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Research Article

ASSESSMENT OF GENETIC VARIABILITY OF THE MAIN YIELD RELATED CHARACTERS IN SOYBEAN

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ABSTRACT
An experiment was conducted during *Kharif* 2011 in 12 soybean genotypes. The data were recorded for 13 yield component traits to study genetic variability, heritability, and genetic advance analysis. Analysis of variance among 12 genotypes showed highly significant differences for all the characters except the number of grain per plant indicated the presence of substantial amount of genetic variability. On the basis of mean performance the highest yield per plant observed in NRC-86. Highest Phenotypic Coefficient of Variation (PCV) was observed in 13 yield component traits for seed yield per hectare, seed yield per plant and number of pod per plant and Genotypic Coefficient of Variation (GCV) was observed in 13 yield component traits for number of pod per plant, seed yield per hectare and seed yield per plant indicating that these characters could used as selection for crop improvement. High estimate of heritability in 13 yield component traits were observed for days to maturity, number of pod per plant and plant height. High genetic advance in 13 yield component traits were observed for number of pod per plant, days to maturity and plant height. High genetic advance percent of mean in 13 yield component traits was observed for number of pod per plant, seed yield per hectare and seed yield per plant.

***Keywords*:** *Soybean, genetic variability, heritability, genetic advance*

INTRODUCTION
Soybean (*Glycine max* (L.) Merril) is a member of Fabaceae family and believed to have originated in Northeastern China and distributed in Asia, USA, Brazil, Argentina etc. This crop is aptly called as "Golden Bean" or "Miracle crop" of the 20th century, because of its multiple uses. Soybean besides having high yielding potential (40-45 q/ha) also provides cholesterol free oil (20%) and high quality protein (40%). Soybean occupies a premier position among crops, being the most important source of both protein concentrates and vegetable oil. As a legume it is capable of utilizing atmospheric nitrogen through biological nitrogen fixation and is therefore much less dependent on synthetic nitrogenous fertilizers than most non-legume crops. In addition, since the introduction of soybean into crop rotations often break the building up of pests and diseases in cereals. Collection of genotypes and assessment of genetic variability is a basic step in any crop improvement programme. Yield being a complex character is influenced by a number of high yield contributing characters controlled by polygenes and also influenced by the environment. Hence, it becomes necessary to partition the observed variability into heritable and non-heritable components measured as genotypic and phenotypic coefficients of variation (GCV and PCV), heritability and genetic advance.

MATERIALS AND METHODS
The experimental material consisting 9 soybean genotype received from Directorate of Soybean Research, Indore and 3 released cultivars used as check varieties namely Bragg, SL-525, and PS-1042, during *Kharif* 2011.The experiment was laid down in Randomized Block Design with 12 genotypes including check variety. The genotypes were replicated thrice each genotype was grown in a plot of size 5 X 2.25 square meter. 13 yield component traits studied is presented in detail (table 1) *viz.* days to initial flowering, days to 50% flowering, number of pods per plant, pod length, number of branches per plant, plant height, days to maturity, number of grain per pod, 100 grain weight, biological yield per plant, harvest index, seed yield per plant and seed yield per hectare. Observations for all traits were recorded on

five randomly selected competitive plants from each replication. Reading from five plants was averaged replication wise and the mean data was used for statistical analysis, where observations were recorded on the plot basis.

Table 1: Analysis of variance for 13 yield component traits in 12 soybean genotypes during *Kharif*-2011

S. No.	Characters	Mean sum of square		
		Replication (df=2)	Treatment (df=11)	Error (df=22)
1.	Days to initial flowering	0.01	31.58*	0.87
2	Days to 50% flowering	0.19	23.80*	1.37
3.	Plant height	6.11	145.18*	3.13
4.	Number of branches per plant	0.01	5.84*	0.82
5.	Number of pods per plant	0.82	507.60*	3.43
6.	Pod length	0.01	0.13*	0.03
7.	Days to maturity	0.44	199.68*	0.98
8.	Number of grains per pod	0.01	0.01	0.06
9.	Biological yield per plant	4.07	52.66*	6.80
10.	Harvest index	42.24	194.86*	29.06
11.	100 grain weight	0.22	1.39*	0.34
12.	Seed yield per plant	3.83	11.39*	1.24
13.	Seed yield per hectare	17.80	50.96*	5.40

**Significant at 5% level of significance*

RESULTS AND DISSCUSSION

The analysis of variance for 13 yield traits in the present study revealed presence of highly significant variation among the genotypes except the number of grain per plant under study at 5 percent level of significance. The high variability observed might be attributed to their genetic makeup and the different geographical regions from which they have originated. The range for various characters has been reported in (table 1). It is interesting to compare the extent of variation observed in present study with that observed in a large number of collections. Results showed that, for the character days to initial flowering, days to 50% flowering, number of pods per plant, pod length, number of branches per plant, plant height, days to maturity, number of grain per pod, 100 grain weight, biological yield per plant, harvest index, seed yield per plant and seed yield per hectare studied is presented in detail (table 2).

