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YIELD AND YIELD ATTRIBUTES OF BHINDI AS INFLUENCED BY IRRIGATION SCHEDULES AND SPLIT APPLICATION OF NITROGEN

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Cultivation of bhindi (*Abelmoschus esculentus* L.) in summer rice fallows has become rumunerative and gaining popularity among the farmers of Kerala. Scarcity of water is the major yield constraint in attaining higher yields of this crop during summer. Information regarding the irrigation requirement and time of application of nitrogen of bhindi is scanty. Sharrna and Prasad (1973) reported higher and profitable yields by adopting proper water management practices. Use of various inputs especially fertilizers in combination with irrigation water is necessary for optimum production. In the package of practices of the Kerala Agricultural University (1982), a fertilizer dose of EO kg N per hectare applied as ammonium sulphate in two equal splits (1/2 at sowing and 1/2 30 DAS) has been recommended besides 9 kg of P_2O_5 and 30 kg of K_2O per hectare applied as single superphosphate and muriate of potash respectively completely as basal. However, farmers are applying nitrogen in more number of splits. With the above background the present investigation was undertaken to study the effect of water management practices in relation to split application of nitrogen on yield attributes and yield of bhindi.

Materials and Methods

The experiment was conducted in the sandy loam soil of the Agronomic Research Station, Chalakudy from January to March 1985. The soil was sandy, mixed, isohyperthermic, aquic ustifluents according to soil taxonomy. The soil was sandy loam in texture and low in organic carbon, available nitrogen and available potassium, but medium in available phosphorus. The field capacity, permanent wilting point and bulk density values were 10.40 per cent, 3.80 per cent and 1.45 g/cm^3 respectively in the surface 0-30 cm soil layer. The ground water table of the experimental area fluctuated between 86 cm and 152 cm from the ground surface during the crop period. The treatments consisting of combinations of five levels of irrigation (daily and irrigation at 30, 45, 60 and 75 mm CPE) 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 spacing adopted was 60 cm x 40 cm. Farm yard manure (12 t/ha) was applied uniformly to all plots as basal. A uniform dose of 9 kg P_2O_5 and 30 kg K_2O per hectare was applied as single superphosphate and muriate of potash respectively as basal. Nitrogen was applied as urea (109 kg/ha) in split doses as per the treatment.

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One presowing irrigation was given to the field one day prior to sowing with 50 mm depth of water. Sowing was done on 23rd January 1985. A common irrigation was also given to all plots on 6th February with 50 mm depth of water. Subsequent irrigations to treatments based on cumulative pan evaporation values were given at a depth of 40 mm. In the case of daily irrigation treatment, 3.5 l of water per plant was applied. The details of irrigation are furnished in Table 1.

Results and Discussion

Yield attributes

From Table 2, it can be seen that the yield attributes viz., number of fruits per plant, length of fruit, dry weight of fruit and girth of fruit were significantly influenced by frequent irrigation (daily and irrigation at 30 mm CPE). Daily irrigation and irrigation at 30 mm CPE increased the number of fruits by 88.40 per cent and 41.88 per cent respectively and the length of fruits by 39.52 per cent and 20.77 per cent respectively over irrigation at 75 mm CPE. The girth of fruit was highest with irrigation at 30 mm CPE. The increase in dry weight of fruits due to daily irrigation and irrigation at 30 mm CPE over 75 mm CPE was 97.98 and 55.94 per cent, respectively. Split application of nitrogen with 50 per cent as basal also favourably influenced the yield attributes except girth.

The number, length and dry weight of fruits were positively and significantly influenced by application of 50 per cent nitrogen as basal and 50 per cent 30 days after sowing. This is in agreement with the findings of Wing and Rajkomar (1982) in bhindi.

Fruit yield

The higher fruit yield in the treatment receiving frequent irrigation is attributed to the increased number, length and dry weight of fruits. The fruit yield increased with a decrease in irrigation interval and daily irrigation recorded a significantly higher yield over the other schedules. Irrigation at 30 mm and 45mm CPE values were on par. Daily irrigation and irrigation at 30 mm CPE enhanced the yield to the extent of 92.44 per cent and 50.33 per cent respectively over 75 mm CPE. Kaufman (1972) reported that in cucumbers, soil wetness increased the fruit number.

Though not significant, the trend in fruit yield due to split application of nitrogen was in favour of the treatment receiving 50 per cent nitrogen as basal and the remaining 50 per cent 30 days after sowing. This is in agreement with the findings of Wing and Rajkomar (1982) in bhindi.

