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CLIMATE AND SOIL BASED CROP WATER REQUIREMENT FOR RICE

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ABSTRACT

Estimation of crop water requirement for Coimbatore region revealed that rice requires 591 and 821 mm during *kharif* and summer respectively. Of which 410 and 510 mm were required for crop ET and 181 and 311 mm were required for percolation during *kharif* and summer respectively. The peak water requirement was found to be at panicle initiation stage in *kharif* and reproductive stage in summer.

KEYWORDS : Crop Water Requirement, Rice, Evapotranspiration

In all the major irrigation projects in India, the design was based on duty of water concept which has became obsolete. The water requirement of crops is mainly based on climate, soil and management practices which are not considered in the duty of water concept. On an arbitrary basis the duty was fixed and the canals were designed. The percolation loss accounts for 40 to 70 per cent of water requirement depending upon the type of soil. The remaining share is to be met by the evapotranspiration (ET) of the crop. Hence, a study was taken up to find out a suitable scientific method of estimating crop water requirement for rice crop based on climate and soil.

MATERIALS AND METHOD

Field experiments were conducted dur-

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ing *Kharif* 1985 and summer 1986 with rice IR 50 at Tamil Nadu Agricultural University, Coimbatore in a clay loam soil (Sand 55% silt 13% and clay 31.5%) with a view to estimate the climate and soil based crop water requirement. The criteria for evaluating crop water requirement with reference to climate and soil were evapotranspiration (ET) and percolation loss. The ET of rice crop was calculted from reference crop ET following pan evaporation method (Doorenbos and Pruitt 1977).

$$ET\ crop = Kc \times ET_0$$

Where,

ET_0 = Reference crop ET
Kc = Crop co--efficient (Table1)
ET crop = Kp x Epan

Where,

Epan = Pan evaporation mm day^{-1}
Kp = Pan coefficient (0.8)

Pan evaporation data was collected from USWB class A pan installed at the agromet observatory, Tamil Nadu Agricultural University, Coimbatore.

Percolation loss in rice field was estimated using the physical property of the soil (Hydraulic conductivity) as suggeted by John Loverday (1974). Percolation rate was taken as constant throughout the crop period as suggested by Ramireddy (1983). Measured saturated hydraulic conductivity of the soil was 2.29 and 3.70 mm day^{-1} during *kharif* and summer respectively. The dates of sowing, transplanting and harvesting for the *kharif* 1985 and summer 1986 crops are given below.

	Kharif 1985	Summer 1986
Date of sowing	23.6.1985	2.1.1986
Date of transplanting	14.7.1985	24.1.1986
Date of harvesting	11.10.1985	29.4.1986
Total duration in days	111	113

RESULTS AND DISCUSSION

Crop water requirement calculated for two different seasons is presented in Table 2.

In *kharif*, the ET of rice was at an average of 4.9 6.8, 5.1, and 4.2 mm day^{-1} at tillering, panicle initiation, flowering and maturity stages respectively. The ET demand increased upto panicle initiation and decreased thereafter. Peak ET (8.6 mm day^{-1}) was observed during panicle initiation which is corroborating with the observation of Nair *et al.* (1973). Anjanayalu *et al.* (1983) stated that 66 to 68 per cent water applied was utilised for ET only.

During summer, the mean ET of rice was 4.9, 5.3, 6.6 and 7.5 mm day^{-1} at tillering, panicle initiation, flowering and maturity stages respectively. Evapotranspiration of rice increased lineraly up to harvest. This might probably be due to the predominent effect of high temperature, wind velocity and low relative humidity which were favoured for increased ET. Similar results of ET increase was observed by Tomar and O' Toole (1980). Peak ET (8.9 mm day^{-1}) occurred during the reproductive stage which coincided with high temperature, evaporation and sunshine hours. The ET of rice at 20 days before and 20 days after 50 per cent flowering represented 55 per cent of the total water applied to rice. It revealed that increased ET at reproductive stage attributed to climatic changes rather than to change in needs of the growth stages.

Percolation loss in rice field was calculated to 181.1 and 310.9 mm over 77 and 84 days during *kharif* and summer respectively. This percolation loss was 30 and 38 per cent of the total water applied to rice field during *kharif* and summer respectively. Increased percolation loss in summer might be due to decrease in depth of water table and high soil temperature.

Table 2. Crop water requirement of rice (mm.week^{-1})

Period	Pan evaporation	ET	ET + percolation	Period	Pan evaporation	ET	ET + percolation
Tillering stage							
July 14-20	38.8	35.4	51.43	Jan. 24-30	36.8	33.6	59.5
July 21-27	33.0	30.1	46.13	Feb. 31-06	37.3	34.0	59.9
Aug. 28-03	41.1	37.5	58.33	Feb. 07-13	38.6	35.10	61.0
Total	112.9	103.0	155.89		112.7	102.7	180.4
Panicle initiation stage							
Aug. 04-10	53.5	51.4	67.43	Feb. 14-20	31.0	28.4	54.3
Aug. 11-17	63.0	60.5	76.53	Feb. 21-27	39.3	37.0	63.0
Aug. 18-24	31.1	29.9	45.93	Mar. 28-06	47.9	46.0	71.9
Total	147.6	141.8	189.89		118.2	111.4	189.2
Flowering stage							
Aug. 25-31	36.2	34.8	50.83	Mar. 07-13	40.1	38.5	64.4
Sept. 01-07	36.8	33.0	49.03	Mar. 14-20	48.9	47.0	72.9
Sept. 08-14	43.3	38.8	54.80	Mar. 21-27	49.6	53.9	79.8
Total	116.3	106.6	154.66		138.6	139.4	217.1
Maturity stage							
Sept. 15-21	38.4	34.4	50.45	Apr. 28-03	62.6	57.3	83.2
Sept. 22-28	27.3	24.5	40.53	Apr. 04-10	52.9	47.4	73.3
				Apr. 11-17	57.9	51.9	77.8
Total	65.7	58.9	90.96		173.4	156.6	234.3
Grand total	442.5	410.3	591.40		542.9	510.1	821.0

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Table 1. Rice Kc value (FAO, 1981)

Stage	Days	Kc
A	20	1.10
B	30	1.14
C	35	1.20
D	20	1.12

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OPTIMUM SEED RATE AND METHOD OF SOWING FOR PRE-MONSOON SOWING OF SORGHUM UNDER RAINFED VERTISOLS

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ABSTRACT

Experiments conducted at Agricultural Research Station, Kovilpatti for three years from 1984-1985 to 1986-1987 *Rabi* season indicated that pre-monsoon sowing i.e., two to three weeks before the onset of monsoon (October 15th) by fertiseed drill or *Gorru* or Country plough with a seed rate of 15 kg ha^{-1} have recorded the highest grain and straw yield as it could utilise fully the monsoon and pre-monsoon showers.

KEYWORDS : Seed rate, Sowing method, Time of sowing, Rainfed condition Vertisol