Original Research Article

Studies of genetic parameters for yield, yield contributing and morphological characters in soybean ~~([~~*Glycine max* (L.) Merrill~~.)~~]

ABSTRACT

~~T~~hirty ~~h~~irty-five genotypes of soybean ~~([~~*Glycine max* (L.) Merr~~.) .]~~ genotypes were studied to observe genetic variability, heritability and genetic advance for nine yields, yield contributing and morphological characters. The analysis of variance revealed that ~~the~~ sufficient variability was present in the material for all the characters. The ~~value of phenotypic coefficient of variation (PCV) is greater~~ more excellent ~~than~~ phenotypic coefficient of variation (PCV) value is greater than the genotypic coefficient of variation (GCV). The high GCV and PCV were observed for the number of pods per plant, ~~number of~~ branches per plant, seed yield per plant and plant height. High heritability estimates coupled with high expected genetic advance were observed for the characters seed yield per plant, number of pods per plant, number of branches per plant and plant height indicating the presence of additive gene action and phenotypic selection may be more fruitful and effective for desired genetic improvement.

Key~~—~~words~~—~~: *Genetic advance*, ~~*Soybean*~~*soybean*, ~~heritability~~*Heritability*, ~~*yield*~~*Yield*, ~~variability~~*Variability*

1. Introduction

Soybean is often termed as 'miracle golden bean of 21st century~~²~~., ~~B~~because it contains about 40% protein well balanced in essential amino acids, 20 ~~per cent~~ % rich in poly-unsaturated fatty acids, especially omega 6 and omega 3 fatty acids, 6-7 ~~per cent~~ % total minerals 5-6 per cent crude fiber and 17-79 ~~per cent~~ % carbohydrates. Besides, it has a good amount of iron, vitamin B complex and isoflavones such as daidzein, genistein and glycitin. ~~Presence~~ The presence of a good amount of calcium and iron makes it highly suitable for women who suffer ~~with~~ from osteoporosis and anaemia. The isoflavones of soybean have been found to possess numerous health benefits as they exhibited properties like preventing cancer, combating the menopausal problem and helping to recover from diabet~~i~~es (Chauhan and Joshi, 2005). The development of superior variety can be based on the magnitude of genetic variability in the base material and the extent of ~~heritability~~ heredity ~~of~~ desirable characters. To begin with any crop

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improvement programme, the information of genetic variability in the genetic system of a particular crop is sought as a pre-requisite. Although increased seed yield is the ultimate aim of the plant breeders, seed yield itself is a product of the interaction of many component traits which influence it directly or indirectly. Therefore, variability existing within each component trait must be exploited by selection to realize a maximum gain in seed yield (Gohil *et al*., 2006).

Seed yield is ~~very complex character being dependent on number of genetic factors interacting with~~a very complex character dependent on several genetic factors interacting with the environment. For the improvement of crop yield, the breeder has to select superior individuals based on their phenotypic expression. Selection based on phenotypic expression is sometimes misleading as the development of the character is the result of the interaction of the heritable and non-heritable factors. ~~This~~ It highlights the imperative need for partitioning the overall variability into its heritable and non-heritable components and genetic parameters like the genetic coefficient of variation (G~~.C.V.~~CV), phenotypic coefficient of variation (P~~.C.V.~~CV), heritability and expected genetic advance (E~~.G.A.~~GA). The development of superior variety can be based on the magnitude of the genetic variability in the base material and the extent of heritability of desirable characters (Dhillion *et al*., 2005). The existence of variability is essential for resistance to biotic and abiotic factors a~~s well as for~~nd varietal adaptability. Selection is also effective when there is genetic variability among the individuals in the population. Hence, the magnitude of genetic variability present in a population is of prime importance to any plant breeder for starting and judicious breeding programme. In ~~present study, efforts have been made to analyze the components of variability with reference to future breeding programme~~the present study, efforts have been made to analyze the components of variability regarding future breeding programmes.

2. Materials and ~~methods~~ Methods

The experimental material consists of ~~thirty~~ thirty-five newly developed promising genotypes of soybean ~~(~~[*Glycine max* (L.) Merr~~.) .~~] developed at different centers from various states of the country, including three national checks *viz.*, Bragg, JS 93-05, JS 97-52 and two local checks viz., MAUS 71 and MAUS 81. The experiment was c~~arried out~~onducted in randomized block design with three replications at All India Co-ordinated Research Project on Soybean, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani. All recommended

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agronomical packages of practices were followed for ~~satisfactory~~ good crop growth. Two sprayings were undertaken ~~for control of~~to control the leaf miner and leaf rolling caterpillar.

