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STABILITY FOR SEED YIELD IN BLACK GRAM (*VIGNA MUNGO* L. HEPPER)

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ABSTRACT

Thirty five black gram genotypes were evaluated over three diverse environments to identify stable genotypes for nine different characters in black gram. The stability analysis of variances of mean data revealed that the significant pooled deviation for all the traits except days to first flowering, number of pods per cluster and hundred seed weight indicated predominance of nonlinear component. Estimates for stability parameters revealed that no genotypes were stable for all traits studied. The genotypes LBG 623, RU 8709, COBG 683 and HG 157 were found to have non-significant deviation from regression and around the unity regression coefficient along with desirable mean value for the trait seed yield per plant. These genotypes said to be suitable for both unfavourable/ high input and favourable/ low input environments for the trait seed yield per plant.

INTRODUCTION

Black gram / Urd bean (*Vigna mungo* L. Hepper) is grown in various regions of India and cover practically all agro ecological zones. There are various genotypes of black gram having varying yield potential. The performance of genotypes keeps changing in varying environmental conditions. The genotypic and environmental interactions are usually present under all conditions in purelines, hybrids, synthetics or any other material used for breeding, which complicated the breeding work and forbid the progress of the crop improvement programmes (Eberhart and Russel, 1966). Thus, it is incumbent to study the performance of a crop over several or a wide range of environments. Such genotypes will be very useful for utilizing their potential for the development of stable and high yielding varieties.

MATERIAL AND METHODS

Thirty five genotypes of black gram were evaluated in RBD with three replication under three diverse environments E_1: Environmental 1 (January, 2010), E_2: Environment 2 (August 2010) and E_3: Environment 3 (January, 2011) for seed yield per plant mean values of five randomly selected plants from each replication were used for statistical analysis. Observations were recorded for nine characters viz., days to first flowering , plant height (cm), number of branches per plant, number of clusters per plant, number of pods per cluster, number of pods per plant, number of seeds per plant, hundred seed weight (g) and seed yield per plant (g). Statistical constants of mean for all the characters, regression coefficient (bi) and deviation from regression (s^2di) for the characters where G X E interactions was significant, was estimated by following the method proposed by Eberhart and Russel (1966).

RESULTS AND DISCUSSION

The pooled analysis of variance (Table 1) revealed that higher significant differences existed among the genotypes (G) for all the traits except number of branches per plant, number of pods per cluster, number of seeds per pod and hundred seed weight. Highly significant differences were observed over environments for traits namely, plant height, number of branches per plant, number of cluster per plant, number pods per cluster, number pods per plant and seed yield per plant indicated the divergence among growing environments. The linear contribution of the highly significant mean square due to environment for the traits plant height, number of clusters per plant, number of pods per cluster, number of pods per plant and seed yield per plant. The mean square due to G X E interaction (linear) was also important for plant height, number of branches per plant, number of clusters per plant, number of pods per plant and seed yield per plant indicated that a considerable proportion of genotype X environment interaction was contributed by the linear component highly significant mean squares was observed for pooled deviation for all the characters except days to first flowering, number of pods per cluster and hundred seed weight revealing the importance of non linear component accounting for total G X E interaction for these characters. The highly significant effect of genotype

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Table 1 Analysis of variance on stability parameters of black gram for nine characters studied

Source	Df	MSS								
		Days to first flowering	**Plant height**	**Number of branches per plant**	**Number of clusters per plant**	**Number of pods per cluster**	**Number of pods per plant**	**Number of seeds per pod**	**Hundred seed weight**	**Seed yield per plant**
Genotypes (G)	34	5.28**	88.97**	0.39	22.13**	0.86	87.77**	1.04	0.20	10.11**
Environment(E)	2	0.20	250.78**	9.55**	26.12**	3.04*	224.67**	1.08	0.11	17.17**
G × E	68	0.69	27.92**	6.95**	17.89**	0.15	12.37**	0.25	0.08	0.73
Env + (G×E)	70	0.67	34.29**	7.02**	18.13**	0.14	18.44**	0.28	8.42**	1.20
Env (linear)	1	0.40	501.56**	0.19	52.24**	6.08*	449.35**	2.16	0.23	34.34**
G×E (linear)	34	0.63	40.62**	5.14**	31.14**	7.21**	16.54**	0.41	0.13	2.18**
Pooled deviation	35	0.73	14.78**	8.50**	4.50**	0.22	7.97**	9.44**	0.03	2.28**
Pooled error	204	0.76	4.63	9.27	38.78	1.07	1.70	1.46	6.84	3.13
Total	314									

