

IRRIGATION AND PLANT DENSITY REQUIREMENTS FOR OPTIMUM YIELDS OF RED GRAM

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A field experiment was conducted at Agricultural Research Institute, Rajendranagar, Hyderabad during *Rabi* seasons of 1978-79 and 1979-80 in vertisols holding a quantity of 250 to 300 mm moisture/m depth of soil, to find out the optimum number of irrigations and plant density for *rabi* redgram. The results has shown that seed yield and yield components except seed weight were not significantly affected by irrigation treatments. However, when two irrigations were given at 75 and 105 days after sowing, maximum seed yield of 2133 and 2139 kg/ha was recorded during 1978-79 and 1979-80 respectively. This showed an increase of 19 and 14% over no irrigation during 1978-79 and 1979-80 respectively. Among the plant densities, 1.11 lakhs/ha (45 X 20 cm) was found to be optimum in view of its wider row spacing which permits growing of short statured inter crop besides its high yield. There is no interaction between irrigation levels and plant densities for any of the characters studied. Thus it can be seen that a plant density of 1.11 lakhs/ha with a spacing of 45 X 20 cm is optimum for getting good yields of *rabi* redgram in vertisols.

Redgram is an important grain legume grown widely in India. It has high protein content (about 20%) and contain some aminoacids not found in cereals. When combined with rice, sorghum, millet or wheat, it provides an adequate balanced protein calorie diet. Despite its dietary importance, yields are low (around 600 kg/ha) and the crop is mainly grown in the dry farming areas under precarious soil moisture conditions and without much fertilizer application in *Kharif* season. In areas where the annual rainfall is more than 700 mm, the moisture stored in vertisols during the rainy season is not fully exploited in *rabi* season. About 40 per cent of the available water in 30 to 180 cm section of the soil remain unutilised by the crops (ICRISAT, 1977). Rajah *et al* (1978)

has indicated the advantage of growing two crops in sequence over single crop or two crops in intercropping at Tindivanam (Tamilnadu). Narayanan and Sheldrake (1979) recorded the highest seed yield of 17.1 q/ha from C₁₁ variety of redgram during *rabi* season. The yield from other varieties ranged between 10.7 to 14.9 q/ha. Jain and Ramasubba Reddy (1981) has compared the performance of different crops grown on residual moisture in vertisols during *rabi* season and concluded that redgram has given the highest seed yield and monetary returns. Thus an experiment was designed to find out the irrigation and plant density requirements for getting optimum yields of *rabi* redgram.

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MATERIALS AND METHODS

A field experiment was conducted at Agricultural Research Institute, Rajendranagar, Hyderabad during the

Main plots (Irrigations)

- I₀ — No irrigation
- I₁ — one irrigation at 75 days after sowing
- I₂ — two irrigations at 75 and 105 days after sowing

A light irrigation (4 cm) was given to all the treatments immediately after sowing during both the years to establish good stand. There was a total rainfall of 22.1 mm and 41.1 mm during crop growth period of 1978-79 and 1979-80 respec-

tively. The soil was deep clay loam with a pH of 8.2, medium in available nitrogen (278 kg/ha), low in P₂O₅ (17.4 kg/ha) and high in K₂O (438 kg/ha). The moisture retention characteristics of soil profile are as under

Sub-plots (Plant densities)

- S₁ — 30 X 10 cm (3.33 lakh plants/ha)
- S₂ — 30 X 20 cm (1.66 lakh plants/ha)
- S₃ — 45 X 10 cm (2.22 lakh plants/ha)
- S₄ — 45 X 20 cm (1.11 lakh plants/ha)
- S₅ — 60 X 10 cm (1.66 lakh plants/ha)
- S₆ — 60 X 20 cm (0.83 lakh plants/ha)

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Soil moisture characteristics	Soil depth (cm)			
	0-15	15-30	30-60	60-100
Field capacity (1/3 atm)	33.7	35.0	32.7	33.3
Wilting point (15 atm)	12.2	14.1	14.0	13.8
Percent available water	21.5	20.9	18.7	19.5
Water available capacity (mm)	46.8	45.5	78.8	113.

Total available water holding capacity is 284 mm/m.

The average moisture content of the soil was determined (thermo-gravimetric) by taking samples from four

different sites in the experimental field after sowing. The data are presented below :

Soil depth in cm	1978-79		1979-1980	
	Percent	mm	Percent	mm
0-15	30.4	40	31.8	42
15-30	31.9	39	30.7	36
30-60	30.4	71	30.2	71
60-100	28.9	88	30.1	95
		238		244

A basal dose of 100 kg DAP/ha was applied uniformly to all the plots. The variety used was C₁₁. The crop was sown on 11-11-1978 and 30-10-1978 and harvested on 2-4-1979 and 20-3-1980 during 1978-79 and 1979-80 respectively. The duration of the crop was 142 and 140 days during 1978-79 and 1979-80 respectively.

