



Studies on Growth Analysis and Seed Yield in Blackgram Cultivars

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ABSTRACT

A field experiment was conducted during Rabi 2007-08 to study the growth analysis and seed yield of Blackgram cultivars, revealed that among the blackgram cultivars LBG735 recorded maximum CGR, NAR, LAI, LAD and lowest SLA compared to other cultivars. LBG735 recorded highest number of pods per plant, number of seeds per pod, test weight, harvest index and seed yield (1650kg) and WBG26 recorded lowest values of above parameters.

Key words : Black gram, Growth analysis, LAD, LAI, NAR

Black gram is an important short duration pulse crop grown in many parts of India. In southern zone of Andhra Pradesh, mainly Nellore and Prakasam districts, it is mainly grown in early Rabi under dry land conditions. The low productivity of Black gram is attributed to the mid and terminal moisture stress often encountered due to irregular or failure of north east monsoon. Moisture stress at flowering and podding stages reduce seed yield and harvest index significantly. Under such conditions, identification of genotypes with higher drymatter and growth characters, Water use efficiency is necessary either for recommending to farmers or for breeding drought tolerant cultivars. Net assimilation rate is an index of photosynthetic efficiency which shows strong positive association with photosynthetic rate and grain yield. A significant positive correlation was obtained between LAD during post flowering and yield which was earlier reported by Niljhwani and Chadra (1980). Hence the present investigation was planned to study the growth analysis and seed yield in Blackgram cultivars.

MATERIAL AND METHODS

A field experiment was conducted in wetland farm of S.V. Agricultural College, Tirupati in a randomized block design with 15 cultivars replicated thrice during Rabi 2007-08. Treatments consist of fifteen cultivars of Black gram (LBG17, LBG20, LBG402, LBG611, LBG 623, LBG 645, LBG 648, LBG 685, LBG 734, LBG 735, LBG 741, LBG 749, LBG 752, T9 and WBG 26) from RARS, Lam were used for the study. The crop was sown with a spacing of 30x10 cm. Recommended dose of fertilizers were applied. Need based life irrigation was given. Prophylactic measures were taken for

protecting the crop from diseases and pests. Destructive analysis of plant samples was done at 15, 30, 45, 60, 75DAS and dried in oven at 80^o c for 48 hours. Leaf area was measured by LICOR 3000 leaf area meter and LAI was computed on the basis of leaf area per unit ground area. The growth parameters were computed from leaf area and dry matter. The data on seed yield and yield components were recorded at the time of harvest.

RESULTS AND DISCUSSION

Production and maintenance of leaf area is important for dry matter production and yield. Leaf area and leaf area index was increased up to 60 DAS in all the cultivars and later it decreased (Table.1). There was a significant difference between cultivars for leaf area and leaf area index at all stages of crop growth. Among the cultivars, LBG 735 recorded highest LAI (4.0) and WBG 26 recorded lowest LAI of 3.40 at 60 DAS. Leaf area which is a product of leaf number and its size. Theoretically the assimilatory surface can be increased by increasing either of the components or both of them. The decreased leaf area and leaf area index after 60 DAS in all the cultivars might be due to lesser leaf number as a result of senescence in early formed leaves. The higher LAI in LBG 735 might be due to more leaf area and good growth thereby leaf area index. Similar results were reported by Rao and Singh (1997) in soybean and Rao (2004) in Red gram.

Crop growth rate (CGR) is the product of leaf area index and net assimilation rate. The CGR increased up to 60 DAS in all the cultivars and later it decreased (Table1). These changes in CGR and LAI correspond to the changes in their associated

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Table 1. Growth parameters of black gram cultivars grown under field conditions

