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Review article

GENETIC VARIABILITY IN SOYBEAN [GLYCINE MAX (L) MERRILL]

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ABSTRACT: Forty five genotypes of soybean (Glycine max (L.) Merrill.) of diverse orgin were evaluated in randomized block design with three replications for variability, heritability and genetic advance during *kharif* 2007. Observations on thirteen characters were recorded. Analysis of variance revealed highly significant differences among the genotypes for the all the characters. High PCV coupled with high GCV, observed for branches per plant, pods per plant, biological yield, harvest index and yield per plant indicate the presence of wider adaptability for these traits in the genotypes studied, suggested the less influence of environment in the expression of characters. High heritability coupled with high genetic advance as percent of mean was observed for days to 50% flowering, plant height, branches per plant, pods per plant, pod length, seeds per pod, 100 seed weight, biological yield, harvest index and seed yield per plant indicating operation of additive gene action and the ample scope for improvement in these traits through simple selection.

Key words: Genetic variability, heritability. Genetic advance and soybean

INTRODUCTION

Soybean [*Glycine max* (L.) Merrill] is a major oil seed crop in the world and is called as a golden bean or miracle bean because of its versatile nutritional qualities having 20% oil and 38 to 43 percent protein, which has biological value as meat and fish protein and rich in amino acids like lysine and tryptophan [1]. Genetic variability is the basic requirement for crop improvement as this provides wider scope for selection. Thus, effectiveness of selection is dependent upon the nature, extent and magnitude of genetic variability present in material and extent to which it is heritable. Hence, in present investigation an attempt was made to assess the variability of pod yield and yield contributing traits, along with indices of variability i.e genotypic coefficient of variation (GCV), phenotypic coefficient of variation (PCV), heritability in broad sence (h^2_{bs}), genetic advance (GA) and genetic advance as percent of mean (GAM). This study will facilitated an understanding behind expression of character and also role of environment there in.

MATERIALS AND METHODS

The experimental materials consists of 45 genotypes of soybean derived from different origins. The genotypes obtained from the different research stations of India. These genotypes of soybean were evaluated in randomized block design with three replications at Regional Agricultural Research Station, Lam, Guntur during *kharif*, 2007. Each genotype was accommodated in a single row of 3.0m length with a spacing of 45cm between rows and 15 cm between plants with in row. Observations on thirteen characters table 1 & 2 were recorded on randomly selected five plants from each genotype and average value was used for statistical analysis. The data is subjected to different statistical analysis viz., analysis of variance, magnitude of genetic variability were performed following standard procedures [2,3].

RESULTS AND DISCUSSION

Analysis of variance revealed highly significant differences among the genotypes for all the characters studied. Replication differences was non-significant for all characters except pod length.

Genotypic Coefficient of Variation (GCV) & Phenotypic Coefficient of variation (PCV)

The estimates of genotypic and phenotypic coefficient of variation were always higher than genotypic coefficient of variation suggesting the influence of environmental factors. Less difference observed between phenotypic coefficient of variation and Genotypic coefficient of variation in certain cases indicated that these characters were less influenced by environment. In the present investigation, Days to 50% flowering recorded moderate phenotypic and genotypic coefficient of variation indicating that there is a scope for improvement of this trait [4]. Partitioning of Total variance into its components revealed that phenotypic coefficient of variation and Genotypic coefficient of variation were low in magnitude for days to maturity [5].The values for GCV and PCV for plant height (cm) revealed that the magnitudes of GCV & PCV were moderate for this trait [5,6] . Number of branches per plant recorded high value of GCV and PCV indicates the greater role of genetic factor in influencing the expression of the character. [6] reported high magnitudes of GCV and PCV for number of branches per plant. GCV and PCV were high for number of pods per plant, suggesting wide spectrum of genotypic variation for this trait. **[7]** Reported high magnitudes both GCV and PCV for no.of pods per plant in soybean. The value of GCV & PCV moderate for pod length. Similar results were also reported [8] The GCV and PCV were moderate for number of seeds per pod [9]. 100 seed weight recorded moderate PCV and GCV Similar results were obtained [6]. The values of PCV and GCV were high for Biological yield per Plant [10]. The GCV and PCV were high for Harvest Index [11]. The estimates of GCV and PCV for protein content were low magnitudes of GCV & PCV [12]. Oil content revealed that Genotypic coefficient of variation and Phenotypic coefficient of variation were low in magnitude for this character [8]. The estimates of PCV & GCV were high for seed yield per plant [4]. In general, the estimates of genotypic and phenotypic coefficient of variation were high for Branches per plant, pods per plant, Biological yield per plant, Harvest Index and seed yield per plant. Moderate magnitudes of GCV and PCV were observed for days to 50% flowering, plant height, pod length, seeds per pod and 100 seed weight. whereas, low estimates of GCV and PCV were expressed by days to maturity, Protein content and Oil content.