The phenotypic coefficient of variation was higher than genotypic coefficient of variation for all 13 yield component traits. All the 12 genotypes showed wide range of variation for the traits *viz* days to initial flowering, days to 50% flowering, number of pods per plant, pod length, number of branches per plant, plant height, days to maturity, number of grain per pod, 100 grain weight, biological yield per plant, harvest index, seed yield per plant and seed yield per hectare studied is presented in detail (table 3). This variation indicated the scope for selection of these traits for further breeding work.

Table 2: Mean performance of soybean 12 genotypes for 13 yield component traits study during Kharif 2011

S. No.	Character	Days to initial flowering	Days to 50% flowering	Plant height (cm)	branches/ plant	pods/ plant	Pod length (cm)	Days to maturity	grains/ pod	Biological yield/ plant	Harvest index	100 grains weight (g)	Seed yield/ plant (g)	Seed yield/ hectare (q)
1.	PS-1477	40.33	43.33	48.23	11.33	**60.53**	4.06	84.66	2.66	18.66	29.27	7.79	5.46	11.48
2.	JS(SH)2003-8	43.00	46.00	42.41	12.13	25.80	3.73	101.33	2.66	15.46	34.48	8.42	5.26	11.06
3.	DS 15-2	**49.33**	**51.33**	43.54	13.26	20.66	3.96	**104.33**	2.66	11.60	37.82	7.47	4.33	9.10
4.	MAUS-449	43.66	46.66	48.88	14.00	35.73	3.47	101.33	2.53	16.46	35.98	7.74	5.93	12.46
5.	SL-778	40.66	45.33	41.17	14.06	29.20	3.74	95.00	2.60	18.53	25.53	**8.74**	4.60	9.66
6.	MACS-1311	42.66	44.66	35.39	14.36	19.73	3.84	83.66	2.60	7.06	30.33	7.39	2.13	4.48
7.	NRC-86	43.66	46.66	38.91	**15.53**	52.93	**4.14**	93.33	**2.73**	**23.93**	38.67	6.70	**9.20**	**19.32**
8.	CSB-08-09	49.33	51.33	**59.48**	15.25	36.13	3.54	95.00	2.60	17.53	33.76	7.50	6.03	12.67
9.	MACS1201	46.00	48.33	38.83	12.80	26.53	3.96	101.33	2.73	14.13	**46.01**	8.59	6.53	13.72
10.	PS-1347 [check-1]	44.00	46.66	38.28	11.56	21.43	3.95	84.33	2.66	12.86	21.54	7.64	2.86	5.72
11.	SL-525 [check-2]	40.33	43.33	33.94	11.93	21.73	3.99	84.66	2.63	16.80	18.13	6.46	3.06	6.44
12.	Bragg [check-3]	40.00	43.00	42.34	13.60	34.40	4.04	83.66	2.46	14.46	23.81	7.61	3.40	7.14
	Mean	**43.58**	**46.38**	**42.61**	**13.32**	**32.06**	**3.87**	**92.72**	**2.63**	**15.62**	**31.28**	**7.67**	**4.90**	**10.27**
	C.V.	2.15	2.52	4.15	6.80	5.77	4.59	1.07	3.06	16.69	17.23	7.69	22.74	22.63
	S.E.	0.54	0.67	1.02	0.52	1.06	0.10	0.57	0.04	1.50	3.11	0.34	0.64	1.34
	C.D. 5%	1.58	1.98	2.99	1.53	3.13	0.30	1.68	0.13	4.41	9.12	0.99	1.88	3.93
	Range Lowest	40.00	43.00	33.94	11.33	19.73	3.47	83.66	2.46	7.06	18.13	6.46	2.13	4.48
	Range Highest	49.33	51.33	S59.48	15.53	60.53	4.14	104.33	2.73	23.93	46.01	8.74	9.20	19.32

Table 3: Estimation of genetic parameters for 13 yield component traits in 12 soybean genotypes during *Kharif*- 2011

S. No.	Characters	σ^2g	σ^2p	σ^2e	GCV	PCV	ECV	h^2 (bs)%	GA	GA as percent of mean
1.	Days to initial flowering	10.23	11.11	0.87	7.34	7.64	2.15	92.10	6.32	14.51
2	Days to 50% flowering	7,47	8.85	1.37	5.89	6.41	2.52	84.50	5.17	11.15
3.	Plant height	47.38	50.48	3.13	16.14	16.67	4.15	93.80	13.72	32.20
4.	No. of branch per plant	1.67	2.49	0.82	9.71	11.86	6.80	67.10	2.18	16.39
5.	No. of pod per plant	168.05	171.49	3.43	40.42	40.83	5.77	98.00	26.43	82.43
6.	Pod length	0.03	0.06	0.03	4.73	6.59	4.59	51.50	0.27	7.00
7.	Days to maturity	66.23	67.22	0.99	8.77	8.84	1.07	98.50	16.64	17.94
8.	No. of grain per pod	0.01	0.01	0.07	2.33	3.85	3.06	36.70	0.07	2.91
9.	Biological yield	15.28	22.09	6.80	25.01	30.07	16.69	69.20	6.70	42.87
10.	Harvest index	55.27	84.33	29.06	23.76	29.35	17.23	65.50	12.39	39.63
11.	100 grain weight	0.35	0.69	0.34	7.70	10.88	7.69	50.10	0.86	11.23
12.	Seed yield per plant	3.38	4.62	1.24	37.51	43.87	22.74	73.10	3.24	66.09
13.	Seed yield per hector	15.18	20.59	5.40	37.94	44.18	22.63	73.80	6.89	67.13

