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RESEARCH PAPER

Response of black gram varieties to sowing times under rain fed vertisol of Southern Tamil Nadu

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Abstract : The field experiments were conducted during 2010-11, 2011-12 and 2012-13 in *Rabi* season (October - December) at Agricultural Research station, Kovilpatti to identify the optimum time of sowing and best suitable blackgram variety for rainfed vertisol. Experiments were laid out in split-plot design with three replications. The treatment combinations comprised of three dates of sowing *viz.*, 39th, 41st and 43rd standard weeks (pre monsoon, monsoon and post monsoon sowing, respectively) in main plot with four different black gram varieties *viz.*, CO 5, CO 6, Vamban 4 and Vamban 5 in the sub plot. The results revealed that sowing during 39th standard week (pre monsoon-D_1) registered increased growth and yield parameters *viz.*, plant height, DMP,LAI, number of pods/plant, number of seeds/pod, pod length, 100 seed weight, which reflected on increased grain yield. Similarly among the varieties tried CO 5 registered higher growth and yield attributes which reflected on increased grain yield which was followed by Vamban 4.

Key Words : Black gram, Dates of sowing, Genotypes, Growth, Yield

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INTRODUCTION

Pulses are an excellent source of plant protein and good substitute of animal protein so known as "poor man's meat" in the developing world. Pulses gives low seed yield mainly due to pulses are grown mostly in the low fertile drylands with poor management. Evaluation of suitable management practices to increase the productivity of pulses under rainfed situation is essential. Crop growth and yield depend on its growth characters like leaf area index, dry matter production and partitioning etc. These growth characters are greatly influenced by environmental factors (*i.e.* temperature, photoperiod etc.), variety and cultural practices (*i.e.* seeding date, seeding rate and spacing etc.). Sowing time is one of the major non-monetary inputs affecting the growth and yield of field crops. Capone *et al*.(2012) reported that early sowing to the beginning of the rainy period was possible to have a sunflower yield of 2300 upto 3000 kg ha^{-1} depending upon the cultivar. Kumar *et al.* (2013) reported that March 12 planting of urdbean produces higher no. of grains/pod, pods/plant and improved source-sink relationship which led to generation of significantly higher

grain yield than February 20 and April 1.

For any yield improvement programme selection of superior parents is a prerequisite it should posses better heritability and genetic advance for various traits. Optimum time of sowing of blackgram may vary from variety to variety and season to season due to variation in agro-ecological conditions. Therefore, there must be a specific sowing dates to obtain maximum yield (Singh *et al*., 2013). Hence, the present study was undertaken to identify the suitable variety(s) and sowing time for rainfed vertisols of southern agro climatic conditions of Tamil Nadu.

MATERIAL AND METHODS

A field experiment was conducted during *Rabi* season of 2010-11, 2011-12 and 2012-13 at the Agricultural Research Station, Tamil Nadu Agricultural University, Kovilpatti, Tamil Nadu. Experiment was laid out in split plot design replicated thrice with dates of sowing in main plots and varieties in sub plots. The plot size was 5 x 4 m. The soil was clay in texture with sub angular blocky in structure with WHC of 65 per cent, EC: 0.32 dSm^{-1}, pH: 8.45, Available N: 140 kg/ha, Available P: 15.5 kg/ha, Available K: 340 kg/ha. Sowing of four blackgram varieties *viz.*, CO 5, CO 6, VBN 4 and VBN 5 was taken during 39th (24 to 30 'Sep- pre monsoon), 41st (8 to 14 'Oct- monsoon) and 43rd standard weeks (22 to 28' Oct-post monsoon). Application of fertilizers @ 12.5: 25: 12.5: 10 kg NPKS ha^{-1} was done in all three years with the spacing of 30 × 10 cm. Pre emergence application of Pendimethalin @ 3.3 lit per ha was done followed by hand weeding on 20-25 DAS. Irrigation was not given since the crop was grown as rain fed. Data on plant height, leaf area index (LAI), dry matter production (DMP), number of pods/plant, number of seeds per pod, 100 seed weight and seed yield were recorded replication wise. The data on yield and other yield attributes were statistically analyzed and presented in Table 1. The Meteorological data regarding rainfall, temperature, relative humidity and sunshine hours were collected from meteorological observatory located near crop field at Agricultural Research Station, Kovilpatti and presented in the Table 2 and 3. During the year 2012-13 the crop was failed due to failure of monsoon rain.

