The Bioscan 10(4): 1947-1950, 2015 (Supplement on Genetics and Plant Breeding) www.thebioscan.in
AN INTERNATIONAL QUARTERLY JOURNAL OF LIFE SCIENCES

CHARACTER ASSOCIATION AND PATH COEFFICIENT ANALYSIS FOR SEED YIELD AND ITS CONTRIBUTING TRAITS IN SOYBEAN [*GLYCINE MAX* (L.) MERRILL]

DINESH KUMAR THAKUR[1]*, SUNIL KUMAR NAG[1], TULESH KUMAR GENDLEY[1] AND RAKESH KUMAR PATEL[2]
[1]Department of Genetics and Plant Breeding,
Indira Gandhi KrishiVishwavidyalaya, Raipur - 492 012, Chhattisgarh
[2] S.G. College of Agriculture and Research Station, Jagdalpur - 494 221, Chhattisgarh, INDIA
e-mail: dineshthakur.in@gmail.com

KEYWORDS
Correlation
Path analysis
Soybean
Protein

Received on :
05.06.2015

Accepted on :
18.09.2015

***Corresponding author**

ABSTRACT
An experiment was conducted with forty genotype of soybean (Glycine max (L.) Merrill.), to study character association among the seed yield contributing traits and their direct and indirect effects on the seed yield. Correlation studies indicated that out of 12 characters, seed yield per plant showed significant positive correlation with pod bearing nodes (0.578), number of pods per plant (0.397), number of seeds per pod (0.368) and 100 seed weight (0.471). Path coefficient analysis showed that, pod bearing length (3.999) contributed most directly to seed yield among all the traits whereas, other characters like, number of pods per plant (3.173), number of seeds pod^{-1}(1.514),100- seed weight (1.039) and oil content (2.003) both directly and indirectly influenced seed yield.Therefore, this is suggested that the traits *viz*., number of pods per plant, number of seeds per pod and 100 seed weight and pod bearing lengthmay be considered as important traits during theselection for improvement of seed yield in soybean.

INTRODUCTION

Soybean (*Glycine max* (L). Merrill) is an important oilseed crop belonging to family Leguminoceae, has come to be recognized as one of the premier agricultural crops today for various reasons because it is a major source of vegetable oil, protein and animal feed. Soybean occupies a unique position among edible legumes because of its contains more protein (~ 40-42 %) than other pulses and a much higher content of edible oil (~20 %) (Gopalan*et al*., 1994). Because of its multiple uses, soybean crop is aptly called as "Golden Bean" or "Miracle Crop" of the 20th century.Soybean is the major oilseed crop in the world accounting for nearly 50% of total oilseeds acreage as well as production.Soybean is the only oilseed crop that can be grown successfully during *kharif* season in Chhattisgarh. In recent past, cultivation of soybean has been gaining popularity in Chhattisgarh but, the area coverage under soybean in the state is about 1.520 lakh hectare and production 126.775 lakh metric tonnes with productivity 1155 kg per hectare, (Anonymous, 2012) which is comparatively low as compared to national and international average promotion of soybean cultivation would also increase the double-cropped area in the state. There is an ample scope for improvement of yield to suit the needs of Chhattisgarh soybean farmer for that the character association and path analysis is studied in available germplasm. Correlation which is the primary tool of breeding programme provide the amount of association among different traits with seed yield component and their direct and indirect effect on seed yield.Therefore, it is essential to identify the contributing traits through which soybean seed yield can be improved further. Keeping this in view, the present study was carried out to formulate the selection strategies for improvement of seed yield in soybean.

MATERIALS AND METHODS

The material for the present investigation comprised of 40soybean genotypes were raised in a Randomized Block Design with three replications during *kharif*-2012in experimental area of Department of Genetics and Plant Breeding at Research Cum Instructional Farm, I.G.K.V., Raipur. (C.G.).The experiments were carried out on heavy (*vertisols*) soil and all recommended agronomic practices were followed to raise a good crop.Each genotype was raised in a double row of 3meter length by adopting a spacing of 45 x10 cm. In each row, five randomly selected plants were observed for days to 50% flowering, days to maturity, plant height (cm), number of primary branches per plant, pod bearing length (cm), Number of pod bearing nodes, number of pods per plant, number of seeds per pod, 100- seed weight, protein content, oil content and seed yield per plant. The mean value of five plants represented each genotype. Standard statistical procedure, were used for the analysis of genotypic and phenotypic coefficients of variation suggested by Miller *et al*.(1958). The path co-efficient analysis was done according to the method byWright (1921).

