

## Analytical Study on Genetic variation, Correlation and Path Coefficient for Various Agronomical Traits in Soybean (*Glycine max.* L. Merrill) in Malwa Region of Madhya Pradesh, India

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### ABSTRACT

Soybean which is known as miracle bean or golden bean is one of the most important leguminous and oilseed crops of India. Despite its qualitative values and economic importance, soybean production is relatively low in our country due to poor genetic make-up of cultivars available. The effectiveness of selection depends on magnitude of variability for yield and its component traits. Study of inter-relationships among yield and contributing traits is also necessary. Keeping all these facts in view, this study was conducted to determine the variability, heritability, character association and path coefficient analysis between yield and its contributing characters of six different soybean genotypes for selecting the best parents for undertaking a breeding programme. The genotypes exhibited a wide range of variability for days to 50 per cent flowering, plant height, days to maturity, 100-seed weight, and seed yield. All the characters except 100-seed weight were also displayed high heritability. High genetic advance was observed for plant height, days to 50 per cent flowering and seed yield. Seed yield had significant positive genotypic and phenotypic correlation with days to maturity whereas plant height showed negative correlation with seed yield. Path coefficient analysis revealed that days to maturity showed positive direct effect with seed yield. Hence, the results suggested that selection should be based on later maturing genotypes for harvesting maximum yield.

**Keywords:** Genetic variability, correlation, direct & indirect effects, yield, soybean.

### INTRODUCTION

Soybean which is known as miracle bean or golden bean is one of the most important leguminous and oilseed crops of India as well as for the world. It has high oil (18 %-22 %)

and protein content (38 %-42 %). Soybean occupied prime position in the world in oil production (57 %) in global trade markets among the major oilseed crops (Pandey et al., 2008).

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The increased demand for oil and protein stimulated soybean production mainly by land expansion, with very modest growth in its productivity. India has an area of 8 % of the world area (9.62 m ha), but figures with the lower productivity (1124 kg ha<sup>-1</sup>) against the world average of 2380 kg ha<sup>-1</sup>. Soybean grown in an area of 9.62 m ha producing 10.82 m t with the productivity of 1124 kg ha<sup>-1</sup> during *kharif* 2008 in India. Madhya Pradesh generally called as soybean state of India, contributes to the extent of 70 per cent with respect to area and 64 per cent to production. It is leading state in soybean production both in terms of area and productivity, contributing 5.0 m ha and 1090 kg ha<sup>-1</sup>, respectively (Anonymous, 2009).

To fulfil the demands of continuously increasing population, maximizing the yield is main objective of crop breeding and improvement programmes. Genetic variation among various characters is important for breeding and in selecting desirable types. For this purpose, adequate exploitation of the available variability in population is view to identify and select the superior genotypes with desirable traits is most important and difficult task. Therefore, it is necessary to know the relative magnitudes of genetic and non-genetic variability exhibited by various traits with the use of suitable parameters like genotypic and phenotypic coefficient of variability (GCV and PCV), heritability (H) & genetic advance (GA). On the other hand, an analysis of the correlation between seed yield and yield components is essential in determining selection criteria; however, path coefficient analysis helps to determine the direct effect of characters and their indirect effects on other characters. Hence, to find out the amount of associations among different characters and their effects on yield so that we can select the best parents for starting a judicious breeding programme.

#### MATERIALS AND METHODS

The experiment contributing six different lines of soybean namely; JS 20-09, NRC-76, RKS-45 including three checks namely; Bragg

(national check), JS 93-05 (zonal check) for early maturing types and JS-335 (zonal check) for medium duration maturing type was carried out under advance varietal trial during *kharif* season adopting randomized complete block design (RCBD) with four replications at Research Farm of Krishi Vigyan Kendra-Ujjain falls in the central zone of India. Each line have 12 rows of 5 meter row-length keeping 45 cm as inter-row spacing. The recommended package of practice was applied to raise a good crop.

Observations were recorded on days to 50 per cent flowering {DTF (50%): d}, days to maturity (DTM:d), 100-seed weight (SI:g) and seed yield (SY: kg ha<sup>-1</sup>) on whole plot basis whereas one single character *i.e.* plant height (PH:cm) was recorded on ten randomly selected plants basis.

