Journal of Crop and Weed 8(1): 111-113 (2012)

Stability analysis of black gram [*Vigna mungo* (L.) Hepper] in summer season

R. B. RAMAN AND S. P. SINHAMAHAPATRA

Department of Plant Breeding,
Bidhan Chandra Krishi Viswavidyalaya
Mohanpur-741252, Nadia, West Bengal

Received: 08.03.2011, Revised: 23.04.2012, Accepted : 25.05.2012

ABSTRACT

An experiment was conducted at Instructional Farm of BCKV, Mohanpur, West Bengal with five genotypes of black gram during summer season of 2007 and 2008. The six environments were created through two row spacing and application of nitrogen. Here, the dwarf determinate genotype VK-6 exhibited the highest seed yield per plant (2.87 g) and yield plot^{-1} (60.53 g) among six environments followed by VK 1, Sarada, T-9 and VK-3. The stability parameters in respect to yield attributing traits revealed that VK-6, Sarada, VK-3 and T-9 for harvest index, T- 9 and Sarada for seeds per pods, VK-3 for pods per plant, VK-1 and VK-3 for number of branches per plant was recorded stable performance over the environments having regression coefficient near to unity and deviation from regression around zero.

Key words: Adaptability, environment, genotype, interaction, seed yield, stability

Yield improvement has always been an important objective for plant breeders although seed yield with stable performance of genotypes is a complex trait influenced by several components. In addition to cultivate in sub-marginal lands and poor crop management, low yield potential of the cultivars is a major factor of low productivity of the crop. Though several improved varieties in the crop have been developed, most of them show inconsistent performance under varied environmental conditions due to genotype-environment interaction. Finlay and Wilkinson (1963) have suggested use of linear regression (b_i) as a measure of stability of genotypes, while Eberhart and Russell (1966) have emphasized the need for considering both linear (b_i) and non-linear (S^2 d) components of genotype (G) – environment (E) interaction for judging phenotypic stability of genotypes. It is estimated that the population of the country would be touching the level of 1.350 million by 2020 AD and our minimum pulse requirements by then would be around 30.3 million tonnes. In spite of the importance of these pulse crops in our daily diet and agriculture, the production of these pulse crops in general and urdbean in particular has not yet increased proportionately with the increase in cereal production. This is due to lack of high yielding varieties, low harvest index, high susceptibility to disease and insect pests, flower drop, indeterminate growth habit of most of the varieties, poor response to input and instability in performances. Grain legumes play an important role in meeting the requirements of dietary protein in India. Pulses are sometimes referred to as the poor man's meat and rich man's vegetable. Among pulses, black gram is one of the important grain legumes contains 24.83% protein, 66.0 % carbohydrate, 1.46% fat, 4.12% crude fiber, 3.58% total ash and 9.3% moisture. The pulse protein is rich in lysine and poor in sulphur containing amino acids like methionine and cysteine particularly black gram protein is rich in the valuable amino acid lysine (7.2%). It is also clear that the pulses offer the most practical means of eradicating protein malnutrition especially among children and nursing mother (Jeswani and Baldev, 1990).

MATERIALS AND METHODS

An experiment was conducted at Instructional Farm of Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal. Five genotypes were tested in two row spacing's (25cm and 15cm) and replicated thrice in split-plot design in 2007 and next year with two row spacing (25cm and 15cm) and two levels of nitrogen (20 kg ha^{-1} and 40 kg ha^{-1}) in split-split plot design. The genotypes of black gram *viz.*, VK-1 (cross derivative of WB-16 and T-9), Sarada (check), VK-3 (cross directive of LU-9 and LBG-623), T-9 (check) and VK-6 (dwarf determinate selection") were used in the present experiment. The data were analysed and the linear and non linear components of genotype (G) environment (E) interaction were calculated by using Eberhart and Russell (1966) methods.

RESULTS AND DISCUSSION

The Analysis of variance (Table 1) revealed that the genotypes, interaction between genotypes and environment and linear effects of environments was highly significant for all the characters but highest differences within genotypes found on plot yield followed by harvest index and pods per plant. Environment was significant for all the characters except no. of branches per plant.

Email: raman.agri02@gmail.com

Table 1 : Analysis of variance for seed yield and yield components in black gram

Source	d.f.	MS					
		Branches plant^{-1}	Pods plant^{-1}	Seeds pod^{-1}	Harvest index	Seed yield plant^{-1}	Plot yield
Genotypes (G)	4	3.38 **	249.95 **	0.08 *	266.56 **	0.72 **	291.14 **
Environments(E)	5	0.18	28.73 **	0.17 **	435.67 **	6.16 **	1000.52 **
G X E	20	0.07 **	15.68 **	0.04 **	18.76 **	0.13 *	168.40 **
E + (G X E)	25	0.09	18.29	0.06 **	102.14 **	1.33 **	334.82 *
E (Linear)	1	0.92 **	143.64 **	0.85 **	2178.38 **	30.82 **	5000.62 **
G X E (Linear)	4	0.07	10.77	0.12 **	22.11	0.04	73.16
Pooled Deviation	20	0.05	13.53	0.02	14.33	0.12	153.77
G_1	2	0.13 **	16.65 **	0.04	24.79 **	0.13	468.89 **
G_2	2	0.04	14.04 **	0.00	9.27	0.10	60.69 **
G_3	2	0.04	24.10 **	0.03	8.89	0.12	146.90 **
G_4	2	0.05	8.96 **	0.00	10.66	0.04	52.14 **
G_5	2	0.00	3.88 *	0.00	18.05 *	0.19 *	40.23 **
Pooled Error	60	0.02	1.24	0.01	5.56	0.07	0.85

