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## EVAPOTRANSPIRATION RATES OF RICE VARIETIES *CULTURE*-20 AND *PATTAMBI*-20 IN A HUMID TROPICAL CLIMATE

1. Rice cultivation on the west coast of India is mainly confined to low land valley areas (Elas) where the crop gets both rainwater as well as sufficient seepage water from uplands for meeting its evapotranspiration. Flooding will be a problem in the month of June and July.

The evapotranspiration rates of rice varieties *Culture*-28 during the first crop period (May-September) and *Pattambi*-20 during the second crop period (September-January) were quantified at Kottamparamba (11° 15′ N, 75° 52′ E & 80 m asl) during 1985-86. The two rice varieties were chosen for the study based on the practices of local farmers.

The study area experiences a humid tropical climate with dry and wet periods from 4 to 8 months. Annual rainfall of the area was 3,300 mm. Air temperatures were 19.9°C-32.6°C and relative humiditv 30-9 %. The windspeeds were below 1.74 kmph and the class A pan evaporation was 3.5-6.2 mm/day. The solar radiation was from 300 and 660 cal $cm^{-2}$ $day^{-1}$.

Soils in the location are oxisols and texturally they are having a sandy loamy in nature. The pH of the soils was 5.2 to 6.4 and they are generally found acidic in nature. The field capacity and permanent wilting point were 25% (at 0.3 bars) and 8% (at 15 bars). The organic carbon and nitrogen contents were very low.

The first crop was transplanted in first week of July and the second crop in first week of October. The spacing of the crop was 15×20 cm and all the agronomic practices were carried out as per the package of practices recommended by the Kerala Agricultural University. The first crop had a duration of 120 days and the second crop 110 days.

The ET of rice was measured using microlysimeters installed in duplicate (Tomar and Toole 1980). These microlysimeters contain a small soil tank, sealed at the lower end and connected to a water reservoir/manometer through flexible tubing. A constant water level is maintained in the microlysimeter with a Mariotte system and water loss from the reservoir/manometer is measured. Its soil tank was made out of GI cylinder of 20 cm inner diameter and 2 mm thickness limiting to soil depth 60 cm. It had a hole 5 cm below the upper rim to be connected to the Mariotte system. The Mariotte system consists of a reservoir-manometer of clear glass tubing (2.62 cm inner diameter) and a bubble glass tubing (0.7 cm outer diameter) was open to atmosphere and the lower one was calibrated with large lysimeters and found suitable even for hourly monitoring of evapotranspiration (Tomar and Toole 1980).

The consumptive use was also calculated according to the Blaney-Criddle method (Doorenbos and Pruitt 1977). Taking the class A pan evaporation and the consumptive use values of Blaney-Criddle as reference crop evapotranspiration, the crop coefficients (ET/reference crop ET) were worked out.

2. The evapotranspiration (ET), class A pan evaporation, consumptive use of water, crop coefficients and effective rainfall (evapotranspiration/rainfall, %) under rice crop at Kottamparamba are presented in Tables 1 and 2. The ET rates were 2.0-5.4 mm/day during the first crop period and 1.6-3.2 mm/day in the second crop period. The peak values were observed after one month from the date of transplanting. For the corresponding period, the class A pan readings were 2.3 - 3.0 mm/day in the second crop period.

The crop coefficients (ET/E pan) in the first and second crop seasons according to pan method were 0.88-1.99 and 0.48-1.64 and according to Blaney-Criddle were 0.22-0.63 and 0.26-0.74. Blaney-Criddle method over estimated, whereas, class A pan gave closer values to the ET of rice.

If the crop coefficients for sowing period are assumed as at the transplanting stage, the seasonal evapotranspiration will be 500 and 450 mm for the first and second crops. The percolation rates of similar sandy loamy soils from rice fields at Chalakudy were reported as 750 and 850 mm during first and second crop seasons (ARS 1984). Since the crop is grown under flooding, the percolation loss per a season will not vary significantly and hence, they are assumed from the previous reports at Chalakudy. Therefore, the total water requirements may be 1250 and 1300 mm for first and second crops. The yield levels were 1650 and 1750 kg/ha and hence the water use efficiency was 3.31-3.9 kg/ha/mm and field water use efficiency was 1.32-1.35 kg/ha/mm.

The percentage of rainfall that has been utilized for meeting ET of the crop (effective rainfall) was between 8 and 100% with a mean values of 33% during first crop period. The water balance equations (rainfall+ soil moisture storage—evapotranspiration-runoff-percolation=0) for the first and second crop seasons were 1164 mm+ 200 mm—500 mm—114 mm—750 mm=0 and 69 mm (+913 mm)+200 mm—332 mm—0 mm—850 mm=0. This shows that the second crop got 913 mm of water through irrigation and from seepage from uplands and the entire rainfall received during the period was effective for meeting its water requirement.

