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Correlation and Path Analysis Studies in Soybean (*Glycine max* (L.) Merrill.)

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ABSTRACT

An experiment was conducted on soybean at All India Coordinated Research Project on Soybean, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani with view to study correlation and path analysis effects for yield, yield components , oil and root nodulation traits in 40 genotypes of soybean. Correlation studies indicated the importance of days to maturity, plant height, 50% flowering, 100 grain weight, number of pods per plant, number of nodules/plant, nodule dry weight and root length. The path coefficient of analysis revealed maximum contribution of days to maturity, days to 50% flowering, oil content, number of nodules per plant, plant height, 100 grain weight and root length. The characters days to maturity, days to 50 % flowering, 100 grain weight, number of nodules per plant and root length had strong association with yield. It also showed the highest direct effect and indirect effect through other component traits. This indicated that direct selection for these characters will help to enhance the breeding efficiency for grain yield in soybean.

Key words: *Correlation, Path analysis, Root Nodulation, Soybean, Yield.*

INTRODUCTION

Soybean is ‘‘The Miracle Golden Bean of 20th Century’’ has revolutionized the agriculture as well as generated economy of many countries like china and Japan. It is rich source of protein (40-43%) and oil (20%) besides mineral and vitamins. India is largest producer of soybean in the world. Soybean is the third largest oil seed crop in India next only to ground nut and mustard. In applied plant breeding, success of the programme may be anticipated if the genetic variability of different selection is known well in advance. Correlation and path analysis provide information on genetic association of yield contributing characters, which in turn are useful in developing breeding strategies. Therefore, present study was undertaken with a view to study correlation and path analysis effects for yield, yield components, oil and root nodulation traits in soybean.

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MATERIAL AND METHODS

The experimental material comprised of 35 promising newly developed cultivars of soybean developed at different centre of country and five checks *viz.*, Bragg, JS 93-05, JS 335, MAUS 71 and MAUS 81. The experiment was laid out during *Kharif* 2008-2009 at experimental form of All India Co-ordinated Research Project on Soybean, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani. The experimental was conducted in Randomized Block Design with three replications, 45 cm row to row distance and 5 cm plant to plant distance and a 30:60 NP kg/ha fertilizer dose was applied. All the recommended agronomic package of practices was followed for satisfactory crop growth. Five plants were selected randomly from each treatment for recording of observations. Observations were recorded on morphological characters *viz.*, days to flowering, days to 50% flowering, days to maturity, number of branches per plant, plant height (cm), root nodulation characters *viz.*, number of root nodules per plant, nodule dry weight per plant (mg), and main root length (cm). Yield contributing characters *viz.*, 100 grain weight (gm), number of pods per plant, oil content (%), and grain yield per plant. The analysis of variance was done as suggested by Panse and Sukhatme[7]. The genotypic and phenotypic simple correlation coefficients were worked out from the respective variances and co variances as per method suggested by Johnson *et al.*[6]. The genotypic correlation coefficients between yield and it's components were further partitioned into direct and indirect effect with the help of path coefficient analysis originally suggested by Wright[11] and further outlined by Dewey and Lu[3].

RESULTS AND DISCUSSION

Correlation coefficient is an important statistical constant which gives the degree of association among the various characters. Grain yield is a complex character and depends upon the other agronomic traits, therefore, study of the relationship of characters with each other and with yield become more important in crop improvement programme. It is very essential to find out the relative contribution of each component character in yield so as to give weightage during the selection. In present investigation genotypic and phenotypic correlation were calculated for yield and yield components (Table 1 & 2).