The data were analysed according to the RCBD and mean values for each character were subjected to analysis. The analysis of variance (ANOVA) was prepared as per statistical method described by Panse and Sukhatme (1967). The genotypic coefficient of variation (GCV), phenotypic coefficient of variation (PCV) were estimated as per Burton (1952). Heritability in broad sense ( $h^2_{bs}$ ) and genetic advance as per cent of mean (GA) were calculated as per procedure of Johnson et al. (1955) cited in Singh and Chaudhary (1979). The correlation coefficients among different characters were carried out as per method suggested by Fisher (1918). The direct and indirect effects of characters were carried out by path coefficient analysis was performed by examining seed yield as a dependent variable for major contributors to seed yield.

#### RESULTS AND DISCUSSION

On the basis of statistical analysis ANOVA revealed highly significant mean squares of genotypes for all the characters studied which indicates sufficient variability and large scope for the selection of desirable genotypes for higher yield from material evaluated. Similar findings were reported earlier by Malik et al. (2006 & 2007), Arshad et al. (2006), Bhushan

et al. (2006) and Shahidul Islam et al. (1996) in soybean.

Genetic parameters of yield and their components are given in Table 1. According to the mean values of days to 50 per cent flowering, days to maturity, plant height, 100-seed weight and seed yield were 43 d, 95 d, 53.1 cm, 12.2 g and 2420 kg ha<sup>-1</sup>, respectively. In general, the estimates for phenotypic coefficient of variation (PCV) for all the characters were higher than their respective genotypic coefficient of variation (GCV) indicating the influence of environmental factors in expressing the traits studied. Similar results were reported earlier by Bhushan et al. (2006). Genotypic coefficient of variations were relatively greater in plant height (18.99%), seed yield (13.90 %) and days to 50 per cent flowering (13.88 %), while it was smaller for days to maturity (3.88 %) and 100-seed weight (3.73 %). Phenotypic coefficient of variation were highest for plant height (21.05 %) followed by seed yield (14.83 %), days to 50 per cent flowering (13.97 %), 100-seed weight (5.51 %), while it was least for days to maturity (4.06 %). Broad sense heritability ranged from 45.7 % to 98.7 %. The heritability values were recorded high for most of the characters due to low genotypic variances indicating less environmental influence and possible governance of these characters were seems to be additive gene action. These results were in accordance with the findings of Bhushan et al. (2006). Days to 50 per cent flowering and seed yield [Jain & Ramgiry (2000)] indicated high heritability as well as high genotypic coefficient of variation. In this manner, crop improvement, in terms of these characters could be possible by simple selection because high heritability coupled with high genotypic variation revealed the presence of an additive gene effect. On the other hand, low heritability coupled with low genotypic coefficient of variation was observed for plant height indicated the character was highly influenced by environmental effect and selection will be relatively more efficient in days to 50 per cent flowering, seed yield and plant height.

## CORRELATION COEFFICIENT ANALYSIS

The seed yield exhibited a highly significant positive correlation with days to maturity (Table 2). These results suggested that any positive increase in such character will accelerate the boost in seed yield. These results were in accordance with those reported by Chettri et al. (2006), Ramana et al. (2000), Bangar et al. (2003). Significant and negative relationships were found for plant height (Rajasekaran et al. (1980), Kalaimagal (1991) and 100-seed weight [Rajasekaran et al. (1980), Jagtap & Choudhary (1993), Shinde et al. (1996), Thorat et al. (1999).] with seed yield. The high positive correlation between days to 50 per cent flowering and 100-seed weight, plant height and 100-seed weight indicated that cultivars with delayed to flowering coupled with higher plant height contribute to seed yield.

The main purpose of plant breeder is to achieve an increase in soybean yield. Yield and its components are polygenic traits, which are strongly influenced by the environment and other factors both known and yet to be identified. To this end, emphasis should be given to the development of soybean lines with longer days to maturity and dwarf type coupled with high 100-seed weight to improve seed yield.