RESULTS AND DISCUSSION

The genotypic and phenotypic correlation coefficients

Table 1: Phenotypic (P), Genotypic (G) and Environmental (E) correlation coefficients among different yield traits in total gene pool of soybean

Character		Days to maturity	Plant height (cm)	Number of primary branches plant^{-1}	Pod bearing length (cm)	Number of pod bearing nodes	Number of pods plant^{-1}	Number of seeds pod^{-1}	100-seed weight (g)	Protein content (%)	Oil content (%)	Seed yield Plant^{-1} (g)
Days to 50% flowering	P	0.522**	0.501**	0.217	0.416**	0.006	0.238	-0.143	-0.556**	-0.006	-0.044	-0.251
	G	0.549**	0.584**	0.392*	0.432**	-0.006	0.438**	-0.332*	-0.581**	-0.029	-0.046	-0.328*
	E	-0.233	0.068	-0.049	0.014	0.118	-0.073	0.064	0.032	0.101	-0.195	0.073
Days to maturity	P		0.231	0.291	0.137	-0.125	0.087	-0.231	-0.384*	-0.015	0.263	-0.316*
	G		0.286	0.554**	0.147	-0.175	0.193	-0.509**	-0.385*	-0.01	0.430**	-0.391*
	E		-0.054	-0.075	-0.011	-0.064	-0.092	-0.031	-0.365*	-0.048	0.147	-0.121
Plant height (cm)	P			-0.042	0.768**	-0.068	0.108	-0.091	-0.141	-0.078	-0.214	-0.136
	G			0.212	0.899**	-0.027	0.385*	0.058	-0.173	-0.007	-0.389*	-0.420**
	E			-0.342*	0.178	-0.137	-0.183	-0.246	0.014	-0.171	-0.064	-0.337*
Number of primary branches plant^{-1}	P				-0.011	0.182	0.433**	-0.105	-0.26	-0.015	0.009	0.074
	G				0.031	0.322*	0.662**	-0.282	-0.475**	0.251	-0.074	-0.081
	E				-0.133	0.099	0.325*	-0.045	0.005	0.13	0.047	0.217
Pod bearing length (cm)	P					0.066	0.161	0.061	-0.074	-0.02	-0.169	0.088
	G					0.095	0.286	0.143	-0.08	-0.083	-0.354*	0.112
	E					0.026	0.024	-0.008	0.015	-0.13	0.107	0.014
Number of pod bearing nodes	P						0.26	0.018	-0.002	-0.016	0.117	0.317*
	G						0.712**	0.087	-0.036	-0.164	0.373*	0.578**
	E						-0.011	-0.013	0.107	0.067	-0.034	0.033
Number of pods plant^{-1}	P							-0.08	-0.222	-0.028	0.077	0.502**
	G							-0.502**	-0.414**	0.067	0.342*	0.397*
	E							0.065	0.015	0.069	-0.045	0.639**
Number of seeds pod^{-1}	P								0.151	0.034	-0.079	0.359*
	G								0.387*	-0.157	-0.205	0.368*
	E								-0.082	0.095	-0.037	0.414**
100-seed weight (g)	P									-0.014	-0.016	0.365*
	G									-0.137	0.014	0.471**
	E									0.254	-0.109	0.046
Protein content (%)	P										-0.001	-0.049
	G										-0.194	-0.297
	E										0.081	0.144
Oil content (%)	P											0.097
	G											0.271
	E											-0.042

** Significant at 1% probability level; *Significant at 5% probability level

between yield and yield attributes are given in Table 1.Among the 12 character combinations, number of pod bearing nodes, 100-seed weight, number of pods per plantand number of seeds per pod exhibited significant and positive correlation with seed yield both at genotypic and phenotypic level. The degree of association was highest betweennumber of pods per plantand seed yield. It was followed by 100-seed weight, number of seeds per pod and pod bearing nodes. Iqbal *et al*. (2010), Karnwal and Singh (2009), Nag *et al*. (2007) and Ganeshmurthy and seshadri (2004) also observed similar strong correlation for number of seeds per pod, 100- seed weight, number of pods bearing nodes and number of pods per plant.The traits, days to 50% flowering, days to maturity, plant height, plant bearing length, number of branches, number of pod bearing nodes and number of pods per plant had highly significant and positive correlations both at genotypic and phenotypic levels among themselves. All these traits also had positive relationship with seed yield indicating certain inherent relationship with seed yield. Selection for these characters simultaneously would bring improvement in soybean yield. Showkat and Tyagi (2010), Nag *et al*. (2007), Ganeshmurthy and seshadri (2004) and Rajanna, *et al*. (2000) reported positive significant association among number of branches, number of pods per plant, days to flowering, plant height, days to maturity, pod bearing length and number of pod bearing nodes. These results are in parallel with the research findings of Sahu *et al.* (2014) and Kamleshwar*et al.* (2013) in greengram. Both the quality characters, oil and protein content, were negatively and no significant correlated with each other and showed no significant association with seed yield. The negative correlation between oil and protein content also observed by Ganeshmurthy and seshadri (2004).