The characters days to flowering, days to 50% flowering, days to maturity, plant height, number of pods per plant, 100 grain weight, number of nodules per plant, nodule dry weight and root length showed positive and significant correlation with grain yield at both the levels. Amaranth *et al*[1]., reported significant correlation of grain yield with days to 50% flowering, number of pods per plant, days to maturity, plant height, number of branches per plant and 100 grain weight. Similarly, results obtained by Taware *et al.*[10], for days to flowering, days to maturity and number of pods per plant, Inderjit and Phul[5] for nodules per plant and number of pods per plant and Sharma *et al.*[9], for number of nodules and nodule dry weight per plant were in accordance with the present investigation. Days to flowering exhibited positive and significant correlation with days to maturity and plant height at both the levels. Days to maturity showed positive and significant correlation with plant height and number of pods per plant. Similar findings were reported by Sharma *et al*[9]., Taware *et al.*[10], and Gohil *et al*[4].

The positive and significant correlation existed between days to flowering with days to maturity and plant height, plant height with number of pods per plant in turn their association with grain yield was positive at both the levels. It is important to note that the characters days to flowering, days to maturity, plant height, number of pods per plant, 100 grain weight, number of nodules/plant, nodule dry weight and root length were positively correlated with grain yield. Selection based on the knowledge and direction of association becomes very useful in identifying key characters which can be perfectly exploited in a short time to achieve yield improvement in soybean.

Path coefficient analysis is a standardized partial regression analysis which permits the separation of correlation coefficient into the measure of direct and indirect effects. This helps in giving the priority to particular character during the selection.

The path analysis indicated that days to maturity and days to 50% flowering exerted the highest direct effect to grain yield at genotypic level (Table 3). Similar results reported by Sharma *et al.*[9], Taware *et al.*[10], Chettri *et al*[2]., and Inderjit and Phul[5]. Number of nodules per plant had positive and direct effects on grain yield. Significant and positive correlation of days to maturity with grain yield could be explained by its positive direct effect. Taware[10] reported indirect effect on yield via days to 50% flowering, number of nodules per plant and 100 grain weight.

The present investigation clearly revealed that the characters days to maturity, days to 50 % flowering, 100 grain weight, number of nodules per plant and root length had strong association with yield. It also showed the highest direct effect and indirect effect through other component traits. This indicated that direct selection for these characters will help to enhance the breeding efficiency for grain yield in soybean.

Table 1: Genotypic correlation of soybean yield with yield contributing characters

Sr.No.	Characters	Days to flowering	Days to 50% flowering	Days to maturity	Plant height (cm)	Number of branches per plant	100 grain weight (gm)	Number of pods per plant	Oil content (%)	Nodule dry wt. (mg)	Number of nodules per plant	Root length (cm)	Yield per Plant (gm)
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Days to flowering	1.000	0.675**	0.767**	0.431**	-0.274	-0.124	0.161	0.027	-0.068	-0.045	0.056	0.552**
2	Days to 50% flowering		1.000	1.114	0.628**	-0.191	-0.041	0.545**	-0.132	0.484**	0.515**	0.235	0.857**
3	Days to maturity			1.000	0.561**	-0.166	0.044	0.480**	-0.105	0.424**	0.456**	0.193	0.870**
4	Plant height (cm)				1.000	-0.145	0.027	0.332*	-0.136	0.260	0.210	0.067	0.406**
5	Number of branches per plant					1.000	0.321*	-0.210	0.156	-0.206	-0.168	0.240	0.016
6	100 grain weight (gm)						1.000	-0.159	0.039	0.162	0.132	0.214	0.375*
7	Number of pods per plant							1.000	-0.048	0.451**	0.444**	0.236	0.316*
8	Oil content (%)								1.000	0.030	0.021	0.196	0.260
9	Nodule dry wt. (mg)									1.000	0.913**	0.272	0.475**
10	Number of nodules per plant										1.000	0.111	0.447**
11	Root length (cm)											1.000	0.420**
12	Yield per Plant (gm)												1.000

*and ** indicates significance at 5 and 1 per cent level respectively.

