633.1 : 556.13

EVAPOTRANSPIRATION AND GRAIN YIELD RELATIONSHIPS UNDER PEARL MILLET [*Pennisetum glaucum* (L.) R. Br.] VARIETIES IN TWO ROW DIRECTIONS

1. The need to utilize available water efficiently is ever increasing. Root systems play an important role in the uptake of water by plants. Evapotranspiration combines evaporation from soil surface and transpiration from plant surfaces. Under field conditions since it is difficult to separate evaporation from transpiration, therefore, evapotranspiration is usually related to biomass production instead of transpiration. Field studies have, however, shown to be linearly related to biomass production (Doyle and Fisher 1979, Chakravarty and Sastry 1983) in wheat crop. The present study was carried out under rainfed conditions with different varieties of pearl millet for calculating evapotranspiration and to study the relationship between evapotranspiration and yield.

2. Field experiments were conducted on an alluvial sandy loam soil (Typic Ustoc repts) of the Indian Agricultural Research Institute Farm, New Delhi during kharif seasons, 1992 and 1993. The pearl millet varieties, PUSA-23, HHB-60 and HHB-67, were sown in east-west and north-south rows. The experiment was planned in factorial randomized design with three replications. All agronomic practices were followed for the crop as per package of practices recommended by the Institute. Five plants were uprooted for dry matter at 10 days interval after 20 days of sowing and dried in oven at 80°C till constant weight was obtained. The dried samples were weighed and dry matter per sq m was calculated. Final dry matter and grain yield (q/ha) were recorded at the harvest of the crop.

2.1. Evapotranspiration was calculated by using the Penman combination approach. Actual evapotranspiration was determined by multiplying potential evapotranspiration (PET) by crop coefficient (Kc) (Rao 1992). The evapotranspiration was cumulated for the different growth stages (seedling emergence to panicle initiation, GS-1, panicle initiation to anthesis, GS-2 and anthesis to maturity, GS-3). Water use efficiency was computed as the ratio of grain yield and evapotranspiration. Linear regression analysis was carried out to develop relationship between ET and grain yield.

TABLE 1

Accumulated evapotranspiration (mm) at different stages in pearl millet

Growth stages	PUSA-23	HHB-60	HHB-67
	1992		
GS-1	142.11	150.39	121.92
GS-2	65.25	70.48	63.09
GS-3	139.23	134.82	114.76
Total	346.59	355.70	299.77
	1993		
GS-1	127.93	133.12	107.17
GS-2	77.87	86.40	72.09
GS-3	143.40	138.45	123.90
Total	349.20	357.97	303.16

3. The cumulative evapotranspiration values at different growth stages in pearl millet are presented in Table 1. Among the growth stages, higher ET was observed in GS-3 than other stages except GS-1 during, 1992 season. Less amount of water was lost by crop during GS-2 than GS-3 and GS-1. The total amount of evapotranspiration varied among the varieties during both seasons. The cumulated ET at harvest was 346.6, 355.7 and 299.8 mm in PUSA-23, HHB-60 and HHB-67 respectively during 1992. The corresponding values for the varieties in 1993 were 349.2, 358 and 303.2 mm respectively. Rao *et al.* (1989) recorded the actual ET of pearl millet for whole growing season to the tune of 410 mm at Hisar. The water loss was minimum during both years in HHB-67, this was due to the short duration (64) of this variety as compared to PUSA-23 (73) and HHB-60 (75 days after sowing). Cumulated ET values were comparatively higher during 1993, due to warmer mean temperature of the season, 1993 (29.9°C) than 1992 (28.7°C).

3.1. Water use efficiency (WUE) of different pearl millet varieties during both seasons is presented in Table 2. In general, WUE values observed were higher during second season in comparison to first season. During kharif season of 1992, the average WUE values recorded were 83.9, 88.9 and 91.4 kg grain yield/cm/ha of PUSA-23, HHB-60 and HHB-67 respectively. The corresponding figures were 86.0, 90.0 and 92.0 kg/cm/ha during 1993. The value of WUE was maximum in

TABLE 2

Water use efficiency, yield and harvesting index in different treatments in pearl millet crop

Treatments	Water use efficiency (kg/cm/ha)		Yield (q/ha)		Harvest index (%)	
	1992	1993	1992	1993	1992	1993
Varieties (V)						
PUSA-23	83.85	85.97	29.06	29.98	25.75	25.66
HHB-60	88.90	89.89	31.66	32.01	28.79	28.58
HHB-67	91.42	91.90	27.42	27.84	27.08	27.95
SEm±	0.73	0.59	0.47	0.65	0.19	0.17
CD at 5%	2.23	1.80	1.44	1.99	0.58	0.52
Row directions (D)						
East-West	87.30	88.35	29.16	29.60	27.17	27.33
North-South	88.78	90.16	29.60	30.29	27.24	27.46
SEm±	1.19	0.53	0.39	0.53	0.15	0.14
CD at 5%	NS	1.62	NS	NS	NS	NS
V × D interaction						
SEm±	2.07	1.58	0.66	0.92	0.27	0.24
CD at 5%	NS	NS	NS	NS	NS	NS

HHB-67 and minimum in PUSA-23. This might be because of highest harvesting index and short duration of HHB-67 variety.

3.2. The influence of direction of sowing on WUE was also observed during both seasons. The average values of both seasons of WUE were 87.8 and 89.5 kg/cm/ha in east-west and north-south directions. Steiner (1986) studied the effect of row directions on ET in grain sorghum crop. The WUE of the crop was higher in north-south direction sowing that east-west. This was attributed to maximum grain yield was observed in north-south direction crop as shown in Table 2. Grewal *et al.* (1989) reported higher grain yield in sowing of pearl millet in north-south direction.

3.3. The grain yield (q/ha) was directly related to cumulative ET (mm) for the whole season. The data was pooled for both seasons and following linear relationship was developed.

$$\text{Grain yield} = 8.077 + 0.0644\ \text{ET} \qquad (1)$$

The correlation coefficient was 0.90 which is significant at $P < 0.05$.

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