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GENETIC VARIABILITY IN SOYBEAN

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ABSTRACT

The genetic parameters viz., genotypic and phenotypic variances, genotypic co-efficient of variation, heritability and genetic advance were assessed from seventy genotypes of soybean. The varieties showed highly significant differences in mean values for all the characters studied. All the characters showed very high heritability. High genotypic coefficient

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of variation was observed for leaf area and number of primary branches per plant. Plant height, number of pods, leaf area and total dry weight per plant exhibited high amount of genetic variation, high heritability and genetic advance.

Knowledge on genetic control and make up of yield components, as yield is a complex character subjected to considerable variation due to interaction of environmental fluctuation, will be useful to a breeder. The efficiency of selection depends mainly on the extent of genetic variability in a population. The study of different genetic parameters such as genotypic variation, heritability, genetic gain, etc., give clear information as to the nature and magnitude of variations for the available plant characters. An attempt was made in this experiment to study the variability of different quantitative characters of soybean.

MATERIALS AND METHODS

Data were collected from the promising genotypes of soybean obtained from different sources. Sixteen morphological, physiological and yield attributing characters were recorded from three replications of a completely Randomised Block Design. Five plants were selected at random in each type for each replication and observations on days to first flowering, days to 50% flowering, days to maturity, plant height, number of primary branches per plant, number of pods per plant, the 100 seed weight, oil content of the seed, protein content of the seed, seed yield per plant, harvest index, total dry weight per plant, leaf area, specific leaf weight, crop growth rate and relative

growth rate were recorded. The mean value of these observations was computed as value per plant and analysed statistically. Different genetic parameters were also computed based on the methods suggested by Singh and Choudhari (1977).

RESULTS AND DISCUSSION

Analysis of variance of different characters revealed that there were high and significant difference (Table 1), indicating wide genetic variability among the genotypes. The range, mean, GCV, PCV, heritability, genetic advance and genetic advance as per cent of mean are presented in Table 2. The highest phenotypic and genotypic variance were recorded for leaf area at harvest, while the lowest phenotypic and genotypic variance were recorded for relative growth rate. In the present study, GCT estimates which indicate the genetic portion of the total variability was high for leaf area and number of primary branches thereby suggesting scope to exploit these inherent traits. Low GCV was recorded for 100 seed weight, days to first flowering and days to 50 per cent flowering. In soybean similar results were reported by Khurana and Sandhu (1972), Lal and Mehta (1973), and Khurang (1980). The wide difference between PCV and GCV might probably be due to the high susceptibility of these traits to environment whereas the narrow

Table 1. Analysis of variance for individual characters in soybean.

Sl.No.	Characters	Mean squares	
		Treatment	Error
	D.F.	69	138
1.	Days to 50% flowering	44.64**	0.66
2.	Days to maturity	106.83**	0.25
3.	Plant height	264.26**	1.10
4.	No.of primary branches	2.86**	0.46
5.	100 seed weight	969.64**	0.67
6.	No.of pods	1781.01**	29.95
7.	Oil content	2.91**	0.01
8.	Protein content	33.96**	0.004
9.	Actual harvest index	0.02**	0.004
10.	Days to first flowering	44.92**	0.55
11.	Leaf area (at harvest)	32784.63**	170.53
12.	Specific leaf weight (at harvest)	145.40**	3.52
13.	Relative growth rate (between 60 DAS - harvest)	0.001**	0.000004
14.	Crop growth rate (between 60 Das - harvest)	142.86**	1.58
15.	Total dry weight per plant (at harvest)	50.11**	0.68
16.	Seed yield per plant	27.52**	0.65

** Significant at 1% level

differences might indicate less influence by the environment. High estimates of heritability were recorded for seed protein content and 100 seed weight but with low GCV. According to Burton (1952), a character having high GCV value with high heritability would be more valuable in the selection programmes. Here high heritability values coupled with high GCV values were observed for days to maturity and plant height, thereby indicating loss environmental influence on these characters and high transmission

index. The high heritability indicates that the trait is generally governed by additive gene action and that the phenotype of the trait strongly reflects the genotype. Similar results were also obtained by Lal and Mehta (1973) and Lawson (1980).

Heritability estimates in the broad sense are not the true indicators of the genetic potentiality of the genotypes and their scope is restricted as they are prone to change with the change in the environment. Hence, if heritability values

Table 2. Genetic parameters for plant characters in soybean

Sl.No.	Characters	Range	Mean	CV%		Heritability (%) (BS)	GA as percentage of mean (%)
				PCV	GCV		
1.	Days to 50% flowering (days)	32.3-48.7	39.38	7.50	7.47	59.69	19.59
2.	Days to maturity (days)	68.0-92.0	79.78	21.51	20.69	99.30	15.34
3.	Plant height (cm)	23.3-63.8	44.77	30.58	24.32	98.76	42.83
4.	Primary branches	2.0-8.0	3.67	47.98	46.80	97.53	40.00
5.	Number of pods	22.0-157.0	51.63	17.01	16.99	95.17	94.04
6.	100 seed weight (gm)	4.57-15.95	10.63	5.70	5.67	99.80	34.97
7.	Oil content (%)	13.60-19.43	17.33	9.53	9.52	98.98	11.66
8.	Protein content (%)	31.00-42.50	35.31	17.31	16.70	99.91	19.62
9.	Actual harvest index	0.349-0.804	0.53	11.31	11.10	85.71	27.87
10.	Days to first flowering (days)	28.3-43.3	34.64	7.24	7.18	69.42	22.46
11.	Leaf area (cm ²)	3.99-445.41	145.24	71.99	71.39	98.46	146.75
12.	Specific leaf weight (mg cm ²)	7.93-46.96	13.05	41.67	41.32	93.08	104.73
13.	Relative growth rate (99 ⁻¹ day ⁻¹)	0.012-0.085	0.035	39.00	38.36	98.33	85.71
14.	Crop growth rate (gm ² day ⁻¹)	6.28-42.58	17.89	20.81	20.33	96.76	77.75
15.	Total dry weight per plant (g)	13.28-33.25	21.15	21.50	21.07	95.41	40.90
16.	Seed yield per plant (g)	5.33-20.03	10.32	9.82	9.70	93.22	57.68

are considered in conjunction with the predicted genetic gain, the reliability of this parameter as a tool in selection programme would increase. It was observed that plant height and number of pods have high heritability coupled with high genetic advance. This indicated the preponderance of additive gene action (Panse, 1957). Therefore, these characters would be effective for the improvement in yield levels. Gopani and Kabaria (1970) and Malhotra (1973) reported the same results.

Thus, the present study involving 70 selected genotypes revealed that plant

height, number of pods per plant, leaf area, crop growth rate and total dry weight per plant exhibited high amount of genetic variation coupled with high heritability and genetic advance. The present materials might therefore, offer great scope for improving these characters. The study has also indicated the low variability for seed oil content, 100 seed weight, days to 50 per cent flowering, seed yield per plant and actual harvest index thus declaring their limited scope in crop improvement through selection.

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