* Significant at 5% level
** Significant at 1% level

Table 2 Performance of stable genotype with non-significant S^2di and around the unity bi for various traits

S.No.	Traits	Genotype	Mean
		LBG 752	32.82
1	Days to first flowering (days)	RU 8702	34.62
		IC 214843	38.78
2	Plant height (cm)	RU 8708	34.31
		HG 157	29.64**
3	Number of branches per plant	COBG 683	2.27
		LBG 623	11.52
4	Number of clusters per plant	RU 8709	9.04
		RU 8708	12.09**
		LBG 623	2.20
5	Number of pods per cluster	RU 8708	2.96
		HG 157	2.72
6	Number of pods per plant	HG 157	25.34
		LBG 623	4.82
7	Number of seeds per pod	RU 8709	4.38
		COBG 683	4.56
8	Hundred seed weight (g)	RU 8709	5.03
		RU 8708	5.36**
		HG 157	5.08
		LBG 623	14.17**
9	Seed yield per plant (g)	RU 8709	11.81**
		COBG 683	10.39**
		HG 157	13.94**

Table 3 Performance of stable genotypes (seed yield per plant) for other traits

Traits	LBG 623	HG 157	RU 8709	COBG 683
Days to first flowering (days)	-	-	-	-
Plant height (cm)	-	stable		
Number of branches per plant	-	-	-	stable
Number of clusters per plant	stable		stable	-
Number of pods per cluster	stable	stable	-	-
Number of pods per plant	-	stable	-	-
Number of seeds per pod	stable	-	stable	stable
Hundred seed weight (g)	-	stable	stable	-

X environment for all the characters indicated differential response of genotypes to various environments. Therefore, the genotypes must be tested over an extensive range of environments for proper assessment where these are to be ultimately grown for commercial purposes. Similar findings were also reported by Abbas *et al.*, 2008 in black gram with different set of genotypes.

The mean performance of a genotype along with two parameters viz., regression coefficient (bi) and deviation from regression (S^2di) considered simultaneously representing a measure of adaptability of the genotype. A genotype with desirable mean, deviation from regression line ($S^2di = 0$) not significantly deviating from zero and unit regression coefficient (bi = 1) not significantly deviating from 1 is said to be average responsive and suitable for all the environments. The genotypes LBG 623 (14.17 g), HG 157 (13.94), RU 8709 (11.81 g) and COBG 683 (10.39 g) were considered as best adapted genotypes for all the environments for seed yield per plant (Table 2). The genotype LBG 623 showed stable performance for the traits namely number of clusters per plant, number of pods per cluster and number of seeds per pod. The genotype HG 157 showed stable performance for the traits namely plant height, number of` pods per cluster, number of pods per plant and hundred seed weight. The genotype RU 8709 showed stable performance for the traits namely number of clusters per plant, number of seeds per pod and hundred seed weight. The genotype

Table 4 The genotypes suitable for favourable environment with non-significant S^2di and more than the unity bi for various traits

