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EVALUATION OF BLACKGRAM [*Vigna mungo* (L.) Hepper] GENOTYPES FOR YIELD AND YIELD ATTRIBUTING TRAITS

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ABSTRACT

Thirty five blackgram genotypes were grown during *Rabi*, 2021-2022 in order to evaluate the performance of elite genotypes of blackgram for 12 quantitative characters. The experiment was laid out in randomized complete block design with three replications. Analysis of variance for all quantitative traits showed that mean sum of squares due to genotypes was highly significant for all characters studied. Based on mean performance, the genotypes LBG-645, MBG-1058 and TU-94-2 were adjudged as the best genotypes for improving yield, while the genotypes PU-31 and P-1032 for improving yield and yield attributes coupled with early maturing traits in blackgram.

KEYWORDS: Genotype, RBD, ANOVA, Yield, Early maturity.

INTRODUCTION

Blackgram (*Vigna mungo* L. Hepper), a diploid (2n = 2x = 22), short duration legume crop of family *Fabaceae*, was domesticated in Northern South Asia from progenitor *Vigna mungo* var. *silvestris* (Lukoki *et al.,* 1980). It is cultivated throughout Southeast Asia because of its multiple benefits to soil and human health. It is nutritionally important crop with about 25 per cent protein nearly three times that of cereals, 60 per cent carbohydrates, 1.3 per cent fat as well as important vitamins and minerals, making it a balanced vegan diet when supplemented with cereals. The ability of its roots to fix atmospheric nitrogen (42 kg/ha/year) (Dey *et al.,* 2020) contribute towards soil health while deep-roots prevents soil erosion by binding soil particles. Short duration of blackgram makes it suitable for intercropping with corn or millet or rotation with cereals like rice or wheat (Muthusamy and Pandiyan, 2018), adding another benefit for farmer.

India is the largest producer as well as the consumer of pulses accounting for more than 70 per cent of global production. It ranks fourth in position after bengalgram, redgram, greengram and cultivated in an area of about 4.14 M ha, with an annual production of 2.23 M t and with a productivity of 538 kg ha^{-1}. Andhra Pradesh is one of the major blackgram growing states of India with an area of 3.93 lakh hectares, with a production of 3.65 lakh tons and a productivity of 929 kg ha^{-1} (Directorate of Economics and Statistics, DAC & FW 2020-2021).

Though India is the largest producer of pulses, around 2-3 million tons of pulses are imported annually to fulfill the domestic consumption requirement as the current yield increase trends may not be sufficient in dealing with the growing demand (Singh *et al.,* 2022). In order to ensure hunger free society with nutritious food, there is a need to boost the yield potential of pulses including blackgram. Hence, for a major breakthrough in yield and productivity of blackgram, it is imperative to identify high yielding varieties with desirable traits.

Considering the above factors, the research was undertaken to study the *per se* performance for yield and yield attributing traits in 35 blackgram genotypes.

MATERIAL AND METHODS

The field experiment was conducted at dryland farm of Sri Venkateswara Agricultural College, Tirupati, Acharya N.G. Ranga Agricultural University during *rabi* 2021-22 in RBD with three replications. The observations were recorded on randomly selected five plants in each genotype in each replication for plant height, number of primary branches per plant, number of clusters per plant, number of pods per cluster, number of pods per plant, number of seeds per pod, pod length, hundred seed weight, seed yield per plant, and harvest index while, the data for days to 50% flowering and days to maturity were recorded on plot basis. The data was analyzed through software – INDOSTAT.

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RESULTS AND DISCUSSION

Analysis of variance for 12 traits revealed significant differences among the means of all the genotypes (Table 1). Thus, it indicated considerable scope for selection of high yielding genotypes with more yield. The variations present in the genotypes can be attributed to the influence of environmental factors.

MEAN PERFORMANCE

The mean performance of 35 blackgram genotypes were presented trait wise in Table 2.

