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 tarits. Narrow differences between phenotypic and genotypic coefficients of variation (PCV and GCV) observed formost 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.

Comment [.1]: What does it mean? Please, enter the meaning of the abbreviation.

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 (Rai *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 podand 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.

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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 Krishi Vishwavidyalaya, 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).

Comment [.3]: Enter a topic for the statistical analysis. What statistical analysis were used to compare the 13 traits among the 25 soybean genotypes?

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).

Comment [.4]: What is the p value?

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 byNeelima*et*

al.(2021),Karnwal and Singh (2009), Malik *et al.*(2011)indicating the wider adapability of these traits in the genotypes studied.

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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 finding were reported byJandong*et al.* 2020, Malek *et al.*(2014) and Karnwal and Singh (2009) for seed yield perplant,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 asoybean improvement program could be successful. The finding is also confirmed bySulistyo (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), Chandel *et a*l.(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.

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Comment [.6]: I suggest that the authors standardize the references according to the journal's norms.

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S.N.	Source	Treatment	Replication	Error

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

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

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

S.N.	Paramet/Characters	Range	General	GCV	PCV	h2	Genetic	Genetic

		max	min	Mean			(Broad Sense)	Advance	Advances as % of Mean
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