

## **Assessment of Genetic Variability, heritability and genetic advance in Soybean (*Glysin max L.*) genotypes.**

### **Abstract**

An experiment was conducted to study genetic variability, heritability, and genetic advance among 25 soybean genotypes. Analysis of variance revealed significant differences for all the thirteen traits. Narrow differences between phenotypic and genotypic coefficients of variation (PCV and GCV) observed for most of the characters revealed less environmental influence on their expression. High values of heritability and genetic advance with high GCV were found for no of pods/plant and for no of seeds/plant can be considered as favorable attributes for soybean improvement through phenotypic selection and high expected genetic gain can be achieved. The traits with higher heritability and GA value may indicate their variability and high selective value. Genetic variation, generally considered a key component in broadening gene pools in any given crop population, is critical to the success of yield improvement programs. Therefore, the objectives of this study were to estimate genetic variability.

### **Introduction**

Soybean [*Glycine max (L.) Merrill*] is the world's most important seed legume, which contributes about 25 per cent of the global edible oil (Raiet *et al.*, 2016). It has highest protein (42 %), rich in lysine and vitamins (A, B and D) and also contains 20 % oil. Improvement of genetic architecture of any crop depends upon the nature and extent of genetic variability. Presence of genetic variability is one of the prerequisites to perform selection in any breeding program. Similarly, genetic advance is also a useful measure to predict gain in specified selection intensity. Pod and seed number are prerequisite yield traits of soybean such as number of pods per plant; numbers of seeds per pod and number of seeds per plant easily identifiable and contributing properties of yield. Heritability estimates are considered in understanding the pattern of inheritance of quantitative character like seed yield. Similarly, genetic advance is also a useful measure to predict gain in specified selection intensity. However, when it is considered along with heritability becomes more valuable to predict response to selection than the heritability estimates alone. Therefore, this study was designed to evaluate soybean genotypes for yield as well as other parameters.

## **MATERIAL AND METHODS**

The present investigation was conducted to measure the different variability parameters like mean, range of variation, genotypic and phenotypic coefficient of variation, heritability in broad sense, genetic advance and genetic advance as percentage of mean using 25 diverse germplasm accessions including 5 checks of soybean. The experiment was laid-out in a Randomized Block Design with two replications at research cum instructional farm Department of Genetics and Plant Breeding, College of Agriculture/Research Station, Indira Gandhi KrishiVishwavidyalaya, Raipur (C.G.). The observations were recorded for 13 different characters, *viz.*, days to initial flowering, days to 50 per cent flowering, days to maturity, plant height (cm), number of primary branches per plant, number of pods per plant, number of seed per pod, number of seeds per plant, 100 seed weight (g), harvest index, seed yield per plant, and oil content (%). The GCV and PCV parameters estimated by (Burton, 1952), heritability suggested by (Johnson *et al.*, 1955) and genetic advance as percentage of mean calculated by (Johnson *et al.*, 1955).

## **RESULTS AND DISCUSSION**

### **Genetic variability**

Genetic variability is the pre-requisites for genetic improvement in a systematic breeding program. Analysis of variance revealed that the mean squares due to genotype were found significant for all the traits under study, which indicated the enormous phenotypic variability was present among the genetic materials studied (Table 1).

All the 25 genotypes showed wide range of variation for most of the traits under study (Table 2), indicated the scope for selection of these traits for further breeding work. The estimates of genotypic (GCV) and phenotypic (PCV) coefficients of variability indicated that the values of PCV were higher than GCV for all the traits partly due to interaction of the genotypes with the environment or other environmental factors influencing the expression of these characters (Table 2).

Narrow differences observed between the PCV and GCV in certain cases indicated that these characters were less influenced by the environment. Similar results for high GCV and PCV for the characters Plant height, number of primary branches per plant, number of pods per plant and seed yield were obtained by indicating the wider adaptability of these traits in the genotypes

studied. Similar results for high GCV and PCV for the characters Plant height, number of branches per plant, number of pods per plant and seed yield were obtained by Neelima *et al.* (2021), Karnwal and Singh (2009), Malik *et al.* (2011) indicating the wider adaptability of these traits in the genotypes studied.

