RESEARCH ARTICLE

ESTIMATES OF VARIABILITY PARAMETERS FOR YIELD AND ITS COMPONENTS IN SOYBEAN (*GLYCINE MAX* L.)

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Received-28.02.2017, Revised-12.03.2017

Abstract: The present study of genetic variability was carried out using 30 genotypes of soybean for 8 quantitative characters. Analysis of variance for the design of experiments indicated highly significances among treatments for all the characters. Wide range of variation was found for seed yield per plant, plant height, 100-seed weight, number of pods per plant , number of secondary branches per plant , number of primary branches per plant ,number of seeds per pod, indicated good scope for improvement. Maximum phenotypic and genotypic coefficients of variation were observed for plant height followed by number of primary branches per plant, seed yield per plant, number of clusters per plant, number of pods per plant and pod length.

Keywords: Soybean, Variability, Heritability, Yield

INTRODUCTION

Soybean (*Glycine max* (L.) Merrill) is one of the important oil yielding crop of India. It has nutritional, medicinal and industrial uses. India is the fifth largest producer of Soybean and sixth in Soybean oil in the world. Soybean occupies an area of about 7.172 million hectare with an annual production of 12.2 million tons and average productivity of 1140 kg/hectare in India (USDA, 2013). In Madhya Pradesh, it is grown in an area of 59.062 Lakh hectare with a production of 34.125 Lac tones with productivity of 608 kg/ha (SOPA, 2015). Seed yield per hectare of this crop is low in India. Its cultivation under poor crop management and non-availability of quality seed of improved soybean varieties are the major reasons for low productivity of the crop. Thus, there is need to develop or identify high yielding Soybean varieties. Development of high yielding cultivars requires information on nature and magnitude of variation in the available germplasm. The observed variability is a combined estimate of genetic and environmental cause of which only the former one is heritable. Heritability and genetic advance of the seed yield and its components is pre-requisite for the improvement through selection. The present investigation provides better insight and scope for the improvement of seed yield through component characters in Soybean.

MATERIAL AND METHOD

The experiment material comprised 30 Soybean strains/varieties were grown in Randomized Block Design with three replications at Research Farm, Rajoula, Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot, Satna (Madhya Pradesh) during *Kharif* 2014. Observations were recorded on five randomly selected plants from each plot for Eight quantitative characters *viz.* days to flowering, days to 50% flowering, plant height (cm.), number of primary branches per plant, number of secondary branches per plant, number of pods per plant, number of seeds per pods, 100-seed weight (gm.), and seed yield per plant (gm.). The variability parameters were determined as per the methodology suggested by Burton and de Vane (1953) and Johnson *et al.,* (1955).

RESULT AND DISCUSSION

Present study, the extent of variability was estimated in the 30 germplasm/ varieties of soybean for their 08 characters. Analysis of variance for various characters is given in Table -1. Design of the experiment indicated highly significant differences among the genotypes for all the eight characters under study which indicating the presence of high genetic variability in the materials. Wide range of variation was found for seed yield per plant, plant height, 100-seed weight, number of pods per plant , number of secondary branches per plant , number of primary branches per plant ,number of seeds per pod, indicated good scope for improvement. Mean, range, GCV, PCV, as per cent of mean are presented in Table -2. The variability estimates, in general, phenotypic coefficient of variation (PCV) was higher than corresponding genotypic coefficient of variation (GCV). The estimates of phenotypic and genotypic coefficients of variation indicated the existence of fairly high degree of variability for seed yield per plant, 100 seed weight and plant height. Moderate variability was observed for number of secondary branches per plant, and no pods per plant. The minimum genotypic and phenotypic coefficients of variation were observed for days to 50% flowering,

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Number of primary branches per plant and number of seeds per pod. Days to first flowering, days to 50% flowering, plant height, number of pods per plant, number of seeds per pod and 1000-seed weight showed almost similar values of phenotypic and genotypic coefficients of variation, indicating that variability was primarily was due to genotypic differences and environment has played little role in the expression of this character. The observations are in agreement with the findings of Savita *et al*. (2007) and Dubey *et al.* (2007).

The major function of heritability estimates is to provide information on transmission of characters from the parents to the progeny. Heritability and Genetic advance are presented in Table -3. Such estimates facilitate evaluation of hereditary and environmental effect in phenotypic variation and thus aid in selection. Heritability estimates are used to predict expected advance under selection so that breeders are able to anticipate improvement from different of selection intensity. Johnson *et al*. (1955) have suggested heritability estimates in association with genetic advance are much useful for selection than heritability alone.

