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Response of *Rabi* Pigeonpea to Irrigation Scheduling in Northern Transitional Tract of Karnataka*

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ABSTRACT

An experiment on *rabi* pigeonpea was conducted during 1981-82 with six irrigation schedules and three genotypes. Irrigation at 0.6 IW / CPE with 5-6 irrigations recorded significantly higher grain yield (1158 kg/ha) than treatments receiving two irrigations either at critical stages (747 kg/ha) or at 0.3 IW / CPE (827 kg/ha). Increasing number of irrigations to 9-10 (50% ASM or 0.9 IW/CPE) produced non-significant increase in yield over 0.6 IW/CPE. Rainfed treatment recorded the lowest grain yield of 442 kg/ha. Genotypes did not differ significantly in their yielding ability. Total consumptive use of water varied proportionately with number of irrigations recording highest consumptive use when irrigations were given at 50% ASM (681.1 mm) and the lowest with rainfed (159.9 mm). Among genotypes, C-11 recorded higher consumptive use of water (451.4 mm) than RG-21 (433.5 mm) or T-21 (411.7 mm).

In Karnataka, where pigeonpea is sown during rainy season, which puts up profuse vegetative growth at the cost of reproductive growth resulting in low productivity. However, its performance during post-rainy season needs to be evaluated. Moreover, with the increased irrigation facility on completion of Upper Krishna Project the pigeonpea area in northern Karnataka is increasing. The effective irrigation schedules particularly for post-rainy season crop also needs to be identified as the crop is sensitive to waterlogging conditions in the seedling and flowering stages. An experiment was, therefore, carried out to study suitable method of irrigation scheduling and the performance of pigeonpea genotypes during post-rainy season (*rabi*).

MATERIAL AND METHODS

The experiment was conducted at Agricultural College Farm, Dharwad on black clay loam soil with 7.6 pH during *rabi*, 1981-82. A total of 50.1mm

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rainfall was received during cropping period. The mean maximum and minimum temperatures varied from 23.2 to 36.9 and 13.6 to 20.9°C, respectively. The daily evaporation from USWB class A pan ranged from 1.3 to 7.9 mm. The treatments consisted of six irrigation levels (irrigation at critical stages, 50% available soil moisture, 0.3, 0.6 and 0.9 IW/CPE and rainfed) and three genotypes (T-21, C-11 and RG-21), being main plot and sub plot treatments, respectively, laid out in split plot design with three replications. Of the three genotypes, T-21 was early type and the other two were of medium duration. The seeds were sown 40 cm × 10 cm spacing in a plot of 5.0 m × 3.2 m. A fertilizer dose of 27 and 69 kg/ha N and P_2O_5, respectively, was applied at sowing. Two common irrigations of 30 mm depth each were given during sowing. Scheduling of irrigation was initiated from four days after sowing. For irrigation at critical stages (pre-flowering and pod filling), the moisture deficit in 0 to 90 cm soil depth was made up while for irrigation at 50 per cent available soil moisture (ASM) the top 0 to 60 cm soil was brought to field capacity when the ASM in soil reached 50 per cent. In IW/CPE method of scheduling, irrigation was followed when particular ratio reached and at each irrigation 60 mm depth of water was applied. Irrigations were withdrawn when crop reached physiological maturity. Observations on growth, yield and soil moisture parameters were recorded periodically and analysed.

RESULTS AND DISCUSSION

Effect of irrigation schedules : Different irrigation schedules exerted significant influence on grain yield (Table 1). Irrigation at 0.6 IW/CPE with 5-6 irrigations (300-360 mm) produced a grain yield of 1158 kg/ha which was on par with the yields obtained with 9-10 irrigations (1278 and 1191 kg/ha with irrigation at 0.9 IW/CPE and 50% ASM, respectively). Higher yield in these treatments was due to increased grain weight/plant, test weight and number of grains/plant. Similar observations were made at ICRISAT (Anon., 1980 a). The lowest yield of 442 kg/ha was obtained with rainfed treatment due to moisture stress at all stages of growth and development which hastened maturity (Kramer, 1959). The frequently irrigated plots, compared to less frequently irrigated plots recorded more height and delayed flowering. However, the grain to pod ratio and harvest index (high and ranged between 0.41 to 0.56) were not influenced significantly due to various irrigation levels.

