.9
April	11.7	11.5
May	40.8	38.1
June	82.6	71.7
July	74.5	65.6
August	86.7	74.7
September	183.7	129.7
October	143.2	110.4
November	25.5	24.5
December	3.9	3.9
Total	664.2	541.5

Figure 4: Climate data and Rainfall data



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

Crop Name: k.Maize — Planting date: 10/05 — Harvest: 08/09

	initial	development	mid-season	late season	total
Kc Values	0.35		1.00	0.58	
Stage (days)	15	46	46	15	122
Rooting depth (m)	0.30		1.00		
Critical depletion (fraction)	0.55		0.55	0.80	
Yield response f.	0.40	0.40	1.30	0.50	1.25
Cropheight (m)			2.00 (optional)		

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

Figure 5: Crop data and Soil data

Total water required during the Khariff season = 496.83 Mcft
Total water required during the Rabi season = 164.51Mcft
Annual Water Requirement For The Crops = 496.83 + 164.51 = 661.35Mcf

IV. RESULTS

The table below shows the crop water required for different crops in kharif and rabi season for the study area Hunasagi.

Table 2: Crop water required in MCFT

Season	Crops	Manual method
KHARIFF	Paddy	457.42
	Maize	38.35
	Groundnut	1.06
RABI	Paddy	17.70
	Maize	146.82

V. CONCLUSION

An attempt made to introduce a concept which will give realistic value of crop water requirement. They will become a basis for planning, design and water management of irrigation system in present practice to find out crop water requirement by modified penman method, the data collection as well as calculation of crop water requirement is a tedious work which requires manpower as well as consumes time.

VI. ACKNOWLEDGEMENT

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