Observations were recorded on nine yields and yield contributing and morphological characters *viz*., days to first flowering, days to 50 percent flowering, days to maturity, plant height, number of branches per plant, number of pods per plant, 100 grain weight, oil content and grain yield per plant. The data were collected and analyzed for genotypic and phenotypic coefficients of variation, heritability (broad sense), and expected genetic advance as percent of the mean. The genotypic and phenotypic coefficient of variation (GCV and PCV) was calculated according to the method suggested by Burton (1952). Heritability (broad sense) was ~~calculated~~ estimated according to the method ~~suggested~~ indicated by Allard (1960). The genetic advance (at 5 per~~-~~cent selection intensity) was calculated for each character using the formula ~~suggested~~ presented by Johnson *et al*.~~,~~ (1955).

3. Results and Discussion

In the genetic improvement of soybean, the knowledge of genetic variability, heritability and genetic advance is a prerequisite to develop varieties having desirable characters. The heritable variation is masked by a non-heritable variation which creates difficulty in exercising selection. Hence, it becomes necessary to ~~spilt~~ split overall variability into heritable and non-heritable components with the help of ~~certain~~ specific genetic parameters. ~~This~~ It may enable the breeder to adopt a proper breeding strategy since ~~many characters of economic importance are highly influenced by environmental conditions~~environmental conditions that affect many characters of economic importance. The analysis of variance showed significant differences among the genotypes for all the nine characters studied (Table 1). The characters under investigation were analysed for genotypic variance (σ^2g), phenotypic variance (σ^2p), genotypic coefficient of variation (GCV), phenotypic coefficient of variation (PCV), heritability (broad sense) and expected genetic advance as percent of the mean (EGA) and are presented in Table 2.

3.1 Range of variability

~~Wide~~ A wide range of variability was observed for the majority of yield contributing characters. Range of variation ~~on the basis of~~based on mean was more for traits viz., the number of pods per plant, plant height, days to maturity, seed yield per plant, days to 50% flowering, days to first flowering, 100 seed weight, oil content and number of branches per plant. Similar

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results were obtained by Chettri *et al*. (2005), Dhillon *et al.* (2005), Gupta and Punetha (2007), Aditya *et al*. (2011) and Akram *et al.* (2016).

Estimates for phenotypic variance are higher than the genotypic variance for all the characters. High genotypic variances were observed for character number of pods per plant followed by plant height, days to maturity, days to flowering, days to 50 per-cent flowering and seed yield per plant. High phenotypic variances were observed for the number of pods per plant, plant height and oil content. The present findings are in agreement with those reported by Dhillon *et al.*(2005), Gohil *et al.* (2006), Sirohi *et al.* (2007), Ghodrati (2013) and Baraskar *et al.*(2014).

3.2 Genotypic and phenotypic coefficient of variation

In the present investigation, the phenotypic coefficient of variation ~~were~~ was ~~greater~~ more significant than the genotypic coefficient of variation. Still, ~~but the differences between them were found to be of lower magnitude indicating that there is~~the differences between them were found to be of lower magnitude, indicating that there is a small effect of environment on a character under study and selection may be effective for ~~important~~ necessary of these traits. The highest values of genotypic coefficient of variation and phenotypic coefficient of variation were recorded for characters viz., number of pods per plant, number of branches per plant, seed yield per plant and plant height, indicating the possibilities of enhancement of these traits through selection. Similar observations were made by Bhairav *et al.*(2006), Gohil *et al.* (2006), Sirohi *et al.* (2007), Aditya *et al.*(2011) and Islam *et al.*(2015). The low estimates of the phenotypic coefficient of variation and genotypic coefficient of variation were observed for days to first flowering, days to 50% flowering, days to maturity and oil content. These results ~~are in conformity~~conform with reports of earlier workers viz., Dhillon *et al.* (2005), Karad *et al.* (2005), Sahay *et al.* (2005), Gupta and Punetha (2007), Ghodrati (2013) and Baraskar *et al.*(2014).

