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Effect of sowing dates and planting geometry on yield of redgram (*Cajanus cajan*) in rainfed vertisols

V.K. PAULPANDI, U. SOLAIAPPAN, S. SENTHIVEL, N. CHELLIAH AND R. BALASUBRAMANIAN
Dept. of Agronomy, Agrl. College & Research Institute, Tamil Nadu Agrl. University, Madurai - 625 104.

Abstract : Field experiments were conducted during *rabi* season of 1995 to 1998 at Regional Research Station, Aurppukottai, to find out the optimum time of sowing and plant population for short duration redgram in rainfed vertisols. September first fortnight sowing recorded highest mean grain yield (812 kg ha^{-1}), gross income (Rs. 12985 ha^{-1}) and benefit cost ratio (3.48). Plant population level @ 4.0 lakhs ha^{-1} (25 x 10 cm) had registered higher grain yield (390 kg ha^{-1}) and gross income (Rs. 6224/-).

Key words: Redgram, Sowing date, Planting geometry.

Introduction

Pigeonpea is an important pulse crop grown during *rabi* season coinciding with the north east monsoon in rainfed vertisols in southern districts of Tamil Nadu. The productivity of pigeonpea is very low (500 kg ha^{-1}) in rainfed condition. Sowing of the crop at appropriate time and optimum plant population are considered to be the most important factors for increasing the pigeonpea yield under rainfed condition. Ahuja (1984) reported that new plant types possess substantially different growth pattern and are sensitive to planting geometry. Ali (1987) reported that pigeonpea suffered more yield loss when planting was delayed. Hence, the present study was undertaken to find out optimum time of sowing and plant population for sort duration redgram (ARG 102) in rainfed situation.

Materials and Methods

Field experiments were conducted during *rabi* season of 1995, 1996 and 1997 at Regional Research Station, Aruppukottai to study the optimum time of sowing and plant population for short duration redgram ARG-102 under rainfed condition. Treatment combinations comprised of four sowing times *viz.* September first fortnight; September second fortnight, October first fortnight and October second fortnight in mainplots and four plant population levels *viz.* 2.5 (40 x 10 cm), 3.3 (30 x 10 cm), 4.0 (25 x 10 cm) and 5.0 (20 x 10 cm) lakh plants ha^{-1} in sub-plots. The experiment was laid out in a split plot design with three replications. The soil was clay loam with a pH of 8.0 and having available nitrogen, phosphorus and potassium at 147.7, 11.0 and 542.2 kg ha^{-1}, respectively. Redgram culture ARG 102 was used as test crop. It is a determinate type, maturing in 90-100 days. The recommended management practices were followed uniformly for all the treatments. A total rainfall of 269.9, 632.7 and 679.8 mm were received during the crop season of 1995-96, 1996-97 and 1997-98, respectively (Table 1).

Table 1. Rainfall received during the crop period (mm)

S.No.	Time of sowing	1995-96		1996-97		1997-98	
		RF	RD	RF	RD	RF	RD
1.	September first fortnight	245.7	21	589.3	30	663.4	49
2.	September second fortnight	237.0	19	561.0	27	657.7	49
3.	October first fortnight	173.6	16	592.8	24	625.5	46
4.	October second fortnight	119.0	11	355.0	18	523.7	40

RF - Rainfall ; RD - Rainy days

Table 2. Yield components and grain yield as influenced by the time of sowing and plant population levels (1995-96 to 1997-98)

Treatment details	No. of pods / plant				No.of seeds/pod				100 grain weight (g)				Grain yield (kg ha^{-1})			
	1996	1997	1998	Mean	1996	1997	1998	Mean	1996	1997	1998	Mean	1996	1997	1998	Mean
A. Time of sowing																
Sep. first fortnight	26.4	37.0	20.2	27.9	3.9	4.1	4.1	4.0	9.4	11.8	10.2	10.5	621.7	1311.3	504.4	811.5
Sep. second fortnight	15.9	19.2	14.2	16.4	3.5	2.8	2.4	2.9	7.3	9.2	9.8	8.8	124.7	531.6	263.2	304.4
Oct. first fortnight	8.7	14.7	8.3	10.6	2.5	2.6	2.1	2.4	5.8	8.7	8.4	7.6	51.2	348.8	76.3	158.2
Oct. second fortnight	5.6	7.7	7.9	7.1	2.3	2.3	2.1	2.2	6.3	7.6	7.1	7.0	50.4	137.3	49.5	78.4
SEd	2.02	1.75	0.48	-	0.28	0.22	0.22	-	0.31	0.40	0.52	-	15.20	15.21	12.42	-
CD (0.05)	4.96	4.30	1.18	-	0.69	0.54	0.54	-	0.71	0.97	1.28	-	37.20	37.22	30.38	-
B. Plant population levels																
2.5 lakh ha^{-1} (40 x 10 cm)	16.5	25.5	15.2	19.1	3.6	3.4	3.1	3.4	7.8	9.8	9.4	9.0	165.7	504.5	173.8	281.1
3.3 lakh ha^{-1} (30 x 10 cm)	14.7	23.5	12.9	17.0	3.3	3.2	2.7	3.1	7.5	9.5	8.9	8.6	211.1	566.8	228.0	335.9
4.0 lakh ha^{-1} (25 x 10 cm)	13.0	19.0	11.8	14.6	2.7	2.8	2.5	2.7	6.9	9.0	8.8	8.2	243.2	664.8	265.8	388.9
5.0 lakh ha^{-1} (20 x 10 cm)	12.5	16.7	10.7	13.3	2.6	2.4	2.4	2.5	6.6	8.5	8.4	7.8	227.9	593.7	225.8	347.6
SEd	1.72	2.29	0.40	-	0.32	0.25	0.18	-	0.18	0.30	0.23	-	9.56	19.36	10.53	-
CD (0.05)	3.44	4.74	0.82	-	0.78	0.52	0.42	-	0.44	0.62	0.49	-	23.48	39.97	21.74	-