Path coefficient is the standardized partial regression coefficients and provide the true contribution of the characters towards the yield, these genotypic correlations were partitioned into direct and indirect effects. Path analysis (Table 2) revealed that pod bearing length had the highest positive direct effect followed by number of pods per plant, number of primary branches per plant, oil percentage, number of seeds per pod,100- seed weight and days to 50% flowering had least positive direct effect. The direct positive effect of pod bearing length, 100- seed weight and oil content on the seed yield was reported by Nag *et al*. (2007)

similarly days to 50% flowering (patil *et al*., 2011), number of seeds per pod (Iqbal *et al*., 2010), number of pods per plant(Iqbal *et al*., 2010, Gireesh *et al*., 2012, Karnwal and Singh (2009)), number of primary branches (Arshad *et al*., 2006 and Karnwal and Singh (2009)). The remaining characters *viz*., days to maturity, plant height, pod bearing nodes, protein content showed only negative direct effects on the seed yield. similar finding is reported by (Haghi *et al*., 2012) for protein content and (Ganeshmurthy and seshadri (2004) and Iqbal *et al*., 2010) for plant height.The direct effects on number of pod bearing nodes was negative but their positive correlation with seed yield could be due to high indirect effects through number of primary branches per plant. It would be logical to expect that a genotype, which has a higher number of branches, will have a greater ability to produce more number of pod bearing nodes and consequently

Table2. Genotypic and Phenotypic path coefficient of various characters influencing seed yield/plant

Character		Days to 50% flowering	Days to maturity	Plant height (cm)	Number of primary branches plant^{-1}	Pod bearing length (cm)	Number of pod bearing nodes	Number of pods plant^{-1}	Number of seeds pod^{-1}	100-seed weight (g)	Protein content (%)	Oil content (%)	Seed yield Plant^{-1} (g)
Days to 50% flowering	P	-0.077	-0.054	-0.100	-0.010	0.084	0.001	0.144	-0.042	-0.193	0.000	-0.004	-0.251
	G	0.638	-1.383	-2.499	0.949	1.729	0.027	1.389	-0.502	-0.604	0.022	-0.093	-0.328*
Days to maturity	P	-0.040	-0.104	-0.046	-0.014	0.028	-0.014	0.053	-0.067	-0.133	0.001	0.022	-0.316*
	G	0.35	-2.521	-1.222	1.339	0.587	0.765	0.613	-0.771	-0.4	0.008	0.862	-0.391*
Plant height (cm)	P	-0.039	-0.024	-0.199	0.002	0.156	-0.008	0.065	-0.026	-0.049	0.004	-0.018	-0.136
	G	0.373	-0.72	-4.278	0.513	3.596	0.117	1.223	0.008	-0.18	0.005	-0.78	-0.42
Number of primary	P	-0.017	-0.030	0.008	-0.047	-0.002	0.021	0.261	-0.031	-0.090	0.001	0.001	0.074
branches plant^{-1}	G	0.25	-1.397	-0.909	2.416	0.124	-1.404	2.100	-0.426	-0.494	-0.193	-0.149	-0.081
Pod bearing length (cm)	P	-0.032	-0.014	-0.153	0.000	0.203	0.008	0.097	0.018	-0.026	0.001	-0.014	0.088
	G	0.276	-0.37	-3.847	0.075	3.999	-0.416	0.908	0.216	-0.083	0.063	-0.71	0.112
Number of Pod	P	0.000	0.013	0.014	-0.009	0.013	0.115	0.157	0.005	-0.001	0.001	0.010	0.317*
bearing nodes	G	-0.004	0.442	0.115	0.777	0.382	-4.361	2.26	0.131	-0.037	0.126	0.747	0.578**
Number of pods plant^{-1}	P	-0.018	-0.009	-0.022	-0.021	0.033	0.030	0.602	-0.023	-0.077	0.001	0.006	0.502**
	G	0.279	-0.487	-1.649	1.599	1.145	-3.107	3.173	-0.76	-0.43	-0.051	0.686	0.397*
Number of seeds pod^{-1}	P	0.011	0.024	0.018	0.005	0.012	0.002	-0.048	0.291	0.052	-0.002	-0.007	0.359 *
	G	-0.212	1.284	-0.25	-0.68	0.571	-0.378	-1.593	1.514	0.402	0.121	-0.41	0.368*
100-seed weight (g)	P	0.043	0.040	0.028	0.012	-0.015	0.000	-0.134	0.044	0.348	0.001	-0.001	0.365 *
	G	-0.371	0.97	0.74	-1.148	-0.321	0.157	-1.314	0.586	1.039	0.105	0.028	0.471**
Protein content (%)	P	0.000	0.002	0.016	0.001	-0.004	-0.002	-0.017	0.010	-0.005	-0.049	0.000	-0.049
	G	-0.019	0.025	0.028	0.607	-0.33	0.717	0.212	-0.238	-0.142	-0.768	-0.389	-0.297
Oil content (%)	P	0.003	-0.027	0.043	0.000	-0.034	0.013	0.046	-0.023	-0.006	0.000	0.082	0.097
	G	-0.029	-1.085	1.665	-0.179	-1.417	-1.626	1.086	-0.310	0.015	0.149	2.003	0.271