*Note: *, ** Significant at 5% and 1% level of probablity, respectively*

Table 2: Mean and stability parameters of yield and yield components in black gram

Genotypes	Branches plant^{-1}			Pods plant^{-1}			Seeds pod^{-1}			Harvest index			Seed yield plant^{-1}			Plot yield		
	$\bar{X}$	bi	s^2d	$\bar{X}$	bi	s^2d	$\bar{X}$	bi	s^2d	$\bar{X}$	Bi	s^2d	$\bar{X}$	bi	s^2d	$\bar{X}$	bi	s^2d
VK-1	1.95	1.11	0.10	27.22	0.22	15.41	6.20	1.40	0.02	29.95	1.45	19.22	2.59	1.10	0.07	56.89	0.58	468.04
Sarada	2.09	1.83	0.02	31.10	1.55	12.78	6.41	1.33	-0.01	21.93	0.97	3.70	2.19	0.91	0.03	50.15	1.08	59.84
VK-3	2.21	1.31	0.02	34.01	1.02	22.86	6.43	1.77	0.01	18.45	0.98	3.31	2.07	1.00	0.05	42.74	0.98	146.05
T- 9	1.91	0.43	0.02	31.64	1.64	7.72	6.23	0.93	-0.01	23.44	1.25	5.08	2.14	1.07	-0.02	49.11	1.34	51.29
VK- 6	0.38	0.32	-0.02	27.63	0.57	2.64	6.44	-0.44	-0.01	35.07	0.65	12.48	2.87	0.92	0.13	60.53	1.01	39.38
Mean	**1.71**	**1.00**	-	**30.32**	**1.00**	-	**6.34**	**1.00**	-	**25.77**	**1.00**	-	**2.37**	**1.00**	-	**51.88**	**1.00**	-
SEm (±)	**0.08**		-	**0.64**		-	**0.06**		-	**1.36**		-	**0.15**		-	**0.53**		-
LSD (0.05)	**0.23**			**1.82**			**0.16**			**3.86**			**0.43**			**1.51**		

The highly significant M.S. value due to environments revealed wide diversity in the environment which may be attributed to different plant density and doses of nitrogen. The highly significant G × E and E + (G × E) interaction indicated differential performance of the genotypes under varied environmental conditions. The M.S. due to environment (linear) has highly significant

Mean performance and stability parameters for grain yield and its components traits are presented in table- 2. The genotype VK-6 exhibited the highest seed yield per plant (2.87 g) and plot yield (60.53 g) over all six environments followed by VK-1, Sarada, T-9 and VK-3. The magnitude of regression coefficient and deviation from regression varied amongst genotypes indicating that genotypes were responsive towards environmental variation. The highest yielding genotype VK-6 recorded regression coefficient nearly to one and deviation from regression around zero and least for seed yield per plant and plot yield respectively indicating not only their wider adaptability and higher seed yield over a wide range of environmental condition but also stability under wider density of plant populations and lower management conditions. The adverse conditions under poor environment and wider density identified the high yielding lines suitable for poor environments, wider density as well as improved environments and closer densities. This genotype may be recommended for general cultivation to impart grain yield sustainability. The stability parameters in respect to yield attributing traits revealed that VK-6, Sarada, VK-3 and T-9 for harvest index, T-9 and Sarada for seeds per pods, VK-3 for pods per plant and VK-1 and VK-3 for number of branches per plant was recorded stable performance over the environments having regression coefficient near to unity and deviation from regression around zero. An ideal genotype is one which has high mean performance, average responsiveness to environment (b_i=1) and least indicating considerable bearing of environment on plot yield, harvest index and pods per plant. Plot yield and pods per plant has significant effect within the genotypes under all the environmental conditions. The G × E interaction was highly significant for seed yield/plant and water absorption (g g^{-1} seeds). The environment (linear) components were significant for all the characters (Ram *et al.,* 2009).

deviation from regression (S^2d) indicating stability of yield (Eberhart and Russell, 1966).

Considering the above discussion the genotype VK 6 was recorded superiority over environments with good yield per plant as well as per plot. This genotype has capacity to give stable yield performance even in poor and low input levels with average responsiveness to environment and stability based on Eberhart and Russell (1966) model. So this genotype (VK-6) could be recommended for large scale cultivation to obtain higher yield and stable segregants these genotype may also be used in further breeding programmes.

REFERENCES

Bilbro, S. D. and Ray, L. L. 1976. Environmental stability and adaptation of several cotton cultivars. *Crop Sci.*, **16**: 821-24.

Eberhart, S. A. and Russell, W. A. 1966. Stability parameters for comparing varieties. *Crop Sci.*, **6**:36-40.

Finlay, K.W. and Wilkinson, G. N. 1963. The analysis of adaptation in plant breeding program. *Australian J. Agric. Res.*, **17**: 747-54.

Jeswani, L. M. and Baldev, B. 1990. *Advances in Pulse Production Technology*, pp. 2-3.

Ram, B., Tikka, S. B. S. and Mahla, H. R. 2009. Stability of seed yield and quality characters in blackgram (*Vigna mungo*). *Indian J. Agric. Sci.*, **79**: 654-57.