## PATH COEFFICIENT ANALYSIS

The estimation of correlation coefficient reveals only the relationship between yield and yield components but do not show the direct and indirect effects of different yield components on yield *per se*. Path coefficient analysis was carried out in the present experiment to know the direct and indirect effect of different characters and depicts the relative importance of each factor on seed yield. The path coefficients were partitioned into direct and indirect effects by using seed yield as a dependent variable. The direct and indirect effects of different characters were given in table 3.

The path coefficient analysis based on seed yield as a dependent variable revealed that days to maturity showed highest positive

direct effect (0.5757) as earlier reported by Arshad et al. (2006) and Chettri et al. (2006) whereas days to flowering, plant height and 100-seed weight exhibited negative direct effect on seed yield.

The path coefficient analysis indicated that the highest positive correlation of seed

yield was recorded with days to maturity and its direct effect on seed yield was also positive (0.5757).

Based upon path coefficient and correlation analysis it may thus, be concluded that selection prospectus for high seed yield seemed to be through days to maturity.

**Table 1: Genetic parameters of different attributes in soybean**

Parameter /Character	Days to 50 % flowering	Days to maturity	Plant height (cm)	100-seed weight(g)	Seed yield (kg/ha)
Mean	43	95	53.1	12.2	2420
Range : Min.	37	90	39	12.0	1737
Max.	49	99	67	13.0	2753
M.S. (lines)	144.342**	55.841**	439.819**	1.067*	580089.63**
GCV (%)	13.88	3.88	18.99	3.73	13.90
PCV (%)	13.97	4.06	21.05	5.51	14.83
$h^2_{bs}$	98.7	91.4	81.5	45.7	87.9
Genetic advance	12.27	7.27	18.96	0.63	23.30
GA as % of mean	28.41	7.64	35.32	5.19	26.86

\*, \*\*: significant at p=0.05 and p=0.01 level of probability, respectively.

**Table 2: Genotypic and phenotypic correlation coefficients among different attributes in soybean**

Character	G/P level	Days to 50 % flowering	Days to maturity	Plant height (cm)	100-seed weight (g)	Seed yield (kg/ha)
Days to 50 % flowering	G:	1.000				
	P:	1.000				
Days to maturity	G:	0.181	1.000			
	P:	0.173	1.000			
Plant height (cm)	G:	0.363	-0.244	1.000		
	P:	0.326	-0.247	1.000		
100-seed weight(g)	G:	0.729**	0.091	0.874**	1.000	
	P:	0.514*	-0.029	0.448*	1.000	
Seed yield (kg/ha)	G:	-0.127	0.743**	-0.585**	-0.464*	1.000
	P:	-0.133	0.620**	-0.438*	-0.309	1.000

\*, \*\*: significant at p=0.05 and p=0.01 level of probability respectively.

**Table 3: Direct and indirect effects among different attributes in soybean**

Character	Days to 50 % flowering	Days to maturity	Plant height (cm)	100-seed weight (g)	Correlation with Seed yield (kg/ha)
Days to 50 % flowering	<b>-0.0583</b>	0.0998	-0.0649	-0.0892	-0.127
Days to maturity	-0.0101	<b>0.5757</b>	0.0492	0.0050	0.743**
Plant height (cm)	-0.0190	-0.1425	<b>-0.1987</b>	-0.0777	-0.585**
100-seed weight (g)	-0.0299	-0.0167	-0.0890	<b>-0.1734</b>	-0.464*

\*, \*\*: significant at p=0.05 and p=0.01 level of probability respectively.

### CONCLUSION

In all characters studied phenotypic coefficient of variation and genotypic coefficient of variation showed almost equal value indicated that characters were not influenced by environmental effects. According to the results of the correlation analysis seed yield was significantly and positively correlated with days to maturity. Path coefficient analysis of seed yield indicated that days to maturity exerted the greatest direct effect. This trait had major contributions to seed yield, and hence can increase the success of breeding studies of soybean in the Malwa region of the Madhya Pradesh of India.