### **Heritability and genetic advance**

The estimates of heritability in the broad sense ranged from 50.31 percent to 98.66 percent (Table 2). In the present study, the highest heritability was recorded by number of pods per plant (98.66%), biological yield (96.99%), seed yield per plant (99.75%) and oil percentage (87.00%) similar findings were reported by Jandong *et al.* 2020, Malek *et al.* (2014) and Karnwal and Singh (2009) for seed yield per plant, Karnwal and Singh (2009) for number of pods per plant. High heritability suggests a high component of the heritable portion of variation that will be exploited by a breeder in the selection of superior genotypes on the basis of phenotypic performance of the varieties. Furthermore, days to 50% flowering (58.33) and number of primary branches per pod (50.31) indicated moderate heritability, indicating the possibility of a soybean improvement program could be successful. The finding is also confirmed by Sulisty (2018). High genetic advance was found for the number of seeds per pod (90.74) and number of pods per plant (52.80) which is similar to the findings with Abebe (2021) for number of seeds per pod. High heritability coupled with high genetic advance was observed for number of pods per plant (98.62, 75.15), Biological yield (96.99, 73.15) and for seed yield per plant (90.75, 68.30), which is due to additive gene effects and expressed in these traits. Similar results were reported by Yadawad *et al.* (2015), Bangar *et al.* (2003), Chandele *et al.* (2014), Amit *et al.* (2014), and Mahbub *et al.* (2015). 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.

### **CONCLUSION**

Analysis of variance revealed that enormous phenotypic variability was present among the genetic materials studied. The values of phenotypic coefficient of variation (PCV) were higher than genotypic coefficient of variation (GCV) for all the characters indicating the influence of environmental factors. High estimates of heritability coupled with high genetic advance expressed as percentage of mean were observed for number of plant height, number of branches per plant, number of clusters per plant, number of pods per plant, which may be

attributed to the preponderance of additive gene action and possess high selective value and thus, selection pressure could profitably be applied on this character for their rationale improvement.

## References

Abebe, Tefera.(2021)Performance Evaluation and Estimates of Genetic Components for Yield and Yield Related Traits of Early Soybean (*Glycine Max* (L.) Varieties at Tepi, Ethiopia. *Advances in Crop Science and Technology*.. 9-11.

Amit kumar, Avinash Pandey, ChubasenlaAochen.(2014) Evaluation of genetic diversity and Interrelationships of Agro-morphological characters in soybean genotypes (*Glycine max* (L.) Merrill.). *Proc. Natl. Acad. Sci. India, Sect B, Biol. Sci*, 11-14.

Bangar, N.D., Lad D.B. and Mukhekar, D.G (2003) Genetic variability, correlation and regression studies in soybean. *Journal Maharashtra Agriculture University* 28 (3): 320-321.

Burton, G. M.(1952) Quantitative inheritance in grasses. *Proceedings of 6th International Grassland Cong.*, **1**: 277-285.

Chandel K.K, Patel N.B., Patel J.B. (2013) Genetic Variability Analysis in Soybean [*Glycine max* (L.) Merrill]. *AGRES – An International e-Journal*;2(3):318-325.

Jandong, E. A., M. I. Uguru, and E. C. Okechukwu. (2020).Estimates of genetic variability, heritability and genetic advance for agronomic and yield traits in soybean (*Glycine max* L.).

Johnson, H. W., Robinson, H. F. and Comstock, R. E. (1955). Estimate of genetic and environment variability in soybean. *Agron. J.*, **47**: 314-318.

Karnwal, M. K. and Singh, K.(2009) Studies on genetic variability, character association and path coefficient for seed yield and its contributing traits in soybean (*Glycine max* L. Merrill.).*Legume Res.*, **32 (1)**: 70-73.

Mahbub, M.M., Mamunur, M.Rahman., Hossain, M.S., Mahmud, F. and Mir Kabir, M.M.(2015). Genetic variability, Correlation and Path anlysis for yield and yield contributing components in soybean. *American-Eurasian J. Agric & Environ. Sci.*, **15(2)**: 231-236.

Malek, M.A., MohdRefii Y., Ujjal Kumar Nath and MonjurulAlamMondal(2014). Morphological characterization and Assessment of genetic variability, character association and Divergence in soybean (*Glycine max* (L.) Merrill). *Mutants. Scientific World J.*, 1-12.