Dry matter production

The dry matter production at the 40th and the 55th day after sowing was significantly influenced by frequent irrigation (daily and at 30 mm CPE). Daily irrigation recorded 220.45 per cent and 108.73 per cent increase over irrigation at

Table 1
Details of irrigation

Sl. No. of irrigation	Daily	30 mm	45 mm	60 mm	75 mm
	14-2-85 to 23-3-85				
]		14-2-85	17-2-85	21-2-85	25-2-85
2		21-2-85	27-2-85	6-3-85	12-3-85
3		28-2-85	9-3-85	18-3-85	
4		6-3-85	17-3-85		
5		13-3-85			
6		18-3-85			
7		24-3-85			
Total number of irrigations	38	1	4	3	2
Quantity of water applied (mm)	494	280	160	120	80
Pre-sowing irrigation (mm)	50	50	50	50	50
Common irrigation (mm)	50	50	50	50	50
Rainfall (mm)	0.4	0.4	0.4	0.4	0.4
Total quantity of water applied (mm)	594.4	380.4	260.4	220.4	180.4

75 mm CPE at 40th and 55th day respectively (Table 3). The production of dry matter is influenced more by moisture supply than by nutrients. The favourable influence of frequent irrigation on dry matter production may be due to the optimum moisture condition at the stage coinciding with the active vegetative phase of the crop (Cummin and Kretchman, 1974).

Split application of nitrogen influenced the dry matter production only at the 40th day after sowing. Application of nitrogen in two equal splits with 50 per cent as basal enhanced the early vegetative growth as evident from dry matter production.

Field water use efficiency

Irrigation significantly influenced water use efficiency and the driest regime (75 mm CPE) recorded the maximum value as evident from Table 4. 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. Daily irrigation registered the 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).

Table 2

Effect of irrigation and split application of nitrogen on mean number of fruits per plant, length of fruit (cm), girth of fruit (cm), dry weight of fruits (g) and yield of fruits (t/ha)

Treatment	Number of fruit	Length of fruit	Girth of fruit	Dry wt. of 10 fruits	Yield of fruits
Irrigation					
I_1 (Daily)	12.34	14.51	6.23	18.65	13.93
I_2 (30 mm CPE)	9.30	12.56	6.59	14.69	10.88
I_3 (45 mm CPE)	9.08	12.34	6.52	14.68	9.70
I_4 (60 mm CPE)	6.48	11.72	6.46	9.43	7.67
I_5 (75 mm CPE)	6.55	10.40	6.31	9.42	7.24
Split application of nitrogen					
S_1 (1/2 + 1/2)	9.32	12.69	6.57	13.96	10.91
S_2 (1/2 + 1/4 + 1/4)	8.35	12.29	6.52	13.09	9.89
S_3 (1/3+1/3+1/3)	8.58	12.01	6.42	13.08	9.42
CD 0.05 (I)	0.707	0.611	0.214	0.595	1.64
CD 0.05 (S)	0.547	0.474	NS	0.461	NS

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

Table 3

Effact of irrigation and split application of nitrogen on dry matter production (g/plant) at different stages of growth

Treatment	Dry matter production		
	25th day	40th day	55th day
Irrigation			
I_1 (Daily)	4.41	19.74	28.22
I_2 (30 mm CPE)	4.32	16.05	25.00
I_3 (45 mm CPE)	4.49	8.98	18.43
I_4 (60 mm CPE)	4.53	8.60	14.91
I_5 (75 mm CPE)	4.32	6.16	13,52
Split application of nitrogen			
S_1 (1/2 + 1/2)	4.42	14.02	20.84
S_2 (1/2 + 1/4 + 1/4)	4.41	12.11	20.65
S_3 (1/3 + 1/3 + 1/3)	4.41	9.60	18.59
CD 0.05 (I)	NS	1.165	3.967
CD 0,05 (S)	NS	0.902	NS

Table 4

Field water use efficiency of bhindi (kg ha/mm) as affected by irrigation and split application of nitrogen

Treatment	Water use efficiency
Irrigation	
I_1 (Daily)	25.14
I_2 (30 mm CPE)	28.63
I_3 (45 mm CPE)	37.32
I_4 (60 mm CPE)	34.84
I_5 (75 mm CPE)	40.18
Split application of nitrogen	
S_1 (1/2 + 1/2)	36.87
S_2 (1/2 + 1/4 + 1/4)	33.51
S_3 (1/3 + 1/3 + 1/3)	31.55
CD 0.05 (I)	6.194
CD 0.05 (S)	NS

Summary

Studies conducted at the Agronomic Research Station, Chalakudy revealed that yield attributes and yield of bhindi raised in summer rice fallows were favourably influenced by frequent irrigation. Daily irrigation was found to be the best treatment. Though not significant, application of nitrogen in 2 equal splits with 50 per cent as basal and 50 per cent 30 days after sowing favourably influenced yield attributes and yield. The study also revealed that field water use efficiency was higher in less frequently irrigated plots.

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