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Growth parameters:

Sowing date wielded significant influence on all

Table 1: Effect of treatment on growth and yield attributes and yield of blackgram

Treatments	Pl ht (cm)		DMP (kg/ha)		LAI		No. of pods/pl		Pod length (cm)		No. of seeds/ pod		100 seed wt (g)		Yield (kg/ha)		
	2010-2011	2011-2012	2010-2011	2011-2012	2010-2011	2011-2012	2010-2011	2011-2012	2010-2011	2011-2012	2010-2011	2011-2012	2010-2011	2011-2012	2010-2011	2011-2012	Pooled mean
39th std week	41.7	39.9	2171	2173	3.83	3.70	33.7	35.0	5.4	4.2	6.6	5.9	5.7	5.3	721	701	711
41st std week	38.4	36.0	2033	1967	2.76	3.01	27.8	31.0	5.2	4.2	6.0	5.3	5.5	5.0	524	567	546
43rd std week	34.6	32.5	1073	1698	2.55	2.85	18.7	28.7	4.5	3.6	4.9	4.2	5.3	4.6	239	358	299
S.E.±	1.8	1.8	101.9	90.9	0.13	0.14	1.5	1.5	0.2	0.19	0.3	0.2	0.3	0.2	26	27	30
C.D. (P=0.05)	5.0	4.9	282.9	252.4	0.37	0.40	4.0	4.1	0.6	0.53	0.8	0.7	NS	NS	72	75	61
CO 5	41.0	40.2	1930	2098	3.68	3.67	29.7	33.8	5.8	4.5	6.5	5.8	5.7	5.6	604	632	618
CO 6	36.3	34.4	1591	1765	2.58	2.57	24.4	29.3	4.6	3.3	5.4	4.7	5.2	4.5	386	431	409
VBN 4	39.1	40.3	1803	1977	3.40	3.44	27.4	31.9	5.1	4.1	5.8	5.1	5.6	4.9	555	558	557
VBN 5	36.5	34.6	1710	1943	2.54	3.07	25.4	31.3	4.7	4.0	5.7	5.0	5.4	4.8	433	546	490
S.E.±	1.5	1.5	78.9	78.4	0.13	0.13	1.4	1.3	0.2	0.16	0.2	0.2	0.2	0.2	23	23	12
C.D. (P=0.05)	3.2	3.1	165.8	164.8	0.28	0.28	2.9	2.7	0.4	0.33	0.5	0.4	NS	0.4	49	48	25
M at S S.E.±	2.9	2.8	156.2	148.7	0.24	0.25	2.5	2.4	0.4	0.30	0.5	0.4	0.4	0.4	44	44	
C.D. (P=0.05)	NS	NS	NS	NS	0.56	NS	5.9	NS	0.9	NS	1.0	0.9	NS	NS	102	NS	
S at M S.E.±	2.7	2.52	136.6	135.8	0.23	0.23	2.4	2.2	0.4	0.27	0.4	0.4	0.4	0.3	41	40	
C.D. (P=0.05)	NS	NS	NS	NS	0.49	NS	5.1	NS	0.8	NS	0.9	0.8	NS	NS	85	NS	

NS= Non-significant

growth characters studied during both years. The result indicated that plant height, DMP and LAI reduced significantly beyond 41st standard week. Maximum plant height, LAI and DMP were recorded when the crop was sown as pre monsoon sowing followed by monsoon sowing and further decrease was noticed in later sowing date (Table 1). Mamta *et al*. (2012) reported that early sowing on 13th July was found sufficient for increased dry matter in various plant part of French bean as compared to delayed sowing *i.e*. 22nd July, 3rd and 12th August. Varieties showed significant variations in growth attributes. The variety CO 5 registered significantly higher plant height, leaf area index (LAI) and dry matter production (DMP) in both years which was at par with the variety VBN 4 in both years. The lower plant height, LAI and DMP was recorded by variety CO 6. The differences among the varieties might be due to their genetic constituents. Kumar *et al*. (2013) also reported

Table 2 : Observed and derived weather parameter during the cropping period

Treatments	SS hrs/d		GDD		HTU		RF (mm)		AGDD		AHTU	
	2010-11	2011-12	2010-11	2011-12	2010-11	2011-12	2010-11	2011-12	2010-11	2011-12	2010-11	2011-12
D_1V_1	5.2	5.7	14.7	15.5	78.3	92.8	574.0	540.0	1257.6	1254.4	7019.3	7554.7
D_1V_2	5.5	5.7	15.4	15.4	87.9	90.9	574.0	536.0	1177.7	1213.1	6673.5	7334.1
D_1V_3	4.6	6.4	14.7	15.1	70.7	98.6	574.0	540.6	1279.6	1294.0	7046.4	7875.8
D_1V_4	5.3	5.7	15.4	15.4	85.7	90.9	574.0	536.0	1177.7	1213.1	6673.5	7334.1
D_2V_1	4.6	5.6	14.0	14.4	68.2	82.1	553.2	472.4	1048.8	1147.0	5405.9	6341.3
D_2V_2	4.9	5.8	14.3	14.6	72.5	85.7	553.2	472.4	1039.4	1135.8	5400.3	6245.7
D_2V_3	5.0	5.3	14.2	14.6	74.2	78.9	554.8	481.2	1118.5	1239.1	5786.9	6925.5
D_2V_4	5.1	5.8	14.1	14.6	74.6	86.4	553.2	472.4	1014.4	1135.8	5369.0	6245.7
D_3V_1	4.5	4.8	13.8	14.1	66.8	68.7	522.2	364.6	1087.9	1032.2	5597.5	5699.5
D_3V_2	4.3	4.4	13.8	14.0	64.5	63.8	520.6	364.6	1038.8	973.7	5304.8	5226.4
D_3V_3	4.4	5.4	13.8	14.1	66.1	77.4	526.1	365.2	1137.3	1091.2	5835.7	6147.1
D_3V_4	4.0	4.6	13.7	14.0	60.3	65.1	520.6	364.6	991.9	1017.2	4999.7	5557.0