1. Days to 50% Flowering

Days to 50% flowering ranged from 33.67 to 41.00 days. Among all the genotypes, VBG-10-010 (33.67 days) was the earliest to flower, whereas LBG 648 and LBG 645 were late in flowering (41.00 days). Ten genotypes were significantly earlier in flowering when compared to the general mean of the days to 50% flowering (36.97 days).

2. Days to Maturity

The trait number of days to maturity varied from 68.33 to 80.33 days with a mean maturity of 71.51 days. The genotypes P 112 and COBG 653 were early in maturity (68.33 days), while LBG 648 was found to be late in maturity (80.33 days). Nine genotypes were significantly early in maturity when compared with the mean maturity of the genotypes.

3. Plant Height (cm)

The shortest plant height was registered by IPU-10-4 (17.97), while the tallest was recorded by LBG 645 (41.77). The general mean was found to be 23.71. Two genotypes were significantly taller in height when compared to the general mean height.

4. Number of Primary Branches per Plant

Number of primary branches expressed in a range from 1.73 to 4.60. Among all the genotypes, more number of primary branches per plant was recorded by the

Table 1. Analysis of variance for yield and yield attributing traits in 35 blackgram genotypes

S. No	Characters	Mean sum of squares		
		Replications (df = 2)	Genotypes (df = 34)	Error (df = 68)
1.	Days to 50% flowering	1.37	10.03**	0.46
2.	Days to maturity	2.66	24.38**	1.38
3.	Plant height (cm)	0.86	78.48**	17.45
4.	Number of primary branches per plant	0.28	0.92**	0.09
5.	Number of clusters per plant	2.39	3.01**	0.78
6.	Number of pods per cluster	0.36	0.33**	0.16
7.	Number of pods per plant	34.36	25.93**	11.73
8.	Number of seeds per pod	0.17	0.77**	0.09
9.	Pod length (cm)	0.08	0.25**	0.04
10.	100 seed weight (g)	0.52	0.67**	0.18
11.	Seed yield per plant (g)	0.65	1.82**	0.41
12.	Harvest index (%)	4.45	87.58**	43.79

** Significant at 1% level

Table 2. Mean performance of 35 blackgram genotypes for yield and yield attributing traits

S. No.	Genotypes	DFF	DM	PH	NPB	NCP	NPC	NPP	NSP	PL	100 SW	SYP	HI
1.	KDRS-136	35.33*	71.33	26.93	4.27*	7.20	4.20	23.27	6.73*	5.24*	5.32	5.24	36.27
2.	SB-25-19	35.33*	69.33*	22.23	3.80	5.53	4.40	17.40	6.13	4.50	5.39	4.23	49.13*
3.	PU-205	36.67	69.00*	18.42	3.93	5.47	4.27	19.27	5.67	4.25	4.74	4.07	45.32
4.	COBG-653	35.33*	68.33*	18.83	3.10	5.53	4.60	18.87	6.07	4.23	4.52	5.40	40.67
5.	P-726	36.67	68.67*	20.23	3.80	7.10	4.00	20.53	5.80	4.56	5.18	5.44	42.72
6.	VBG-11-6	35.33*	69.33*	23.93	4.07	6.40	3.93	18.47	6.27	4.93	5.43	4.54	38.24
7.	VBN-7	37.33	72.33	20.90	3.67	4.67	4.13	16.07	5.87	4.61	5.15	4.22	43.49
8.	SB-40-5	36.33	70.00	20.70	3.67	4.80	4.07	17.47	6.13	4.39	5.17	5.07	41.04
9.	TBG-104	36.33	70.33	21.80	3.50	5.73	4.47	19.67	6.47	4.75	5.38	5.11	37.86
10.	NDU-11-204	38.33	78.33	26.45	3.63	5.53	4.27	19.40	6.13	4.82	5.70	5.24	39.26
11.	IPU-10-4	36.33	71.67	17.97	1.73	6.03	4.73	25.67*	5.60	4.25	5.15	5.19	42.97
12.	P-1032	38.00	68.67*	20.73	4.33*	5.80	4.00	19.87	5.87	4.98	5.42	6.14	35.66
13.	MBG-1058	37.00	73.00	24.13	4.60*	7.67*	4.80*	28.33*	6.60*	4.91	5.16	5.44	36.59
14.	PU-31	34.33*	69.67	22.87	3.87	7.07	4.07	20.47	6.47	4.59	5.46	5.71	40.75
15.	VBG-10-010	33.67*	72.33	18.33	3.93	5.33	4.00	18.93	6.13	4.57	4.62	4.28	38.32
16.	MBG-1061	38.67	74.33	26.23	3.07	4.93	4.27	17.00	6.13	4.88	5.86	4.07	28.91
17.	UG-708	35.67*	68.67*	21.37	3.80	6.13	4.33	18.07	5.87	4.46	5.12	4.88	44.77
18.	VBN-4	39.00	71.67	20.77	3.80	4.27	4.00	12.87	5.73	4.45	5.63	3.67	32.43
19.	MBG-1051	39.67	73.33	26.33	3.80	5.93	4.40	16.27	6.80*	5.31*	6.40*	4.18	28.90
20.	TU-94-2	35.33*	70.00	24.30	3.47	7.67*	4.60	20.67	6.60*	4.56	5.72	5.79*	39.76
21.	P-728	36.00	72.00	21.80	3.47	7.00	4.20	19.27	6.00	4.60	5.75	3.78	38.40
22.	WBG-26	37.67	72.00	22.97	2.73	5.27	3.67	17.20	6.27	4.65	5.24	4.04	39.83
23.	LBG-22	39.67	72.67	25.10	3.57	5.80	3.87	20.40	5.27	4.57	5.65	5.21	38.83
24.	LBG-787	37.00	73.00	24.17	2.70	6.00	3.93	16.87	5.53	4.75	5.85	3.87	29.93
25.	LBG-752	34.67*	71.33	24.43	3.07	5.27	3.87	16.60	6.93*	4.72	5.56	4.00	34.43