Where, σ^2g = Genotypic variance
σ^2p = Phenotypic variance
GCV = Genotypic coefficient of variation
PCV = Phenotypic coefficient of variation
h^2 (bs) % = Heritability (broad sense)
GA = Genetic advance
GA% = Genetic advance as percent of mean

The characters number of pods per plant, seed yield per hectare, seed yield per plant, biological yield per plant (g), and harvest index (%) showed higher values of PCV and GCV. Similar findings for number of pods per plant were reported by Gupta *et al.,* (2007), for number of branches per plant by Bhushan *et al.,* (2006), for grain yield per plant (g) by Yadav (2007), for biological yield per plant (g) by Bhushan *et al.,* (2006), for harvest index (%) by Dixit *et al.,* (2002). The results indicate a greater scope for selection to improve these characters. Moderate values of PCV and GCV were noticed for characters *viz.,* plant height (cm), 100 grain weight (g). Similar findings were reported by Dhillon *et al.,* (2005).

The characters *viz,* days to initial flowering, days to 50 percent flowering, pod length (cm), days to maturity, number of grains per pod and number of branch per plant showed lower values of PCV and GCV. Similar kind of results was obtained by Gohil *et al.,* (2006). This suggests that there is scope to enrich the variation for these characters.

The coefficient of variation indicates only the extent of variability existing for various characters, but does not give any information regarding heritable proportion of it. Hence, amount of heritability permits greater effectiveness of selection by separating out the environmental influence from the total variability

and to indicate accuracy with which a genotype can be identified phenotypically. In present study, broad sense heritability, which includes both additive and non-additive gene effects (Hanson *et al.,* 1956), was estimated.

The results indicated that estimates of heritability were high for these characters under study *i.e.,* days to maturity, number of pods per plant, plant height, days to initial flowering days to 50% flowering, seed yield per hectare, seed yield per plant, Similar observations were made by Parameshwar (2006) for days to 50 percent flowering by Srivastava and Shukla (1998), for number of pods per plant by Bangar *et al.,* (2003), for number of branches per plant by Parameshwar (2006), for plant height (cm) by Agarwal *et al.,* (2001), for days to maturity by Hina Kausar (2005), for number of grains per pod, Nirmala Kumari and Balasubramanian (1993), for 100- grain weight (g) by Bangar *et al.,* (2003) for grain yield per plant (g) by Agrawal *et al.,*(2001), for biological yield per plant (g) and harvest index (%) by Dev Vart *et al.,* (2005).

Yield being a complex character is influenced by many factors. In the present study, high heritability coupled with high genetic advance as percent mean was observed for number of pods per plant, seed yield per hectare, seed yield per plant, Similar results were reported by Gohil *et al.,* (2006), for number of pods per plant and number of primary branches by Bhandarkar *et al.,* (1999), for plant height (cm) by Chettri *et al.,* (2005), for 100- grain weight (g) Sultana *et al.,* (2005), for grain yield per plant (g) by Karad *et al.,* (2005), and for biological yield per plant (g) reported by Dixit *et al.,* (2002). This indicates the lesser influence of environments in expression of characters and prevalence of additive gene action in their inheritance, since are amenable for simple selection. High heritability with moderate genetic advance as percent of mean was recorded for biological yield, harvest index. Similar results were obtained by Taware *et al.,* (1997). The results indicate that these characters were less influenced by environment but governed by additive and non-additive gene action.

The character pod length (cm), days to 50% flowering, days to initial flowering, number of branch per plant, days to maturity, number of grain per pod, 100 grain weight showed high heritability but low genetic advance as percent of mean, thereby indicating that expression of these characters may be due to non-additive gene action. Similar results were obtained by Dhillon *et al.,* (2005). Hence, breeding methods that consider heterosis make effective improvement for these characters.

From the above discussions, it can be concluded that high genotypic coefficient of variability and phenotypic coefficient of variability coupled with high heritability were observed for the characters number of pod per plant, seed yield per hectare seed yield per plant, biological yield. This indicates that there is a lesser influence of environment in the expression of character which is amenable for selection. The character *viz.,* days to initial flowering, days to 50 percent flowering, days to maturity and pod length (cm) showed high heritability but low level of variability. Hence, these characters are not amenable for selection in the present study.

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