Sl. No.	Cultivars	Crop growth rate (g m ⁻² day ⁻¹)						Net assimilation rate (g m ⁻² day ⁻¹)						Leaf area index						Leaf area duration (Cm ² day ⁻¹)						Specific leaf area (Cm ² g ⁻¹)					
		15-30		45-60		60-75		15-30		45-60		60-75		45		60		75		15-30		45-60		60-75		30		60		75	
		DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	
1.	LBG 17	4.13	19.42	3.30	0.1162	0.0436	0.0059	2.22	3.95	3.73	7.12	46.27	57.60	306.5	254.2	289.7															
2.	LBG 20	3.43	13.64	1.62	0.118	0.0332	0.0030	2.04	3.64	3.37	5.98	42.60	52.57	314.1	321.5	353.5															
3.	LBG 402	3.63	15.84	1.90	0.1131	0.0378	0.0040	2.11	3.77	3.53	6.30	44.10	54.75	308.3	346.5	388.6															
4.	LBG 611	3.67	16.26	2.60	0.1136	0.0382	0.0045	2.11	3.80	3.55	6.37	44.32	55.12	309.9	275.9	313.8															
5.	LBG 623	3.47	14.48	1.66	0.1120	0.0370	0.0032	2.05	3.68	3.42	6.07	42.97	53.25	313.0	301.8	342.2															
6.	LBG 645	3.93	17.60	3.02	0.1151	0.0401	0.0050	2.17	3.88	3.64	6.25	45.37	56.40	300.0	261.1	303.7															
7.	LBG 648	3.80	16.85	2.80	0.1145	0.0389	0.0049	2.15	3.84	3.60	6.45	44.92	55.80	304.0	266.1	311.5															
8.	LBG 685	4.04	18.41	3.14	0.1155	0.0419	0.0056	2.20	3.91	3.68	6.75	45.82	56.92	296.2	258.5	296.4															
9.	LBG 734	3.34	13.20	1.40	0.1155	0.0277	0.0028	2.00	3.60	3.33	5.70	42.00	51.97	306.3	317.6	375.0															
10.	LBG 735	4.26	20.30	3.50	0.1178	0.0442	0.0063	2.33	4.00	3.77	7.42	47.47	58.20	309.8	248.2	283.3															
11.	LBG 741	3.58	15.13	1.76	0.1127	0.0375	0.0035	2.06	3.73	3.46	6.22	43.42	53.91	311.6	294.7	331.9															
12.	LBG 749	3.27	12.10	1.34	0.1112	0.0298	0.0026	1.97	3.55	3.28	5.75	41.40	51.22	311.2	326.5	379.4															
13.	LBG 752	3.19	11.63	1.33	0.1109	0.0297	0.0024	1.93	3.51	3.24	5.52	40.80	50.62	307.5	319.1	370.0															
14.	T 9	3.10	10.78	1.15	0.1105	0.0286	0.0024	1.88	3.46	3.17	5.21	40.15	49.72	295.2	346.6	386.4															
15.	WBG 26	3.03	10.32	1.10	0.1100	0.0271	0.0022	1.86	3.40	3.13	5.06	39.45	48.97	297.0	347.7	402.8															
	SE m+	0.41	1.05	0.16	0.0013	0.0016	0.0040	0.09	0.09	0.10	0.87	1.59	1.38	3.10	5.19	5.19															
	C:D (0.05)	1.20	3.04	0.47	0.0040	0.0050	0.0130	0.27	0.27	0.30	NS	4.63	4.02	9.30	15.04	15.05															

Table 2. Yield and yield components of black gram cultivars grown under field conditions

Sl. No.	Cultivars	No. of pods / plant	No. of seed / pod	Test weight (g) (100 seed)	Seed yield (kg / ha)	Harvest index (%)
1.	LBG 17	26.0	7.1	5.0	1615	42.70
2.	LBG 20	19.0	6.3	4.2	1320	39.55
3.	LBG 402	22.3	6.6	4.5	1410	39.21
4.	LBG 611	22.1	6.7	4.6	1510	40.37
5.	LBG 623	19.3	6.4	4.3	1350	39.28
6.	LBG 645	24.1	6.9	4.8	1580	40.80
7.	LBG 648	23.1	6.8	4.7	1560	39.45
8.	LBG 685	25.3	7.0	4.9	1602	38.46
9.	LBG734	18.0	6.4	4.1	1360	39.45
10.	LBG735	27.1	7.2	5.1	1650	44.79
11.	LBG741	20.5	6.5	4.4	1380	38.45
12.	LBG749	17.5	6.1	4.0	1280	38.40
13.	LBG 752	16.5	6.0	3.9	1250	38.13
14.	T 9	15.8	5.9	3.8	1235	38.50
15.	WBG 26	15.0	5.8	3.7	1210	38.05
	S E m+	1.41	0.19	0.11	77.23	0.50
	C.D(0.05)	4.09	0.57	0.32	223.88	1.50