Table 2: Phenotypic correlation of soybean yield with yield contributing characters

Sr. No.	Characters	Days to flowering	Days to 50% flowering	Days to maturity	Plant height (cm)	Number of branches per plant	100 grain weight (gm)	Number of pods per plant	Oil content (%	Nodule dry wt. (mg)	Number of nodules per plant	Root length (cm)	Yield per Plant (gm)
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Days to flowering	1.000	0.508**	0.513**	0.342*	-0.234	-0.1000	0.100	0.021	-0.045	-0.030	0.039	0.377*
2	Days to 50% flowering		1.000	0.717**	0.450**	-0.173	-0.042	0.388*	-0.110	0.375*	0.351*	0.186	0.436**
3	Days to maturity			1.000	0.462**	-0.140	0.024	0.384*	-0.091	0.351*	0.389*	0.1543	0.586**
4	Plant height (cm)				1.000	-0.134	0.043	0.329*	-0.129	0.247	0.199	0.063	0.312*
5	Number of branches per plant					1.000	0.313*	-0.193	0.155	-0.199	-0.156	0.227	0.029
6	100 grain weight (gm)						1.000	-0.134	0.037	0.158	0.127	0.200	0.296
7	Number of pods per plant							1.000	-0.046	0.4065**	0.410**	0.217	0.255
8	Oil content (%)								1.000	0.029	0.021	0.188	0.207
9	Nodule dry wt. (mg)									1.000	0.878**	0.258	0.348*
10	Number of nodules per plan										1.000	0.112	0.345*
11	Root length (cm)											1.000	0.303*
12	Yield per Plant (gm)												1.000

*and ** indicates significance at 5 and 1 per cent level respectively.

Table 3: Direct and indirect effects of yield components on soybean yield per plant

Sr. No.	Characters	Days to flowering	Days to 50 % flowering	Days to maturity	Plant height (cm)	Number of branches per plant	100 grain weight (gm)	Number of pods per plant	Oil content (%)	Nodule dry wt. (mg)	Number of nodules per plant	Root length (cm)	Yield per plant (gm)
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Days to flowering	**-0.1824**	0.3143	0.4852	-0.0397	0.0179	-0.0396	-0.0186	0.0095	-0.0108	0.0106	0.0052	0.552
2	Days to 50 % flowering	-0.1231	**0.4654**	0.7055	-0.0578	0.0124	-0.0133	-0.0631	-0.0468	0.0773	-0.1216	0.0217	0.857
3	Days to maturity	-0.1398	0.5187	**0.6330**	-0.0516	0.0128	0.0140	-0.0555	-0.0373	0.0677	-0.1078	0.0178	0.870
4	Plant height (cm)	-0.0786	0.2924	0.3551	**-0.0921**	0.0094	0.0086	-0.0384	-0.0481	0.0414	-0.0497	0.0061	0.406
5	Number of branches per plant	0.0500	-0.0887	-0.1050	0.0133	**-0.0654**	0.1029	0.0242	0.0555	-0.0328	0.0397	0.0221	0.016
6	100 grain weight (gm)	0.0225	-0.0193	0.0277	-0.0024	-0.0209	**0.3208**	0.0184	0.0138	0.0259	-0.0311	0.0198	0.375
7	Number of pods per plant	-0.0293	0.2538	0.3038	-0.0306	0.0137	-0.0509	**-0.1158**	-0.0171	0.0720	-0.1049	0.0218	0.316
8	Oil content (%)	-0.0049	-0.0614	-0.0666	0.0124	-0.0162	0.0124	0.0056	**0.3551**	0.0048	-0.0050	0.0180	0.260
9	Nodule dry wt.(mg)	0.0124	0.2252	0.2682	-0.0239	0.0134	0.0520	-0.0522	0.0106	**0.1598**	-0.2155	0.0251	0.475
10	Number of nodules per plant	0.0082	0.2395	0.2888	-0.0193	0.0110	0.0422	-0.05146	0.0075	0.1458	**-0.2362**	0.0162	0.447
11	Root length (cm)	-0.0102	0.1095	0.1222	-0.0061	-0.0157	0.0688	-0.0273	0.0694	0.4351	-0.0261	**0.0924**	0.420

Residual effect = 0.0643

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