### REFERENCES

- Anonymous (2009). All India Coordinated Research project on Soybean. Director's report (2008-09). Directorate of Soybean Research (ICAR), Khandwa Road, Indore-452001 (MP).
- Arshad, M. Ali, N., & Ghafoor, A. (2006). Character correlation and path coefficient in soybean (*Glycine max*. L. Merrill). *Pak J. Bot.*; 38(1), 121-130.
- Bangar, N. D., Mukhekar, G. R., Lad, D. B., & Mukhekar, D. G. (2003). Genetic variability, correlation and regression studies in soybean. *Journal of Maharashtra Agricultural Universities*, 28(3):, 320-321.
- Bhushan, B., Sharma, S. P., & Ranwah, B. R. (2006). Genetic variability, heritability and genetic advance in soybean (*Glycine max*. L. Merrill). *Natnl. J.Pl. Improv.*; 8(1), 98-95.
- Burton, G. W. (1952). Quantitative inheritance in grasses.- *Proc. 6<sup>th</sup> Inter. Grassland Congr.*, 1, 277-83.
- Chettri, M., Mondal, S., & Nath, R. (2006). Studies on correlation and path analysis in soybean (*Glycine max*. L. Merrill) in the Darjeeling hills. Department of agronomy, Bidhan Chandra Krishi Vishwavidyalaya, Mohanpur, Kalyani-741235, West Bengal, India.
- Fisher, R. A. (1918). The correlation between relatives on the supposition of mendelian inheritance. *Trans. Roy. Soc., Edinburgh.*; 52:, 399-433.
- Jagtap, D. R., & Choudhary, P. N. (1993). Correlation studies in soybean. *Annals of Agricultural Research*, 14(2), 154-158.
- Jain, P. K., & Ramgiry, S. B. (2000). Genetic variability of metric traits in Indian germplasm of soybean (*Glycine max* (L.) Merrill). *Advances in Plant Sciences*, 13(1), 127- 131.
- Johnson, H. W., Robinson, H. F., & Comstock, R. E. (1955). Genotypic and phenotypic correlations in soybean and their implication in selection.- *Agron. J.*, 47:, 477-483.
- Kalaimagal, T. (1991). Studies on variability, character association and genetic divergence in soybean (*Glycine max* (L.) Merrill). *M.Sc. (Agri.) Thesis*, University of Agricultural Sciences, Bangalore.
- Malik, M. F. A., Ashraf, M., Qureshi, A. S., & Ghafoor, A. (2007). Assessment of genetic variability, correlation and path analyses for yield and its components in soybean. *Pak J. Bot.*; 39(2), 405-413.
- Malik, M. F. A., Qureshi, A. S., Ashraf, M., & Ghafoor, A. (2006). Genetic variability of the main yield related characters in soybean. *International J. Agric & Biology*; 8(6), 815-819.
- Pandey, K., Singh, K., Singh, B. V., Pushpendra, Gupta, M. K., & Yadav, N. S. (2008). Character association and path coefficient analysis in advance Breeding lines of soybean [*Glycine max* (L.) Merrill]. *Soybean Research*; 6, 15-20.
- Pansey, V. G., & Sukhatme, P. V. (1969). Statistical method for Agricultural Workers- Published by Indian Council of Agricultural Research, New Delhi, pp-381.
- Rajasekaran, S., Premsekar, S., & Hanumantha Rao, H. K. (1980). Selection and

- elevation of the relative influence of the morphological characters and yield components on yield of soybean. *Madras Agricultural Journal*, 67(2), 71-76.
- Ramana, M. V., Pramila Rani, B., & Satyanarayana, A. (2000). Genetic variability, correlation and path analysis in soybean. *Journal of Oilseeds Research*, 17(1), 32-35.
- Shahidul Islam, M. D., & Sharmin, K. (1996). Inter-relationship and path coefficient analysis in vegetable soybean (*Glycine max*. L. Merrill). *Thai J. Agril. Sci.*; 29(1), 65-74.
- Shinde, A. K., Birari, S. P., Bhave, S. G., & Joshi, R. M. (1996). Correlation and path coefficient analysis in soybean. *Annals of Agricultural Research*, 17(1), 28-32.
- Singh, R. K., & Chaudhary, B. D. (1979). Biometrical methods in Quantitative Genetic Analysis. Kalyani Publishers, New Delhi.
- Thorat, A., Khorgade, P. W., Ghorade, R. B., & Ghodke, M. (1999). Variability heritability and genetic advance in soybean (*Glycine max* (L.) Merrill). *Journal of Soils and Crops*, 9(2), 198-200.