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WATER USE EFFICIENCY OF BHINDI AS AFFECTED BY IRRIGATION AND SPLIT APPLICATION OF NITROGEN

Nonavailability of water during summer season is one of the major yield constraints in attaining potential productivity in bhindi (*Abelmoschus esculentus* L.). An appropriate irrigation schedule for this crop has not yet been worked out. The agronomic studies on this crop mainly deal with the fertilisation aspect. Studies on the consumptive use, water use efficiency and soil moisture extraction pattern of the crop are meagre. Therefore, the present investigation was undertaken at the Agronomic Research Station, Chalakudy, Kerala from January to March, 1985 to study the effect of water management in relation to split application of nitrogen on the above parameters of bhindi.

The soil was sandy loam in texture, low in available nitrogen and potassium and medium in available phosphorus. The field capacity values in 0-30, 30-60 and 60-90 cm soil layers were 10.40, 10.90 and 11.10 per cent respectively while the corresponding permanent wilting point values were 3.80, 4.10 and 4.50 per cent respectively. The bulk density in these layers was 1.45, 1.47 and 1.41 g/cm^3. The treatments consisting of combinations of five levels of irrigation (daily and irrigation at 30, 45, 60 and 75 mm CPE values) and three split applications of nitrogen (1/2 basal + 1/2 30 DAS, 1/2 basal + 1/4 30 DAS + 1/4 50 DAS, 1/3 basal + 1/3 30 DAS + 1/3 50 DAS) were laid out as a factorial experiment in randomised block design with three replications. The test variety was Pusa Savani and the spacing adopted was 60 cm x 40 cm. Farm yard manure (12 t/ha) was supplied completely as basal to all plots. A uniform dose of 9 kg P_2O_5 and 30 kg K_2O per hectare was applied as superphosphate and muriate of potash respectively as basal.

One pre-sowing irrigation was given to all plots one day prior to sowing with 50 mm depth of water. Sowing was done on 23rd January, 1985. A common irrigation was given to all plots on 6th February at a depth of 50 mm. The evaporation readings from a USWB class 'A' open pan evaporimeter were recorded daily and whenever the cumulative pan evaporation values attained the treatment values, irrigation was given to the concerned plots at a depth of 40 mm of water. In the case of daily irrigation treatment, 3.5 of water was applied per plant.

The results of the study indicated the profound influence of irrigation on water use efficiency and the driest regime (75 mm CPE) recorded the maximum value as evident from Table 1. Water use efficiency is likely to increase with decrease in soil moisture supply until it reaches the minimum critical level because the plants may try to economise water loss in the range from minimum critical to optimum soil moisture level. Frequent irrigation (30 mm CPE) registered lowest value as water above the optimum level may be lost in the form of excessive evaporation, transpiration or deep percolation. These findings are in agreement with that of Singh and Singh (1979).

Split application of nitrogen or its interaction with irrigation did not appreciably influence water use efficiency.

It is clear from Table 2 that consumptive use increased with increase in

Table 1. Yield of fruits (kg/ha), consumptive use (mm) and crop water use efficiency (kg ha/mm) as affected by irrigation ana split application of nitrogen

Treatment	Yield of fruits	Consumptive use	Crop water use efficiency
Irrigation			
I_1 (Daily)	13929	-	-
I_2 (30 mm CPE)	10881	229.50	47.41
I_3 (45 mm CPE)	9702	143.41	67.65
I_4 (60 mm CPE)	7667	109.08	70.29
I_5 (75 mm CPE)	7238	80.80	89.58
Split application of nitrogen			
S_1 (1/2 1/2)	10905	140.62	77.55
S_2 (1/2+1/4+1/4)	9893	142.33	69.51
S_3 (1/3+1/3+1/3)	9417	139.18	67.66
CD 0.05 (1)	16.39		7.125
CD 0.05 (S)	NS		NS

Table 2. Consumptive use of water and pan evaporation values during growth period as influenced by irigation as split application of nitrogen

Treatments	Total water applied during the period of irrigation (mm)	Total consumtive use (mm)	Average consumtive use (mm/d) ET	Total CPE (mm)	Average pan evaporation (mm/d) EO	$\frac{ET}{EO}$
Irrigation						
12	330.00	229.50	4.781	224.50	4.989	0.958
b	210.00	143.41	2.987	224.50	4.989	0.599
I_4	170.00	109.08	2.270	224.50	4.989	0.455
I_5	130.00	80.80	1.683	224.50	4.989	0.337
Split application of nitrogen						
S_1	266.00	140.62	2.929	224.50	4.989	0.587
S_2	' 266.00	142.33	2.965	224.50	4.989	0.594
S_3	266.00	139.18	2.900	224.50	4.989	0.581

Table 3. Soil moisture depletion pattern (per cent) as influenced by irrigation and split application of nitrogen

Treatment	Soil depth (cm)		
	0-30	30-60	60-90
Irrigation			
I_2	71.56	20.63	7.81
I_3	69.83	21.34	8.83
I_4	67.38	22.83	9.79
I_5	65.33	23.68	10.93
Mean	68.53	22.12	9.35
Split application of nitrogen			
S_1	68.56	22.14	9.36
S_2	68.54	22.10	9.38
S_3	68.50	22.12	9.32
Mean	68.53	22.12	9.35

the frequency of irrigation. Frequent wetting of the soil surface and root zone resulted in a higher evapotranspiration loss. The maximum consumptive use was recorded by irrigation at 30 mm CPE (229.50 mm) which produced the maximum dry matter. The ratio ET/EO increased with increase in irrigation frequency and 30 mm CPE recorded the maximum value.

With regard to split application of nitrogen there was no appreciable variation among the treatments.

At 0-30 cm soil depth, the percentage depletion of moisture decreased with increase in moisture stress (Table 3). On the other hand at 30-60 and 60-90 cm depths, it increased with moisture stress. On an average 68.53, 22.12 and 9.35 per cent of moisture was extracted from 0-30, 30-60 and 60-90 cm soil depth respectively. The non-availability of water in the surface layers of the soil might have caused the roots to penetrate deeper resulting in higher moisture extraction from deeper layers of soil. Black (1973) has pointed out that root grows and forages deeper into the soil in search of water when the moisture supply is not adequate in the surface. This is in conformity with the findings of Giles and Alexander (1950) in tomato.

Split application of nitrogen did not appreciably influence the moisture depletion.

College of Agriculture
Vellayani 695 522, Kerala, India

V. Jayakrishnakumar
G.R. Pillai*

**Present address:* Kerala Agricultural University, Vellanikkara 680 654, Trichur, India

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