S.No	Characters	Genotype	Mean
1	Days to first flowering (days)	RU 8711	33.50
		RU 8701	33.27
		COBG 683	34.03
		TMV 1	36.53
		ADT-3	34.52
		RU 8703	35.57
		VBN 5	43.93
2	Plant height (cm)	NIRMAL-7	36.55*
		COBG 647	41.16
		RU 8704	36.61*
		RU 8703	41.10
3	Number of branches per plant	COBG 662	2.75**
		T9	2.45
		IC 10703	2.87**
		IC 214843	2.03
		VBN 05-02	2.59
		RU 8709	2.52
		RU 8702	2.14
		COBG 647	2.09
		VBG 05-014	2.37
		KKB 05001	2.98**
4	Number of clusters per plant	VBN 5	12.98**
		KKB 05016	11.57*
		TAU 1	9.54
		VBN 4	12.43**
		VBN 3	9.67
		COBG 683	11.44*
		TMV 1	14.08**
		COBG 662	2.56
5	Number of pods per cluster	VBN 5	2.37
		IC 10703	2.63
		TAU 1	2.55
		VBN 4	3.18**
		RU 8704	3.01*
6	Number of pods per plant	VBN 5	35.38**
		TAU 1	28.85**
		VBN 4	27.73
7	Number of seeds per pod	NIRMAL-7	4.02
8	Hundred seed weight (g)	T9	5.00
		RU 8711	5.02
		COBG 653	4.12
		ADT-3	10.48
9	Seed yield per plant (g)	VBN 5	14.06**
		VBG 05-014	11.70**

COBG 683 showed stable performance for the traits namely number of branches per plant and number of seeds per pod respectively (Table 3)

A genotype with desirable mean, deviation not significantly deviating from zero and significant unit regression coefficient value (bi>1) is said to be highly responsive suitable for favourable environments (table 4). The genotype VBN 5 and VBG 5-014 had significant mean value with non-significant S^2di value and significant regression coefficient value (bi>1). The genotype VBN 5 showed non- significant deviation from regression and regression coefficient as more than the unity for other characters namely, plant height, number of clusters per plant, number of pods per cluster and number of pods per plant. The genotype VBG 5-014 showed non-significant deviation from regression and regression coefficient as more than the unity for the trait number of branches per plant.

Table 5 The genotypes suitable for unfavourable environment with non-significant S^2di and less than the unity bi for various traits

S.No.	Traits	Genotype	Mean
1	Days to first flowering (days)	COBG 662	31.11**
		T9	33.74
		IC 10703	37.55
		IC 669	43.12
2	Plant height (cm)	ADT-3	33.50**
		VBG 05-008	42.73
		KKB 20055	30.93**
3	Number of branches per plant	LBG 623	2.71**
		T9	10.25
		IC 10703	12.47**
		VBG 05-008	9.59
4	Number of clusters per plant	COBG 647	7.68
		RU 8704	13.58**
		KKB 20055	12.79**
		T9	2.87
5	Number of pods per cluster	RU 8706	2.88
		VBG 05-014	31.21**
6	Number of pods per plant	RU 8704	35.26**
		IC 214843	4.26
7	Number of seeds per pod	KKB 05016	4.11
		TAU 1	6.06**
		TAU 1	4.81
8	Hundred seed weight (g)	LBG 752	4.79
		NIRMAL-7	4.87
		KKB 20055	5.53**
		T9	10.12*
9	Seed yield per plant (g)	TMV-1	8.27
		RU 8702	9.58
		RU 8704	10.25**

A genotype with desirable mean, deviation not significantly deviating from zero and significant unit regression coefficient value (bi<1) is said to be low responsive suitable for unfavourable environments (table 5). The genotype T9 and RU 8704 had significant mean value with non-significant S^2di value and significant regression coefficient value (bi<1). These genotypes were suitable for unfavourable or poor environments. The genotype T9 showed non- significant deviation from regression and regression coefficient as less than the unity for other characters namely, plant height, number of clusters per plant and number of pods per cluster. The genotype RU 8704 showed non- significant deviation from regression and regression coefficient as less than the unity for number of clusters per pod and number of pods per plant.

The results suggested that no single genotype was stable for all the traits studied. On the basis of mean performance and stability parameters, the genotypes namely LBG 623, HG 157, RU 8709 and COBG 683 were considered as stable one. These genotypes may be recommended for commercial cultivation or used as parent in crossing programme aimed at breeding a high yielding variety with general adaptability.

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