3.3 Heritability and genetic advance

The knowledge about the heritability of a trait is helpful to enable the plant breeder ~~for deciding~~to decide the appropriate selection procedure to be followed for improvement of the trait under a given situation. The high heritability estimates a~~long with expected genetic advance is~~nd

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expected genetic advance is more ~~useful~~ helpful in predicting yield under phenotypic selection than heritability estimates alone (Johnson et al. 1955). In the present investigation, the heritability range~~range of heritability~~ was from 30 per~~-~~cent for oil content to 99.42 for plant height. The desirable broad sense heritability (more than 60%) was observed for days to flowering (90.71%), days to 50% flowering (96.94) and days to maturity (99.30 ~~per~~ percent). These results a~~re in agreement~~gree with those results obtained by Gohil *et al.* (2006) and Gupta and Punetha (2007). Bhairav *et al.* (2006), Baraskar *et al.* (2014), Islam *et al.* (2015) and Kushwantoro (2017) reported high genetic advances for the number of branches per plant, pods per plant, seed yield per plant and plant height, suggesting that a~~ll these characters were governed by additive gene effect~~dditive gene effects controlled all these characters. ~~Similar~~ A similar trend of results ~~were~~ was observed in the present investigation.

High heritability estimates coupled with high expected genetic advance were observed for the characters viz., seed yield per plant, number of pods per plant, number of branches per plant and plant height indicating the presence of additive gene action on the expression of these characters. Similar trends of results were reported by Dhillon *et al.* (2005), Yadav *et al.* (2007), Islam *et al.* (2015) and Kushwantoro (2017). ~~Selection of characters which have high heritablility with expected high expected genetic advance will be more useful than the character having~~The selection of characters with high heritablility with expected high expected genetic advance will be more useful than the character with low genetic gain. High heritability estimates coupled with ~~low~~ insufficient genetic advance ~~was~~ were observed for characters viz., oil content, days to 50 per~~-~~cent flowering, days to maturity and 100 seed weight. Similar type of findings were reported by Dhillon *et al.* (2005), Sahay *et al.* (2005), Karad *et al.* (2005), Chettri *et al.* (2005) and Baraskar *et al.*(2014), indicating the presence of poor genetic variance in the material for these characters.

4. Conclusion

It is cleared that the characters viz., seed yield per plant, number of days for first and 50 per~~-~~cent flowering, number of branches per plant, number of pods per plant and plant height recorded high heritability with high expected genetic advance indicating the presence of additive gene action and phenotypic selection will be effective for these traits. Therefore, due weightage should be given for the improvement of these traits.

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5. References

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Table ~~:~~1: ~~Analysis~~ Analysis of variance for yield, yield contributing and morphological characters in soybean

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Source of Variation	D~~.~~F.	Mean Sum of squares								
		Morphological characters					Yield contributing characters			
		Days to first flowering	Days to 50% flowering	Days to maturity	Plant height (cm)	Number branches per plant	Number of pods per plant	100 seed weight (g)	Oil content (%)	Seed yield per plant (g)
1	2	3	4	5	6	7	8	9	10	11
Replication	2	28.981	0.476	66.860	3.634	1.675	53.434	0.224	0.759	2.929
Treatment	39	23.055**	24.29**	192.92**	156.297**	3.644**	290.289**	9.814**	10.676**	2.866**
Error	78	0.761	0.252	82.41	4.342	0.452	4.997	0.291	0.300	0.473

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Table ~~:~~ 2: Parameters of Genetic Variability for yield, yield contributing and morphological characters in ~~Soybean~~ soybean

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Sr. No.	Character	Range	General mean	Genotypic variance (σ^2g)	Phenotypic variance (σ^2p)	GCV(%)	PCV(%)	Heritability (%)	Expected genetic advance (%)
1	Days to first flowering	27.00-40.00	32.96	7.43	8.19	8.26	8.68	90.71	16.22
2	Days to 50% flowering	29.00-42.66	35.92	8.01	8.26	7.88	8.06	96.94	15.98
3	Days to maturity	71.0-108.33	96.66	48.12	48.46	7.11	7.13	99.30	14.60
4	Plant height (cm)	26.33-58.00	39.64	53.45	53.76	18.46	18.52	99.42	37.93
5	Number branches per plant	2.33-6.33	4.10	1.06	1.51	25.15	30.03	70.00	43.40
6	Number of pods per plant	18.0-60.66	30.48	95.09	100.95	31.99	32.82	95.00	64.23
7	100 seed weight (g)	7.86-15.86	11.04	3.17	3.46	16.13	16.86	91.59	31.81
8	Oil content (%)	15.53-21.80	18.68	8.43	8.80	14.37	16.10	30.00	5.13
9	Seed yield per plant (g)	1.71-6.60	4.15	0.95	0.96	23.59	23.61	99.00	48.59

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