Cont...

Table 2. Cont...

S. No.	Genotypes	DFF	DM	PH	NPB	NCP	NPC	NPP	NSP	PL	100 SW	SYP	HI
26.	TU-67	38.33	69.67	23.03	3.47	4.07	4.27	16.33	6.07	4.53	4.81	3.50	48.53
27.	MBG-223	36.67	69.00*	19.80	2.73	4.00	4.33	14.67	6.33	4.99	5.79	3.50	34.86
28.	P-112	34.33*	68.33*	20.30	3.07	5.67	4.40	21.80	5.33	4.44	4.31	4.90	42.80
29.	LBG-709	37.67	72.67	23.30	3.90	6.13	4.00	17.33	6.67*	4.95	6.02	4.65	34.09
30.	MBG-1050	39.33	72.67	23.77	3.93	5.33	4.27	18.47	6.40	4.89	5.50	4.13	34.32
31.	RVSU-60	36.67	70.67	24.20	3.93	6.27	4.07	21.80	5.27	4.67	5.53	5.01	34.02
32.	LBG-648	41.00	80.33	41.25*	4.13*	7.00	3.07	17.93	6.80*	5.36*	5.41	5.03	24.56
33.	LBG-645	41.00	78.00	41.77*	3.93	7.60*	3.67	21.67	6.93*	5.05*	4.83	6.43*	35.78
34.	LBG-20	37.00	71.67	27.77	3.67	6.93	3.87	20.07	5.20	4.53	6.19*	5.77*	38.08
35.	VBG-11-31	36.33	68.67	22.83	3.60	4.87	4.40	17.53	5.27	4.97	4.71	3.94	37.22
	General Mean	**36.97**	**71.51**	**23.71**	**3.59**	**5.89**	**4.15**	**19.04**	**6.10**	**4.71**	**5.36**	**4.73**	**37.96**
	Minimum	**33.67**	**68.33**	**17.97**	**1.73**	**4.00**	**3.07**	**12.87**	**5.20**	**4.23**	**4.31**	**3.50**	**24.56**
	Maximum	**41.00**	**80.33**	**41.77**	**4.60**	**7.67**	**4.80**	**28.33**	**6.93**	**5.36**	**6.40**	**6.43**	**49.13**
	C.D. 5%	**1.10**	**1.92**	**6.81**	**0.49**	**1.44**	**0.65**	**5.58**	**0.48**	**0.33**	**0.70**	**1.04**	**10.78**
	S.E. (d)	**0.55**	**0.96**	**3.41**	**0.25**	**0.72**	**0.33**	**2.79**	**0.24**	**0.16**	**0.35**	**0.52**	**5.40**
	S.E. (m)	**0.39**	**0.67**	**2.37**	**0.17**	**0.50**	**0.23**	**1.94**	**0.17**	**0.11**	**0.24**	**0.36**	**3.77**
	C.V. (%)	**1.83**	**1.64**	**17.62**	**8.38**	**15.03**	**9.66**	**17.98**	**4.86**	**4.27**	**8.00**	**13.52**	**17.43**