Malik, M. F. A., Ashraf, M.,Qureshi, A. S. and Khan, M. R. (2011). Investigation and comparison of some morphological traits of the soybean populations using cluster analysis. *Pak. J. Bot.* **43(2)**: 1249-1255.

Neelima, G., Mehtre S. P. and Narkhede G. W., (2018). Genetic Variability, Heritability and Genetic Advance in Soybean, *Int. J. Pure App. Biosci.* **6(2)**: 1011-1017.

Rai, S. K., DeekshaCharak and Rajeev Bharat (2016). Scenario of oilseed crops across the globe. *Plant Archives.* 16(1): 125-132.

Sulistyo, A.(2018). Correlation, path analysis and heritability estimation for agronomic traits contribute to yield on soybean. In: *IOP Conference Series: Earth and Environmental Science.* IOP Publishing, .p. 012034.

Yadawad, A., Hanchinal, R. R., Nadaf, H. L., Desai, S. A., Biradar, S. and Naik, V. R.(2015). Genetic variability and heritability estimates for yield attributes and leaf rust resistance in F3 population of wheat (*Triticumaestivum*L.). *The Bioscan.* **10(2)**: 935-938.

**Table: 1. Analysis of variance for thirteen yield and yield attributing traits of soybean genotypes**

<b>S.N.</b>	<b>Source</b>	<b>Treatment</b>	<b>Replication</b>	<b>Error</b>
	<b>Degree of Freedom</b>	24	1	24
1	<b>Days to 50% flowering</b>	10.472**	3.92	3.462
2	<b>Days to maturity</b>	68.932**	7.296	5.246
3	<b>Plant height</b>	258.484**	17.88	33.511
4	<b>Pod bearing lenth</b>	230.849**	91.666	17.197
5	<b>No of primary branches/plant</b>	1.405**	1.62	0.37
6	<b>N of pods/plant</b>	1340.854**	151.728	9.032
7	<b>No of seeds/pod</b>	0.444**	0.146	0.1
8	<b>Biological yield</b>	519.134**	1.217	7.91
9	<b>No of seeds/plant</b>	6860.384**	1,597.26	1,249.61
10	<b>100 seed weight</b>	6.227**	0.047	0.554
11	<b>Harvest index</b>	240.184**	12.4	22.473
12	<b>Oil%</b>	9.321**	1.828	0.628
13	<b>Seed yield/plant</b>	78.525**	3.277	3.805

**Table 2. Genetic variability parameters for yield and yield attributing traits**

S.N.	Paramet/Characters	Range		General Mean	GCV	PCV	h <sup>2</sup> (Broad Sense)	Genetic Advance	Genetic Advances as % of Mean
		max	min						
1	Days to 50% flowering	48.50	41.00	44.56	4.20	5.92	50.31	2.74	6.14
2	Days to maturity	119.85	94.00	96.35	5.86	6.32	85.86	10.77	11.18
3	Plant height	82.40	32.05	54.13	19.59	22.32	77.05	19.18	35.43
4	P0d bearing length	69.50	25.40	45.98	22.48	24.22	86.13	19.76	42.98
5	No of primary branches/plant	5.70	2.90	4.20	17.11	22.40	58.34	1.13	26.92
6	N of pods/plant	103.15	26.80	70.26	36.73	36.98	98.66	52.80	75.15
7	No of seeds/pod	3.95	2.20	2.70	15.34	19.31	63.12	0.68	25.10
8	Biological yield	71.55	21.10	44.34	36.05	36.61	97.00	32.44	73.15
9	No of seeds/plant	251.50	37.55	137.85	38.42	46.19	69.18	90.75	65.83
10	100 seed weight	16.70	9.80	12.58	13.39	14.64	83.67	3.17	25.23
11	Harvest index	70.80	17.60	39.15	26.65	29.27	82.89	19.57	49.98
12	Oil%	22.37	13.42	18.85	11.06	11.83	87.37	4.01	21.30
13	Seed yield/plant	32.75	9.10	17.56	34.80	36.53	90.76	12.00	68.30