➢ Bold figures diagonal values are direct effect; Residual effect : G = -0.07662; P = 0.3259

more seed yield. This sort of relationship is evident from the present study.

Thus,This investigation revealed that it would be rewarding to lay emphasis on more number of primary branches per plant, pods bearing length, number of pods per plant, number of seeds per pods,100-seed weight and oil content in selection programme of soybeanand may be advantageous for selecting the high yielding genotypes in soybean from the available gene pool.

REFERENCES

Anonymous 2012. The Soybean Processors Association of India, Soybean Crop Estimate Kharif 2012 .www.sopa.org.

Arshad, M., Ali, N. and Ghafoor, A. 2006. Character correlation and path coefficient in soybean (*Glycine max* (L.) Merrill). *Pakistan J. Bot.* **38(1):** 121-130.

Gireesh, C., Husain, S. M., Bhojraj, N. K. and Yatish, K. R. 2012. Studies on variability, character association and path coefficient analysis for yield and its attributing traits in exotic lines of soybean (*Glycine max* (L.) Merrill). *Bhartiya Krishi Anusandhan Patrika*. **27(1):** 35-39.

Ganesamurthy, K. and Seshadri, P. 2004. Genetic variability, character association and path coefficient analysis in soybean. *Madras Agric. J.* **91(1-3):** 61-65.

Gopalan, C., Ramashastry, B. V. and Balasubramanian, S. C. 1994. *Nutritive Value of Indian Foods*, *Indian Council of Medical Research*, pp. 24-26.

Haghi, Y., Boroomandan, P., Moradin, M., Hassankhali, M., Farhadi, P., Farsaei, F. and Dabiri, S. 2012. Correlation and path analysis for yield, oil and protein content of soybean (*glycine max* l.) Genotypes under different levels of nitrogen starter and plant density. *Biharean biologist*. **6(1):** 32-37.

Iqbal, Z., Arshad, M., Ashraf, M., Naeem, R., Malik, M. F. and Waheed, A. 2010. Genetic divergence and correlation studies of soybean (*Glycine max* (L.)Merrill) genotypes.*Pakistan J. Bot.* **42(2):** 971-976.

Kamleshwar, K., Yogendra, P., Mishra, S. B., Pandey, S. S. and Ravi, K. 2013. Study on genetic variability, correlation and path analysis with grain yield and yield attributing traits in green gram [Vignaradiata (L.) wilczek]. *The Bioscan.* **8(4):** 1551-1555.

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.

Miller, P. A., Williams, J. E., Robinson, H. F. and Comstock, R. E. 1958. Estimates of variance and co-variance in upland cotton and their implications in selection. *Agron J.* **50:** 126-131.

Nag, S. K., Yadav, R. K., Sahu, L., Salam, J. L., Soni, D. K. and Ranjan, S. K. 2007. Study of correlation and path coefficient analysis for yield and its attributes in soybean (*Glycine max* (L.) Merrill). *Plant Archi.* **7(1):** 175-178.

Patil, S. S. Naik, M. R. Patil, P. P. and Shinde, D. A. 2011. Genetic variability, correlation and path analysis in soybean. *Legume Res.* **34(1):** 36-40.

Rajanna, M. P., Viswanatha, S. R., Kulkarni, R. S. and Ramesh, S. 2000. Correlation and path analysis in soybean (*Glycine max* (L.) Merrill). *Crop Res.(Hisar)*. **20(2):** 244-247.

Sahu, H., Amadabade, J., Kumar, P., Sao, A. and Patel, R. K. 2014. Assessment of segregating generations for geneticvariability and yield regulating traits in mungbean. *The Bioscan*. **9(4):** 1701-1706.

Showkat, M. and Tyagi, S. D. 2010. Correlation and path coefficient analysis of some quantitative traits in soybean (*Glycine max* L. Merrill.). *Res. J. Agric. Sci.* **1(2):** 102-106.

Wright, S. 1921. Correlation of Causation. *J. Agric. Res.* **20:** 257-287.