Table 3: Rainfall (mm) received by different treatment at different phenological stages (2010-11)

Treatments	P_1	P_2	P_3	P_4	P_5	P_6	Total rainfall
D_1 - 39th standard week	20.8	198.2	38.0	19.1	286.2	11.8	574.0
D_2 - 41st standard week	32.6	216.9	175.1	40.8	87.9	0.4	553.6
D_3 – 43rd standard week	5.6	381.0	73.6	10.9	49.6	1.8	522.4
V_1- CO 5	19.7	257.2	110.3	24.6	137.5	0.5	549.8
V_2- CO 6	19.7	256.3	94.5	25.2	145.7	7.9	549.3
V_3- VBN 4	19.7	291.6	83.5	18.1	136.4	2.4	551.6
V_4- VBN 5	19.7	256.3	93.8	26.5	145.2	7.9	549.3

Table 4 : Rainfall (mm) received by different treatment at different phenological stages (2011-12)

Treatments	P_1	P_2	P_3	P_4	P_5	P_6	Total rainfall
D_1 - 39th standard week	50.0	179.2	65.0	19.9	221.0	3.2	538.2
D_2 - 41st standard week	67.8	174.2	15.3	53.2	162.0	2.2	474.6
D_3 – 43rd standard week	27.0	157.5	161.1	0.0	16.8	2.4	364.8
V_1- CO 5	48.3	154.5	102.8	12.4	139.2	1.8	459.0
V_2- CO 6	48.3	151.1	92.9	13.3	148.7	3.4	457.7
V_3- VBN 4	48.3	224.3	33.1	58.5	93.5	4.7	462.3
V_4- VBN 5	48.3	151.1	92.9	13.3	151.5	0.5	457.7

P_1 – P_6 are different phases: P_1- Germination, P_2- Vegetative, P_3- 50 % flowering, P_4 – Pod initiation, P_5- Pod development, P_6- Physiological maturity

genotypic variation with respect to plant growth and grain yield in blackgram.

Yield parameters:

Yield attributing character and yield of blackgram was significantly influenced by sowing date. Experimental results revealed that 39th standard week sowing produced higher seed yield compared to other date of sowing which was due to higher yield attributing characters *viz.*, number of pods plant^{-1}, seeds pod^{-1} and 100 seed weight (Table 1). Sowing after 39th standard week gradually decreased the seed production and the yield was very poor beyond 41st standard week. Sandhya Rani *et al*. (2014) reported that delay in sowing causes a substantial decrease in all the growth and development parameters. The maximum yield from 39th standard week sowing might be due to suitable temperature and efficient utilization of higher soil moisture from sufficient rainfall during crop growing period (in October and November), which enhanced the vegetative as well as reproductive growth of the crop. Late sowing (41st and 43rd standard week) resulted in lower yield due to excessive rainfall during flowering stage that accelerate the growth process which caused excessive vegetative growth and poor flowering and pod setting that resulted into higher straw production and poor grain yield. Gowda *et al*. (2011) reported that, late sown crop was observed to be stunted and had shorter and less number of pods/plant due to low total rainfall received during the crop growth period.

Yield attributing character and yield of blackgram was significantly influenced by different varieties of blackgram. Variety CO 5 produced higher seed yield which was followed by in order of VBN 4, VBN 5 and CO 6. Higher seed yield of CO 5 was due to higher yield attributing characters *viz.*, number of pods plant^{-1}, seeds pod^{-1} and 100 seed weight. The lower seed yield was recorded by CO 6, which was the consequence of lower yield attributing character (Table 1). The observed varietal variation in seed yield might be due to genetic variation. These findings are in line the findings of Verma *et al*. (2011) and Dudhat and Asodaria (2012).

Meteorological data suggests that pre monsoon sown crop (24th Sep.-30th Sep.) was well benefited from monsoon rains (Table 3 and 4). The crop attained vigorous vegetative growth prior to onset of flowering that was later used in pod formation and grain filling. With the delay in sowing the amount of rainfall received from sowing harvest decreased gradually. And also crop sown in post monsoon (D_3) suffered from decline in GGD, HTU and low PTU, so the growth of the crop was adversely affected (Table 2 and 3). In addition, relatively low sunshine hours associated with low night temperature may have hampered grain formation.

Conclusion:

Blackgram genotypes differ in their yield potential; and sowing date tremendously influences their yield performance. Among the varieties, CO 5 was the most promising. Sowing should preferably be done around 39th standard week (24 Sep.-30 Sep.) and no sowing is desirable beyond 41st standard week (8 Oct.- 14 Oct.). For obtaining higher seed yield, blackgram variety CO 5 may be sown during the period of 39th standard week (24 Sep.-30 Sep.). The other options may be VBN 4 sown around 41st standard week (8 Oct.-14 Oct.).

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