Heritability (h^2_{bs}) and genetic advance (Gs)

Genotypic coefficient of variation measures the amount of variation present in particular character. However, it does not determine the proportion of heritable variation present in the total variation. Therefore, heritability which represents the heritable variation existing in the character was calculated. High value of heritability and low genetic advance expressed as percentage of mean suggested that this character was conditioned by high genotype-environmental interaction. In such a situation, selection would not be rewarding. The estimates of genetic parameters revealed that Days to 50% flowering expressed high heritability coupled with high genetic advance as percent of mean of this trait indicates the operation of additive genes and offer the best possibility for improvement of this trait through mass selection, progeny selection, family selection to any other suitable modified selection procedure aiming to exploit the additive gene effects[4]. High heritability along with moderate genetic advance as percent of mean as observed in the present study for Days to maturity indicates the predominance of additive gene action in the expression of this trait. High heritability coupled with high genetic advance as percent of mean was recorded indicates the predominance of additive gene action in the expression of Plant height [13,14]. The magnitude of heritability in broad sense was high coupled with high genetic advance as percent of mean for Number of branches per plant. The results suggest that there is a wide scope for improvement of this trait through simple selection procedure [12,13]. High heritability and genetic advance expressed as percent of mean was high for Number of pods per plant[7,13]. High heritability coupled with high genetic advance as percent of mean of this trait indicates the operation of additive genes and offer the best possibility for improvement of this trait through mass selection, progeny selection, family selection to any other suitable modified selection procedure aiming to exploit the additive gene effects [8]. High heritability coupled with high genetic advance as percent of mean of this trait indicates the operation of additive genes and offer the best possibility for improvement for Number of seeds per pod through selection procedure aiming to exploit the additive gene effects [15]. High heritability coupled with high genetic advance as percent of mean for 100 seed weight (g) indicates the operation of additive genes and offer the best possibility for improvement of this trait through mass selection, progeny selection, family selection to any other suitable modified selection procedure aiming to exploit the additive gene effects [13].

High heritability coupled with high genetic advance as percent of mean was recorded indicates the predominance of additive gene action in the expression of Biological yield per plant. The results suggest that there is a wide scope for improvement of this trait through simple selection procedure [13].The high values of heritability as well as genetic advance as percent of mean was observed for Harvest index (%) indicates the predominance of additive gene action in the expression of this trait [13,14]. However, high heritability along with moderate genetic advance as percent of mean was observed in Protein content (g) indicates the predominance of additive gene action in the expression of this trait [16]. High heritability coupled with moderate genetic advance as percent of mean was recorded indicates the predominance of additive gene action in the expression of Oil content (%) [17]. High heritability coupled with high genetic advance as percent of mean was recorded indicates the predominance of additive gene action in the expression of Seed yield Per Plant (g). The results suggest that there is a wide scope for improvement of this trait through simple selection procedure [14].Thus, from the present investigation, it can be concluded that high genetic advance was not always associated with high heritability for the characters studied.

Table 1: Analysis of Variance for yield and yield attributing characters of 45 soybean genotypes during kharif ,2007

Mean squares

Source	df	Days to 50% Flowering	Days to Maturity	Plant height (cm)	Branches/ plant	Pods/ Plant	Pod Length (cm)	seeds/ pod	100 Seed wt (gm)	Biological Yield (gm)	Harvest Index (%)	Protein Content (%)	Oil Content (%)	Seed yield/ plant (gm)
Replications	2	1.155	1.118	7.726	0.061	8.223	0.055	0.057	0.152	4.736	2.901	2.029	0.121	1.154
Treatments	44	53.35**	233.03**	259.12**	1.832**	380.05**	0.789**	0.456**	8.501**	69.705**	219.91**	15.547**	4.390**	29.511**
Error	88	0.943	1.307	8.687	0.054	6.284	0.018	0.057	0.498	3.880	12.55	1.562	0.187	0.976

Table 2: Range of variation, mean, phenotypic and genotypic coefficient of variation, heritability (b.s), genetic advance and genetic advance expressed as per cent of mean for thirteen characters of soybean

Characters	Range of variation	Mean	Phenotypic coefficient of variation (%)	Genotypic coefficient of variation (%)	Heritability in broad sense (%)	Genetic advance	Genetic advance expressed as per cent of mean
Days to 50% flowering	30.0 to 46.0	38.35	11.18	10.89	94.88	8.38	21.86
Days to maturity	81.0 to 118.66	105.78	8.37	8.30	98.33	17.95	16.97
Plant height (cm)	30.53 to 67.07	50.38	19.05	18.13	90.57	17.91	35.54
Branches per plant	1.00 to 4.96	2.51	31.92	30.56	91.63	1.51	60.27
Pods per plant	12.35 to 49.56	29.94	38.19	37.26	95.20	22.43	74.90
Pod length (cm)	1.26 to 15.28	3.21	16.35	15.79	93.19	1.01	31.40
Seeds per pod	1.00 to 3.00	2.35	18.57	15.50	69.71	0.63	26.66
100 seed weight (g)	7.26 to 15.28	12.79	13.90	12.76	84.26	3.09	24.13
Biological yield per plant (g)	12.30 to 33.42	21.18	23.98	22.10	84.97	8.89	41.97
Harvest index (%)	19.63 to 51.85	36.57	24.70	22.72	84.62	15.75	43.07
Protein content (%)	33.52 to 41.55	37.83	6.59	5.70	74.90	3.85	10.17
Oil content (%)	18.00 to 22.48	20.35	6.01	5.81	88.18	2.29	11.24
Seed yield per plant (g)	3.34 to 14.99	8.00	40.44	38.51	90.69	6.04	75.55

CONCLUSION

The analysis of variance showed significant difference among the genotypes of all characters studied indicating that the data generated from the above diverse material shall represent wide variability. The genotypic coefficient of variation for all characters studied were lesser than the phenotypic coefficient of variation. High PCV coupled with high GCV observed for branches per plant, number of pods per plant, biological yield per plant (g), harvest index (%) and seed yield per plant (g) indicating the presence of wider variability for these traits in the population studied. High heritability coupled with high genetic advance as percent of mean was observed for days to 50% flowering, plant height (cm), number of branches per plant, number of pods per plant, pod length(cm),number of seeds per pod, 100 seed weight (g), biological yield per plant (g), harvest index (%) and seed yield per plant(g) indicate the operation of additive gene action in the inheritance of these traits and improvement in these characters is possible through simple selection.

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