Moisture depletion from the top layers (0 to 30 cm depth) was higher in frequently irrigated plots (50% ASM, 0.6 and 0.9 IW / CPE) than in less frequently irrigated treatments and rainfed (Table 2), which was in accordance with the results obtained at Navasari (Anon., 1980 b). Unlike in frequently irrigated plots, in less frequently irrigated treatments the roots could go deep into soil in search of moisture and hence more depletion has taken place from 60-90 cm layer. Higher per cent age of depletion was in 30-60 cm layer in all the treatments as this layer is considered to be an effective root zone, The total consumptive use of water varied proportionately with number of irrigations

Table 1. Influence of irrigation levels and genotypes on the growth and yield attributes of *rabi* pigeonpea

Treatment	Plant height (cm)	Days to 50% flowering	Grain to pod ratio	Number of grains / plant	100 grain weight (g)	Grain weight (g/plant)	Grain yield (kg/ha)	Harvest index
Irrigation levels								
I_0 – Rainfed	51.0	72.0	0.64	56.2	5.8	2.9	442	0.41
I_1 – Irrigation at critical stages	56.8	72.7	0.84	68.0	6.9	6.2	747	0.54
I_2 – Irrigation at 50% ASM	82.4	78.0	0.77	124.1	7.5	10.6	1191	0.46
I_3 – Irrigation at 0.3 IW/CPE	54.7	78.8	0.80	74.8	6.7	5.9	827	0.54
I_4 – Irrigation at 0.6 IW/CPE	71.6	77.9	0.74	124.8	7.2	10.9	1158	0.46
I_5 – Irrigation at 0.9 IW/CPE	78.8	77.6	0.83	98.8	7.8	11.0	1278	0.56
S.Em. ±	1.9	0.5	0.05	6.7	0.2	0.4	75	0.03
C.D. at 5%	6.1	1.5	N.S.	20.9	0.5	1.1	238	N.S.
Genotypes								
V_1 – T_{21}	69.9	72.3	0.79	92.3	6.7	7.5	939	0.53
V_2 – C-11	72.5	77.4	0.74	98.2	7.4	7.9	972	0.45
V_3 – RG-21	59.9	75.7	0.78	98.8	6.8	7.4	913	0.48
S.Em. ±	0.9	0.3	0.09	6.1	0.2	0.3	46	0.02
C.D. at 5%	2.7	1.0	N.S.	N.S.	0.5	N.S.	N.S.	0.07

N.S. – Not significant.

Table 2. Influence of irrigation level and genotypes on the moisture depletion pattern, total consumptive use and water use efficiency in *rabi* pigeonpea.

Treatment	Moisture depletion (%) at different depths (cm)				Total consumptive use (mm)	Water use efficiency (kg/ha mm)	Number of irrigations	Irrigation interval (days)
	0–15	15–30	30–60	60–90				
Irrigation levels								
I_0 – Rainfed	15.6	18.5	33.9	30.0	154.9	2.85	—	—
I_1 – Irrigation at critical stages	17.9	20.3	33.7	28.0	358.2	2.09	2	42
I_2 – Irrigation at 50% IW/CPE	22.0	24.6	36.4	16.9	681.1	1.74	9–10*	12
I_3 – Irrigation at 0.3 IW/CPE	17.7	21.2	34.6	26.5	291.1	2.84	2	44
I_4 – Irrigation at 0.6 IW/CPE	22.2	24.7	33.2	19.9	474.9	2.45	5-6*	20
I_5 – Irrigation at 0.9 IW/CPE	22.5	24.2	37.6	15.6	632.8	2.02	8-9*	13
Genotypes								
V_1 - T - 21	20.3	23.5	34.8	21.4	411.7	2.40		
V_2 - C - 11	20.5	21.7	35.5	23.0	451.4	2.29		
V_3 - RG - 21	19.2	21.9	34.8	24.0	433.5	2.30		

* Irrigation to C - 11 and RG - 21 only

and quantity of water supplied at each irrigation. The treatments receiving irrigation at 50% ASM recorded highest consumptive use of water (681.1 mm) while the lowest was recorded in rainfed (159.9 mm). Water use efficiency was inversely proportional to quantity of water used. Thus, the rainfed and 50% ASM treatments recorded highest (2.85 kg/ha mm) and lowest (1.74 kg/mm) water use efficiencies, respectivly.

Effect of Genotypes : The cultivars did not differ significantly among themselves in grain yield (937, 972 and 913 kg/ha with T-21, C-11 and RG-21, respectively). This is due to non-significant differences in grain weight and number of grains/plant and grains to pod ratio. Similar observation was made by Venkataraman and Green (1979) with C-11 and T-21. Genotypes, however, differed significantly in harvest index and 100-grain weight and the early type T-21 recorded highest harvest index (0.53) and it also flowered earlier (72 days) than other two genotypes. Though C-11 and RC-21 were both medium duration cultivars, RG-21 flowered earlier than C-11. Among the three genotypes, C-11 produced more height (72.5 cm).

Among the three genotypes, C-11 recorded the highest total consumptive use (451.4 mm) of water followed by RG-21 (433.5 mm) and the lowest was in T-21 (411.7 mm). This difference arose because of difference in quantity of water applied to each genotypes. The cultivars, received one extra irrigation at 121 days after commencement of irrigation scheduling with 60 mm water while early variety T-21 had matured by that time. The difference between C-11 and RG-21 might be due to more vegetative growth of C-11 which might have required more water for its transpiration needs. Correspondingly the water use efficiency was higher in T-21 (2.40 kg/ha mm) than in C-11 (2.29 kg/ha mm) or RG-21 (2.30 kg/ha mm).

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