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Short Communication

Studies on evapotranspiration of gram (*Cicer arietinum*) under different irrigation schedules

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Gram (*Cicer arietinum*) is one of the important *rabi* crop of the Maharashtra state and premier pulse crop of India. In Maharashtra, gram is occupying an area of 9.04 lakh hactare with production of 5.62 lakh ton and productivity of 612 kg ha^{-1}. The low productivity of gram in is mainly due to the fact that, it is grown under receding soil moisture conditions and with very limited or no irrigation. Therefore, critical appraisal is necessary to schedule a limited quantity of irrigation water at critical growth stages of gram for life saving irrigations.

An experiment was carried out during *rabi* season of 1999-2000 in randomized block design with four replications and five irrigation treatments based on cumulative pan evaporation (CPE) values with spacing 30 x 10 cm on the farm of Center of Advanced Studies in Agricultural Meteorology, College of Agriculture, Pune. Vijay variety of gram was dibbled on 3rd December. The gross plot size was 4.5 x 3m and net plot size was 3.3 x 1.8 m. The site was uniform, levelled and well drained with soils clayey in texture.

The soil moisture was taken just before the irrigation with the help of neutron probe. Evapotranspiration (ET) was calculated by the method of Dastane (1970) using weekly soil moisture values. The potential evapotranspiration (PET) was calculated by modified Penman method. The crop coefficient was calculated at different physiological growth stages by taking the ratio of AET to PET.

The mean ET (Table 1) was initially 46.1 mm at 30 DAS, decreased to 38.4 mm at 45 DAS (branching), further decreased to 35.6 mm at 60 DAS (flowering) and then increased to 39.4 mm at 75 Das (pod initiation) and again decreased thereafter up to 28.5 mm at 105 DAS (physiological maturity). These results were consistent with those of Rao and Raikhelkar (1992) in sesamum.

Mean Cumulative ET (Table 1) was 71.2 mm at 45 DAS (branching), 156.6 mm at 75 DAS (pod initiation), 186.2 mm at 90 DAS (pod development) and 214.6 mm at 105 DAS (physiological maturity). At physiological maturity, it was significantly the highest in 100 mm CPE (245.0 mm) treatment in which four irrigation in addition to common irrigation were given and the lowest in control (143.1 mm) treatment.

Table 1 : Cumulative evapotranspiration (mm) at different growth stages of gram as influenced by irrigation treatments.

Treatments	Days after sowing						
	30	45	60	75	90	105	At Harvest
I_1:Irrigation at sowing	44.2	70.2	92.2	113.2	133.2	143.1	151.0
I_2: Irrigation at CGS	45.0	90.5	124.1	170.9	200.4	220.7	230.1
I_3: Irrigation at 100 mm CPE	48.0	92.0	127.0	172.0	205.0	245.0	278.6
I_4: Irrigation at 125 mm CPE	47.0	89.5	122.0	166.0	201.0	234.0	259.0
I_5: Irrigation at 150 mm CPE	46.2	81.2	121.2	161.2	191.2	230.4	250.0
S.E.	0.27	0.29	0.94	0.66	1.28	2.82	7.22
C.D. at 5%	1.05	1.15	2.82	1.98	3.84	8.62	23.84
General mean (cumulative)	46.1	71.2	117.3	156.6	186.2	214.6	233.7
Mean for DAS (mm)	46.1	38.4	35.6	39.4	29.6	28.5	19.1

Table 2 : Relationship between irrigation treatments, ET grain and stover yield of gram.

Treatments	ET (mm)	Grain yield (q ha^{-1})	Stover yield (q ha^{-1}.)
I_1 : Irrigation at sowing	151:00	17.40	22.45
I_2 : Irrigation at CGS	230.10	28.59	33.47
I_3 : Irrigation at 100 mm CPE	278.60	31.99	37.97
I_4 : Irrigation at 125 mm CPE	259.00	29.31	37.70
I_5 : Irrigation at 150 mm CPE	250.00	29.31	35.55
S.E.	7.22	1.51	1.19
C.D. at 5%	23.84	4.65	3.67
General mean	233.70	27.58	32.67

The relationship between ET, grain yield, stover yield and irrigation treatments are shown in Table 2. The total mean evapotranspiration in the life cycle was 233.7 mm, with mean daily value 1.6 mm day^{-1}.

Irrigation applied at 100 mm CPE gave the highest ET (278.6 mm) and also the grain and stover yield viz., 31.99 q ha^{-1} and 37.97 q ha^{-1}, respectively. However, yield was at par with irrigation applied at 125 mm CPE

Table 3 : Crop coefficients at different crop growth stages of gram as affected by different irrigation treatments.

Treatments	Days after sowing					
	30	45	60	75	90	105
I_1 : Irrigation at sowing	0.40	0.48	0.44	0.44	0.40	0.15
I_2 : Irrigation at CGS	0.41	0.82	0.67	0.90	0.60	0.39
I_3 : Irrigation at 100 mm CPE	0.44	0.87	0.70	0.87	0.79	0.63
I_4 : Irrigation at 125 mm CPE	0.42	0.74	0.69	0.85	0.69	0.63
I_5 : Irrigation at 150 mm CPE	0.42	0.64	0.79	0.82	0.78	0.57
General mean	0.42	0.71	0.66	0.78	0.65	0.45

(259.0 mm). The lowest ET, grain yield and stover yield was observed in the treatment with only one irrigation at sowing.

The data regarding the crop coefficients (Kc) at different growth stages of gram are presented in Table 3. Mean Kc values increased initially up to branching to 0.71, which declined to 0.66 at flowering. It again increased to its highest value to 0.78 at pod formation and then decreased thereafter upto maturity. The crop coefficient was the highest 0.90 at 75 DAS (pod initiation) in treatment with irrigation at crop growth stages and the lowest 0.45 in treatment with irrigation at sowing.

REFERENCES

Dastane, N.G., 1970. A practial manual for water use Research in Agriculture, Navbharat Prakashan, Poona -2.

Rao, V.P., and Raikhelkar., S.V., 1992. ET of sesamum in relation to pan evaportion. *Ind. J. Agric. Sci.*, 84 (11) : 768-770.