DFF: Days to 50 % flowering, **DM:** Days to maturity, **PH:** Plant height (cm), **NPBP:** Number of primary branches per plant, **NCP:** Number of clusters per plant, **NPC:** Number of pods per cluster, **NPP:** Number of pods per plant, **PL:** Pod length (cm), N**SP:** Number of seeds per pod, **100 SW:** 100 seed weight (g), **SYP:** Seed yield per plant (g) and **HI:** Harvest index (%).

genotypes MBG 1058 (4.60), whereas the lesser number was registered by IPU-10-4 (1.73). A significantly greater number of primary branches per plant than the general mean of the genotypes (3.59) was shown by four genotypes.

5. Number of Clusters per Plant

Maximum number of clusters per plant was recorded by the genotypes MBG 1058 and TU-94-2 (7.67), while it was minimum in MBG 223 (4.00). Three genotypes significantly surpassed the general mean (5.89) of the genotypes.

6. Number of Pods per Cluster

The difference for this trait was between 3.07 to 4.80 with a general mean of 4.15. Among the genotypes, more or less number of pods per cluster was registered by MBG 1058 (4.80) and LBG 648(3.07). One genotype showed significantly greater number of pods per cluster than the general mean (4.15).

7. Number of Pods per Plant

Number of pods per plant ranged from 12.87 to 28.33. MBG 1058 (28.33) registered maximum number of pods per plant, whereas VBN 4 recorded a minimum (12.87) number of pods per plant. Two genotypes significantly excelled the general mean (19.04).

8. Number of Seeds per Pod

Number of seeds per pod was highest in the genotypes LBG 645 (6.93), LBG 752 (6.93) and lowest in LBG 20 (5.20). Eight genotypes exhibited a significantly greater number of seeds per pod when compared to the general mean (6.10).

9. Pod Length (cm)

The genotype, COBG 653 (4.23 cm) registered the shortest pod length while LBG 648 (5.36 cm) was found to be the longest. Four genotypes were significantly longer in length when compared to the general mean (4.71 cm).

10. 100 Seed Weight (g)

Among 35 genotypes, MBG 1051 recorded the maximum 100 seed weight (6.40 g), while P 112 had the minimum 100 seed weight (4.31 g). The general mean of 5.36 g was significantly exceeded by two genotypes for 100 seed weight.

11. Seed Yield per Plant (g)

Seed yield per plant ranged from 3.50g to 6.43 g with a general mean of 4.73g. Out of 35 genotypes tested, LBG 645 recorded the highest seed yield (6.43 g), whereas MBG 223 and TU 67 registered the lowest seed yield per plant (3.50 g). Three genotypes put forth significantly higher seed yield per plant than general mean.

12. Harvest Index (%)

The maximum and minimum harvest index was observed in SB-25-19 (49.13%.) and LBG 648 (24.56%) respectively. One out of 35 genotypes were found to exhibit significantly higher harvest index than that of the general mean (37.96%). In any plant breeding programme for developing high yielding varieties or hybrids the basic need is the choice of parents with high mean values as they are expected to produce desirable segregants upon crossing (Gilbert, 1958). Hence, selection of the genotypes with high *per se* performance are to be identified first for each of the traits under study, aimed towards development of high yielding blackgram varieties.