RESULTS AND DISCUSSION

The data on seed yield and yield attributes are presented in Table-1. The seed yield and yield attributes except seed weight were not significantly influenced by the irrigation treatments. The root studies conducted at the time of harvest indicated that the roots of redgram entered deep into the soil (115 cm) which was still wet and may be extracting the moisture from this zone. The total available water in the soil was 238 mm during the year 1978-79 and 244 mm during 1979-80. Further there was a rainfall of 22.1 mm during 1978-79 and 41.1 mm during 1979-80. Thus redgram crop which could extract water from one meter depth of soil had an available water of more than 250 mm. The evaporative demand measured as total cumulative pan evaporation during the crop growth period was 790 mm during the first year and 779 mm during the second year. The water available for the crop during the season was more than 35% of the evaporative demand which was higher than the moisture availability index (MAI) threshold value of 0.33 suggested by Hargreaves (1972) for dry crops. Thus the redgram crop even under no irrigation has hardly experienced any drought and perhaps

this might be the reason for non-significant yield differences due to irrigation treatments. However I₁ has recorded the highest seed yield of 2133 and 2139 kg/ha, followed by I₂ (2050 and 2077 kg/ha) and I₃ (1790 and 1874 kg/ha) during 1978-79 and 1979-80 respectively. Similar trend was observed in other yield contributing characters also.

Differences in seed yield and yield components were significant due to plant densities. The highest seed yield of 2221 and 2440 kg/ha was recorded with 3.33 lakhs/ha (S₁) and the lowest seed yield (1766 and 1625 kg/ha) was observed with 0.83 lakhs/ha (S₆) during 1978-79 and 1979-80 respectively. The treatment S₁ was significantly superior over S₂, S₃ and S₆ but was on par with S₄ and S₅ plant densities in 1978-79 while during 1979-80 S₁ was significantly superior over S₂, S₃ and S₆ plant densities but on par with S₄ and S₅ plant densities thus suggesting that the yields of *rabi* redgram were optimum with a population range of 1.11 to 2.22 lakhs/ha. However a spacing of 45 X 20 cm with a plant density of 1.11 lakhs/ha seems to be congenial since it permits growing of short statured intercrop. For all other yield contributing factors, S₆ has recorded the highest values and S₁ has recorded the lowest values. Thus the highest seed yield obtained in S₁ can be explained based on its highest population i.e. 400% population over S₆ population.

There is no significant interaction between irrigation and plant densities for any of the characters studied indicating that irrigations does not have

any effect on yield components of redgram when raised at different spacings

Table 1: Yield and yield attributes of rabi redgram in relation to irrigation and plant densities.

Treatments	No. of branches/ plant		No. of pods/ plant		No. of grains/ plant		1000 seed weight (g)		Seed yield (Kg/ha)	
	I	II	I	II	I	II	I	II	I	II
Irrigation levels										
I ₀	7.44	7.52	61.40	66.17	156	166	94.04	93.08	1790	1874
I ₁	7.72	7.95	65.68	69.25	165	173	97.77	94.68	2050	2077
I ₂	7.80	8.21	69.45	71.61	170	178	99.33	95.19	2133	2139
'F' test	NS	NS	NS	NS	NS	NS	Sig	Sig	NS	NS
SEM ±	0.17	0.22	2.74	2.13	3.84	5.46	0.68	0.42	131	67
C.D. at 5%	—	—	—	—	—	—	2.36	1.46	—	—
Plant densities										
S ₁	6.43	6.64	40.56	43.15	86	88	93.76	90.12	2221	2440
S ₂	7.28	7.19	64.67	62.30	146	152	95.73	92.79	1846	2181
S ₃	7.26	7.50	52.76	53.60	127	133	96.52	93.40	1993	2201
S ₄	8.34	8.32	78.80	83.03	208	220	97.96	94.72	2084	2014
S ₅	7.57	8.44	59.12	67.02	160	175	98.56	96.86	1831	1718
S ₆	9.05	9.27	97.07	104.98	254	268	99.72	98.12	1766	1625
'F' test	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig
SEM ±	0.25	0.20	2.05	3.39	4.81	7.96	0.53	0.56	103	94
C.D. at 5%	0.71	0.58	5.84	9.65	13.71	23.00	1.51	1.59	295	270
I X S										
'F' Test	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

I Rabi 1978-79 and II Rabi 1979-80.

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