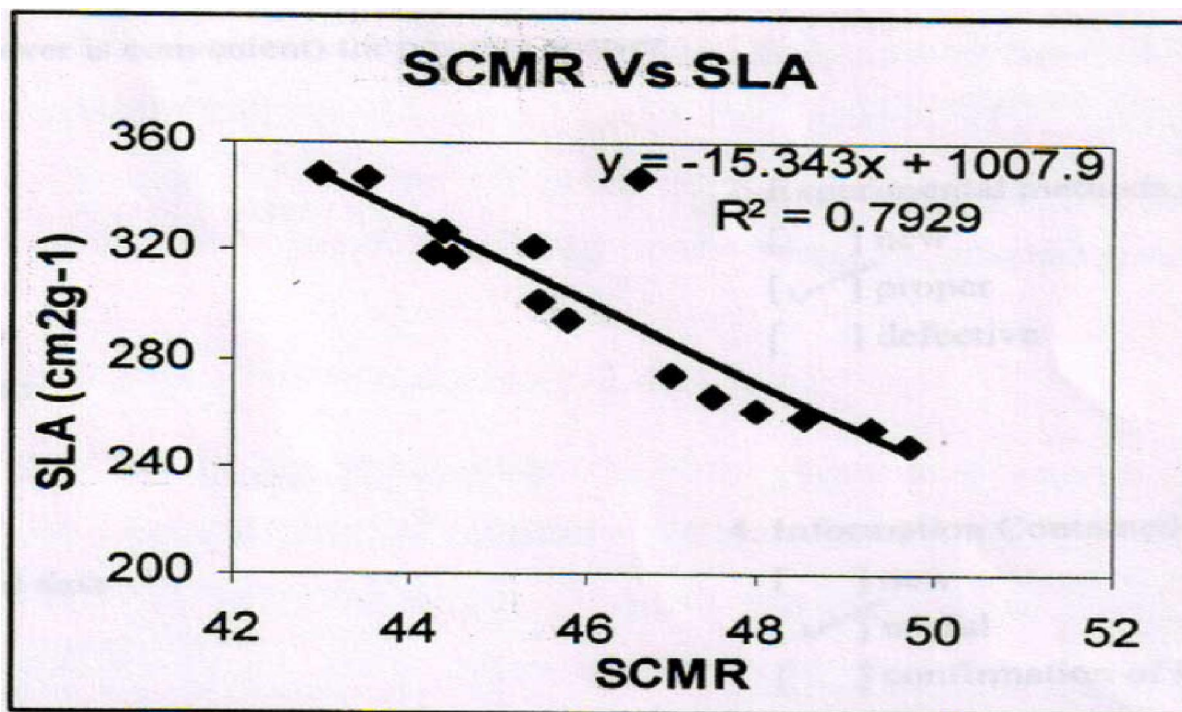
characters viz., number of leaves and dry matter production. Among the cultivars tested, LBG 735 recorded significantly higher CGR ($20.30 \text{ g m}^{-2} \text{ day}^{-1}$) and lower CGR was recorded in WBG 26 of $10.32 \text{ g m}^{-2} \text{ day}^{-1}$ at 45-60 DAS. The highest CGR in LBG 735 might be due to higher production of dry matter and leaf area. Such differences among the cultivars reported by several workers (Rahangdale *et al* (1994) and Patra *et al* (1998). Further, Premachandra (1987) attributed such cultivar differences under stress conditions to their ability to maintain Photo synthesis and osmotic adjustment.

The net assimilation rate gradually decreased from 15-30 DAS to maturity in all the cultivars (Table 1). The lower values of NAR might be due to much of the dry matter would have gone into non-assimilatory tissues and senescence. Similar decrease of NAR with the age of the crop was also reported by Williams (1946) and Sestak (1971) in other crops. Among the cultivars, LBG 735 recorded significantly highest NAR ($0.1178 \text{ g dm}^{-2} \text{ day}^{-1}$) and lowest NAR was recorded in WBG 26 of $0.1100 \text{ g dm}^{-2} \text{ day}^{-1}$. The varietal differences in NAR might be due to changes in leaf area and dry matter production and also partitioning of dry matter to non-assimilatory tissues.