Table 3. Economics and rainfall use efficiency of redgram (ARG 102)

Treatments	Gross return (Rs/ha)				Benefit Cost Ratio				Rainfall use efficiency (kg grain/mm/ha)			
	1996	1997	1998	Mean	1996	1997	1998	Mean	1996	1997	1998	Mean
A. Time of sowing												
Sep. first fortnight	9900	20986	8068	12985	2.73	5.58	2.14	3.48	2.5	2.2	0.8	1.8
Sep. second fortnight	2012	8395	4208	4872	0.62	2.42	1.24	1.43	0.5	0.9	0.4	0.6
Oct. first fortnight	804	5581	1216	2534	0.25	1.66	0.36	0.76	0.3	0.6	0.1	0.3
Oct. second fortnight	796	2194	776	1255	0.25	0.66	0.25	0.39	0.4	0.4	0.1	0.3
B. Plant population levels												
2.5 lakh ha^{-1} (40 x 10 cm)	2652	8075	2768	4498	0.76	2.27	0.97	1.27	-	-	-	-
3.3 lakh ha^{-1} (30 x 10 cm)	3372	9066	3644	5361	0.98	2.56	1.04	1.53	-	-	-	-
4.0 lakh ha^{-1} (25 x 10 cm)	3892	10527	4252	6224	1.11	2.92	1.18	1.74	-	-	-	-
5.0 lakh ha^{-1} (20 x 10 cm)	3596	9487	3604	5562	1.01	2.58	0.99	1.53	-	-	-	-

Results and Discussion

Effect of sowing time

The crop sown during September first fortnight had recorded significantly higher values of pod number per plant, number of seeds per pod and 100-grain weight. There was a decline in yield components under late sown situation. Shankaralingappa and Hegde (1989) observed significant difference in number of pods $plant^{-1}$ in redgram due to sowing dates.

Maximum grain yield was obtained when the crop was sown during September first fortnight and the grain yield gradually declined when the sowing was delayed (Table 2).

The sowing of ARG 102 during September first fortnight had recorded significantly higher mean yield of 812 kg ha^{-1} than late sown crops. The yield reduction in September second fortnight, October first fortnight and October second fortnight sown crops were 62.5, 80.5 and 90.4 per cent, respectively as compared to September first fortnight sowing. The increase in grain yield was mainly due to higher values of yield attributes like number of pods $plant^{-1}$, seeds pod^{-1} and grain weight (Table 2). More rainy days and availability of soil moisture throughout the crop period were responsible for more yield attributes and grain yield in early sown redgram. Eventhough high rainfall was received during 1997-98, the yield during the year was low. Because the intensity of rainfall during flowering was high which reflected in poor seed setting and ultimately yield. Moreover, high rainfall was conducive for more incidence of pod borer. Padhi (1995) also reported higher yield attributes and grain yield of redgram in early sown situation.

Effect of plant population

The plant population at 2.5 lakh plants ha^{-1} recorded higher values of pod number $plant^{-1}$, number of seeds pod^{-1} and 100-grain weight as compared to higher levels of plant population. This might be due to competition among plant populations. There was an increase in the grain yield of redgram with increasing level of plant population upto 4.0 lakh plants ha^{-1} and further increase in the plant population decreased the yield. The population level at 4.0 lakh plants ha^{-1} (25 x 10 cm) recorded significantly higher grain yield which was 14 and 28 per cent higher than the population

evel of 3.3 and 2.2 lakh plants ha^{-1}, respectively. 'adhi (1995) observed higher yield components nd grain yield under low level of plant opulation than higher population level.

Economics and RUE

Redgram ARG 102 sown during September first fortnight recorded higher values of gross return and B:C ratio than late sown crops due to higher grain yield (Table 3). Among the various plant population levels, 4.0 akh plants ha^{-1} (25 x 10 cm) recorded higher gross return and B:C ratio. The rainfall use efficiency (kg grain mm^{-1} ha^{-1}) was worked out based on the rainfall received during the growth periods of the experimental crops. RUE (kg grain mm^{-1} ha^{-1}) was higher in September first fortnight sowing which gradually decreased with delay in sowing. This might be mainly due to higher grain yield per unit rainfall received during the period. Solaiappan and Subramanian (1995) reported higher seed yield, monetary return and RUE in redgram due to early sowing in September under rainfed situation.

It can be concluded that sowing of pigeonpea culture ARG 102 during September first fortnight with plant population of 4.0 lakh plants ha^{-1} (25 x 10 cm) is a suitable low cost technology for getting maximum grain yield and gross return in rainfed vertisols.

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