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**TABLE 1**

**Evapotranspiration rates of rice variety *culture*-28 at Peringolam**

| Days after transplanting | Evapotranspiration (mm) | Class A pan evaporation (mm) | Consumptive use Blaney-Criddle (mm) | Crop coefficients | | Rainfall (mm) | Effective rainfall (%) |
|---|---|---|---|---|---|---|---|
| | | | | Pan method | Blaney-Criddle method | | |
| 26-30, July | 14.1 | 16.0 | 64.8 | 0.88 | 0.22 | 167·0 | 8 |
| 31-35 | 20.5 | 16.6 | 63.9 | 1.23 | 0.32 | 175.3 | 12 |
| 36-40 | 23.5 | 17.2 | 64.3 | 1.37 | 0.37 | 134.8 | 17 |
| 41-45 | 26.5 | 17.7 | 64.4 | 1.50 | 0.41 | 99.2 | 27 |
| 46-50 | 21.6 | 19.9 | 63.8 | 1.09 | 0.34 | 32.2 | 67 |
| 51-55 | 23.6 | 18.7 | 61.3 | 1.26 | 0.38 | 36.2 | 65 |
| 56-60, August | 24.5 | 20.5 | 59.9 | 1.20 | 0.41 | 81.0 | 30 |
| 61-65 | 27.5 | 16.6 | 58.9 | 1.66 | 0.47 | 109.6 | 25 |
| 66-70 | 33.0 | 17.4 | 59.8 | 1.89 | 0.55 | 91.0 | 36 |
| 71-75 | 37.5 | 18.8 | 59.7 | 1.99 | 0.63 | 111.8 | 34 |
| 76-80 | 32.8 | 17.7 | 60.2 | 1.85 | 0.54 | 76.7 | 43 |
| 81-85 | 25.4 | 18.1 | 54.2 | 1.40 | 0.47 | 15.2 | 100 |
| 86-90, September | 23.5 | 18.7 | 46.2 | 1.26 | 0.51 | 15.8 | 100 |
| 91-95 | 22.9 | 21.2 | 51.3 | 1.08 | 0.45 | 11.0 | 100 |
| 961-00 | 21.4 | 17.4 | 50.6 | 1.23 | 0.42 | 6.7 | 100 |
| Total | 378.3 | 272.5 | 883.3 | 1.39 | 0.43 | 1163.5 | 33 |

**TABLE 2**

**Evapotranspiration rates of rice variety PTB-20 at Peringolam**

| Days after transplating | Evapotranspiration (mm) | Class A pan evaporation (mm) | Consumptive use Blaney-Criddle (mm) | Crop coefficients | | Rainfall (mm) | Effective rainfall (%) |
|---|---|---|---|---|---|---|---|
| | | | | Pan method | Blaney-Criddle method | | |
| 1-5, Oct | 11.2 | 20.2 | 42.2 | 0.54 | 0.26 | 4.2 | 100 |
| 6-10 | 12.6 | 26.5 | 41.1 | 0.48 | 0.31 | 0.0 | 100 |
| 11-15 | 16.2 | 20.4 | 41.4 | 0.79 | 0.39 | 0.2 | 100 |
| 16-20 | 20.5 | 17.1 | 42.2 | 1.20 | 0.49 | 36.4 | 56 |
| 21-25, Nov | 19.0 | 12.9 | 37.1 | 1.47 | 0.51 | 4.0 | 100 |
| 26-30 | 18.7 | 18.0 | 36.3 | 1.04 | 0.52 | 11.4 | 100 |
| 31-35 | 21.0 | 14.8 | 36.8 | 1.42 | 0.57 | 1.8 | 100 |
| 36-40 | 25.6 | 19.0 | 37.3 | 1.35 | 0.69 | 0.0 | 100 |
| 41-45 | 27.9 | 17.0 | 37.8 | 1.64 | 0.74 | 0.0 | 100 |
| 46-50 | 22.4 | 19.5 | 36.8 | 1.15 | 0.61 | 0.0 | 100 |
| 51-55, Dec | 18.1 | 17.8 | 33.5 | 1.02 | 0.54 | 0.0 | 100 |
| 56-60 | 18.0 | 17.9 | 34.3 | 1.01 | 0.52 | 9.6 | 100 |
| 61- 65 | 15.9 | 14.9 | 33.8 | 1.07 | 0.47 | 1.8 | 100 |
| 66-70 | 17.8 | 18.6 | 34.8 | 0.96 | 0.50 | 0.0 | 100 |
| 71-75 | 16.6 | 19.5 | 33.8 | 0.85 | 0.49 | 0.0 | 100 |
| 76-80 | 18.8 | 20.2 | 33.5 | 0.93 | 0.56 | 0.0 | 100 |
| 81-85, Jan | 14.1 | 18.8 | 32.5 | 0.75 | 0.43 | 0.0 | 100 |
| 86-90 | 17.9 | 20.8 | 33.0 | 0.86 | 0.54 | 0.0 | 100 |
| Total | 332.1 | 333.9 | 658.2 | 0.99 | 0.50 | 69.4 | 100 |

A. S. RAO*
ROY THOMAS
HEMA PRABHA

*Centre for Water Resources Development and Management, Calicut*-673 571.

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*Present address : Division IV, Central Arid Zone Research Institute, Jodhpur-342 003