In the present study, estimates of heritability in broad sense ranged from 30.00 per cent for days to 50% flowering to 98.70 for 100-seed weight. High heritability estimates was found for 100-seed weight followed by seed yield per plant, plant height, no. of primary branches, no. of seeds per pod while low estimates was found in no. of secondary branches and days to 50% flowering. It indicated less environmental influence on the characters and recorded high transmission index. The high heritability indicates that these traits are generally governed by the additive gene action and that the genotypes of the traits strongly reflect the phenotypes. Similar results were reported by Tewari *et al*. (1989), Borah and khan (2000), Nehru and Manjunath (2001), Pal *et al*. (2003), Nigude *et al.* (2004), Prasanthi (2004), Eswaran *et al*. (2007), Nehru *et al*. (2009) and Manggoe *et al*. (2012). Burton (1952),

The expected genetic advance in per cent of mean ranged from 3.49 per cent for days to 50% flowering to 48.05 per cent for 100-seed weight (Table 4.3). High estimates of expected genetic advance were found for 100-seed weight, seed yield per plant and plant height while moderate to low genetic advance was found for number of pods per plant , number of primary branches per plant , number of secondary branches per plant, number of seeds per pod and days to 50% flowering. Similar were the findings of), Borah and khan (2000), Pal *et al*. (2003), Nigude *et al.* (2004), Malik et al. (2006) for 100-seed weight, Eswaran *et al*. (2007), and Nehru *et al*. (2009) and Badkul *et al*. (2014)for no. of branches per plant andno. of pods per plant.

Table 1. Analysis of Variance for Eight quantitative characters in Soybean.

S. No.	Character	Mean Sum of Square		
		Replication	Treatments	Error
	d.f.	2	29	58
1	Days to 50% Flowering	3.68	9.12**	3.95
2	Plant Height(Cm.)	20.80	124.39***	18.39
3	No. of Primary Branches per plant	0.26	1.53***	0.43
4	Number of Secondary Branches	4.21***	0.51***	0.19
5	No.of Pods Per Plant	348.51***	26.12***	9.02
6	No. of Seeds Per pod	0.89	0.123***	0.04
7	100 Seed weight(g)	0.45**	14.77***	0.07
8	Seed yield per plant(g)	23.63***	7.57***	0.83

*** Significant at 5% probability level; **Significant at 1% level probability level.**

Table 2. Mean, range, genotypic and phenotypic coefficient of variation for 8 quantitative characters in Soybean

S. No.	Characters	Grand mean (`X) + SE (m)	Range		Component of variability		Coefficient of Variation	
					Genotypic	Phenotypic	GVC	PCV
			Min.	Max.				
1	Days to 50% Flowering	42.69 ±1.15	39.00	46.00	1.72	5.68	3.08	5.58
2	Plant Hight(Cm.)	25.8 ±2.48	14.68	39.97	35.33	53.73	22.96	28.31
3	No. of Primary Branches per plant	6.20 ± 0.38	4.80	7.80	0.37	0.80	9.75	14.40
4	No. of Secondary Branches	3.02± 0.25	2.20	4.20	0.11	0.30	10.79	18.12
5	No.of Pods Per Plant	21.25 ±1.73	14.47	27.07	5.70	14.72	11.24	18.05
6	Number of Seeds Per pod	2.82 ± 0.12	2.00	3.13	0.03	0.07	5.76	9.43
7	100 Seed weight(g)	9.43 ± 0.15	6.58	14.38	4.90	4.97	23.48	23.63
8	Seed yield per plant(g)	5.65± 0.53	2.77	8.89	2.25	3.08	26.53	31.06
8	Seed yield per plant(g)	5.65± 0.53	2.77	8.89	2.25	3.08	26.53	31.06

Table 3. Heritability (%) in broad sense, genetic advance and genetic advance in percent of mean for 08quantitative characters of Soybean

S.N.	Characters	Heritability (%)	Genetic advance	Genetic advance in percent of mean
1	Days to 50% Flowering	30.4	1.49	3.491
2	Plant height(Cm.)	65.8	9.93	38.347
3	No. of Primary Branches per plant	45.9	0.843	13.608
4	Number of Secondary Branches	35.4	0.399	13.235
5	No.of Pods Per Plant	38.7	3.061	14.403
6	No. of Seeds Per pod	37.3	0.204	7.245
7	100 Seed weight(g)	98.7	4.531	48.048
8	Seed yield per plant(g)	73	2.637	46.675

High heritability estimates coupled with high genetic advance were observed for seed yield per plant, harvest index, biological yield per plant, number of pods per plant, number of pods per cluster, number of cluster per plant and 1000-seed weight indicated that these traits were mostly controlled by additive gene action. Phenotypic selection for these characters would be highly effective as also reported earlier by Tewari *et al*. (1989),), Borah and khan (2000), Pal *et al*. (2003), Nigude *et al.* (2004), Eswaran *et al*. (2007), Nehru *et al*. (2009) and Sureshrao *et al*. (2014)for number of pod per plant, seed yield per hectare and seed yield per plant .

The present study revealed that the 100 seed weight, seed yield per plant and plant height possessing high heritability along with high genetic advance and high to moderate variability estimates indicating a greater scope for the improvement through selection from the population.

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