Leaf area duration gradually increased from 15 DAS to 75 DAS. (Table 1). There were significant differences between cultivars for leaf area duration at all stages of crop growth. Among the cultivars LBG 735 recorded significantly highest ($58.2 \text{ cm}^2 \text{ day}^{-1}$) leaf area duration and lowest leaf area duration was recorded in WBG 26 of $48.97 \text{ cm}^2 \text{ day}^{-1}$ at 60-75 DAS (pod filling stage). Higher LAD during pod filling stage might be reason for higher photosynthetic activity in LBG 735 which helped to accumulate and transport more assimilators into pods resulted in higher pod yield. A significant positive correlation was obtained between LAD during post flowering and yield in mung bean as reported by Nijhwan and Chandra (1980).

Specific leaf area (SLA) was increased upto 30 DAS (Table 1) and it decreased from 45-60 DAS and again increased at 75 DAS in all the cultivars. There were significant differences between the cultivars for specific leaf area at all stages of crop growth. Among the cultivars tested WBG 26 recorded significantly highest SLA ($387.8 \text{ cm}^2 \text{ g}^{-1}$) and the lowest SLA was recorded in LBG 735 of $283.3 \text{ cm}^2 \text{ g}^{-1}$. SLA was negatively correlated with SCMR (Fig1).

Fig 1. Correlation between SCMR and SLA in field study.



Specific leaf area is a measure of rate of leaf expansion. Higher SLA means higher leaf area per unit biomass and a large surface area for transpiration on the other hand, if SLA is lower, the leaf thickness would be more and hence their capacity of photosynthesis would be higher since transpiration and photo synthetic capacity determine the variability in TE an inverse relationship between SLA and WUE is normally observed (Wright et al 1994).

In the present study, LBG 735 recorded lower SLA and there by it has high WUE and dry matter. WBG 26 recorded high SLA and lower WUE and dry matter. Genotypes with lower SLA (Thicker Leaves) are known to have more of photosynthetic machinery i.e. more Chlorophyll content (Rao and Wright 1994). Similarly Wright et al (1993) suggested that selection of low SLA types might result in the production of more dry matter. Reddy et al (2000) reported that specific leaf area of groundnut genotypes was higher under adequately irrigated treatment compared to simulated drought treatment and also stated that WUE has a strong negative relationship with SLA. Similar findings were also reported by Sudhakar et al (2006) in green gram and Latha and Reddy (2007) in groundnut.

Yield in crop plants is the ultimate expression of many yield attributes and are dependent on each other. There was significant differences between

cultivars for number of pods per plant, number of seeds per pod , test weight and seed yield (Table 2). Among the cultivars tested LBG 735 recorded significantly highest seed yield (1650 kg ha⁻¹) and lowest seed yield was recorded in WBG 26 of 1210 kg ha⁻¹. The higher seed yield in LBG 735 might be due to more dry matter, CGR, LAI, and NAR and there by increased yield components and yield. Incidentally, the cultivar has highest dry matter, SCMR and lower SLA, which are most desirable traits, looked in any cultivar. Similar results were reported by Bindhu Madhava et al (2002) in groundnut. Sudhakar et al (2006) reported that there was a positive relationship between SCMR and seed yield in green gram.

Harvest index reflects the physiological capacity of a crop to mobilize and translocate the photosynthates to organs having economic value. There was significant difference between cultivars for harvest index .LBG 735 recorded significantly higher H.I (44.79%) and lower H.I was recorded in WBG 26 of 38.05 percent. The higher H.I in LBG 735 might be due to better partitioning of assimilates to sink. Babitha (1996) observed high H.I and high WUE in TAG 24, KGS 768 and Somanth groundnut cultivars even under moisture stress conditions. The present field study clearly revealed that LBG 735 recorded maximum CGR, NAR, LAI, LAD, and yield and yield components and lowest SLA compared to other cultivars.

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