A perusal of mean values in the present investigation revealed that the genotypes P-112 followed by COBG-653, SB-25-19, UG-708 and VBG-11-6 were earliest to flower as well as earliest to mature. These genotypes may provide useful genetic variability in breeding programs aimed at developing short duration blackgram varieties.

Considering the plant height, the genotypes LBG-645 was the tallest followed by LBG-648, LBG-20, KDRS-136 and NDU-11-204. Similarly, higher number of primary branches per plant registered for the genotypes MBG-1058, P-1032, KDRS-136, LBG-648 and VBG-11-6. The genotypes with tall height and more primary branches per plant would produce increased number of clusters and number of pods per plant thereby seed yield per plant will be increased. Hence, these genotypes could be utilized in future breeding programme for improving these traits.

In blackgram, the seed yield mainly depends on the contribution of yield determining characters and among them, number of clusters per plant, number of pods per plant, number of pods per cluster and number of seeds per pod are very important. Plant types with more number of above said traits usually produce higher yields. In the present study, the genotypes TU-94-2, MBG-1058, LBG-645, KDRS-136, and P-726 registered more number of clusters per plant. Similarly, the genotypes MBG-1058, IPU-10-4, TU-94-2, COBG-653 and TBG-104 for number of pods per cluster; the genotypes MBG-1058, IPU-10-4, KDRS-136, P-112 and RVSU-60 for number of pods per plant and the genotypes LBG-645, LBG-752, LBG-648, MBG-1051 and KDRS-136 for number of seeds per pod registered superior performance. Hence, these genotypes have the maximum potential for utilization in hybridization programme to improve the seed yield in blackgram.

Hundred seed weight is one of the important attributes among the seed yield components as it has greater contribution towards seed yield. Higher test weight was registered by MBG-1051 followed by LBG-20, LBG-709, MBG-1061 and LBG-787. Hence, these genotypes could be utilized in future breeding programme for improving this trait.

Higher yield potential of genotypes is mainly attributed to increased biomass coupled with enhanced harvest index. The genotype SB-25-19 recorded the highest *per se* for harvest index followed by TU-67, PU-205, VBN-7, UG-708. Hence, these genotypes could be exploited for higher yield coupled with higher harvest index.

The ultimate aim of any breeding programme is to improve the yield and hence the breeding procedures have to be carefully formulated to increase the potentiality of this complex character. Among the genotypes, LBG-645 recorded high mean for seed yield per plant followed by P-1032, TU-94-2, LBG-20 and PU-31 suggesting that these genotypes might be successfully exploited for blackgram yield improvement.

Based on the overall mean performance of genotypes, several genotypes showed high mean performance for more than one traits. Among the genotypes, LBG-645 and MBG-1058 registered high *per se* for seven yield attributes *viz.,* plant height, number of seeds per pod, number of primary branches per plant, number of clusters per plant and number of pods per plant, pod length and seed yield per plant. The next best genotype was TU-94-2 as it showed high *per se* for six yield traits *viz.,* number of clusters per plant, number of pods per plant, number of seeds per pod, 100 seed weight and seed yield per plant. hence, these genotypes could be utilized for the development of high yielding blackgram varieties. Further, PU-31 exhibited high *per se* for five yield and yield attributing traits *viz.,* number of clusters per plant, number of pods per plant, number of seeds per pod, seed yield per plant, harvest index and low *per se* for days to 50 per cent flowering. Similarly, P-1032 showed high *per se* for three yield and its attributing traits *viz.,* number of primary branches per plant, pod length, seed yield per plant and low *per se* for days to maturity Hence, these genotypes could be well exploited as donors for development of short duration blackgram genotypes along with high yield. Bharathi (2019) and Kalpana (2021) reported several genotypes showed high mean performance for more than one traits including yield and yield attributes in blackgram.

From the foregoing discussion based on *per se*, it could be concluded that the genotypes LBG-645, MBG-1058 and TU-94-2 were adjudged as the best genotypes for improving yield, while the genotypes PU-31 and P-1032 for improving yield and yield attributes coupled with early maturing traits in blackgram.

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