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CORRELATIONAND PATH COEFFICIENT ANALYSIS FOR YIELD AND ITS COMPONENTS IN SOYBEAN (*GLYCINE MAX* L. MERRILL)

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ABSTRACT
The present investigation was carried out in soybean to measure the correlation coefficients and path coefficients using 13 genotypes of soybean. The experiment was laid out in a randomized complete block design with three replications at the Main Agricultural Research Station, University of Agricultural Sciences, Dharwad during *kharif* 2013.Seed yield per plant (g) was found to have significant and positive correlation with days to 50 flowering (0.3212), plant height (0.3577), number of branches per plant(0.5346), number of pods per plant(0.8486), pod weight per plant(0.9672), 100 seed weight(0.7960), biomass(0.9376) and harvest index(0.8605). While pod length (-0.7421) exhibited significant negative association with seed yield per plant (g). Path coefficient analysis revealed that harvest index had highest positive direct effect (0.5039) on seed yield per plant followed by biomass (0.3382), pod weight per plant (0.2076) and days to 50% flowering (0.1003). The study suggested these characters were considered as most important traits which should be used as selection criteria to develop high yielding varieties in soybean.

INTRODUCTION

Oil and fats are essential items in human diet since they provide energy; improve taste and palatability of food. Oilseed crops are next to cereals in production of agricultural commodities in India, which occupy a place of prime importance in Indian economy. Soybean (*Glycine max* (L). Merril) is legume of short cycle that grows on tropical, subtropical and temperate regions. Soybean is an important source of high quality, in expensive protein and oil. Soybean has the highest protein content (40 to 42%) of all other food crops and is second only to groundnut in terms of oil content (18 to 22%). The oil contains 85% unsaturated fatty acids and is free from cholesterol, along with ample mineral elements and is thus highly desirable for human diet.(Antalina *et al.,* 2000). Being legume it also fixes atmospheric nitrogen to available form. As the best source of protein it truly claims the title "the meat that grows on plant"

In India, cultivation of soybean has reached about 12.03 million hectare, with the total production of about 12.45 million tones and average productivity of about 1035 kg per hectare. (Anon, 2013). Looking to the average productivity, it is quite clear that still there is a considerable scope for increasing yield potential of s oybean crop through the genetic improvement. To accomplish success in soybean improvement programme, it requires studying the character association like correlation and path analysis among yield and its component traits.Breeding soybean for higher yield and resistance to biotic stress has been a primary objective since its introduction.Yield is a polygenic trait, which is governed by numbers of genes. However, direct selection for yield alone is usually not very effective or may often be misleading. Hence, selection based on its contributing characters could be more efficient and reliable (Kumar et al., 2013a; Kumar et al., 2013b). In order to obtain a clear picture of the contribution of each of such componential characters in the total genetic architecture of yield, path analysis should be employed for this purpose. The estimation of correlation coefficients among yield and its components has been useful to the breeders in selecting suitable plant type. However, simple association does not provide the exact basis of simultaneous improvement of the different traits. Under such conditions, path coefficient analysis is a technique which facilitates the partitioning of the correlations coefficient into different components of direct and indirect effects. Keeping in the view of above facts, the objectives of the present investigation was to study the association of yield and its component traits and the direct and indirect effects of yield component traits on yield in soybean genotypes.

MATERIALS AND METHODS

The present investigation was carried out to measure the correlation coefficients and path coefficients using 13 genotypes of soybean (Table1.). The experiment was laid out in a Randomized Complete Block Design with three replications at the Main Agricultural Research Station, University of Agricultural Sciences, Dharwad during *kharif* 2013, which is located at a latitude of 15°26′ N, longitude of 75°07′ E and altitude of 678 m above mean sea level. The experiment had plot size of 4 meter length of each genotype having 3 rows. Row to row and plant to plant distance were maintained at 30 and 10 cm, respectively. All the recommended agronomic practices to raise a healthy crop were followed. The observations were recorded for 11 different characters, *viz.,* days to 50 per cent flowering, plant height (cm), number of

branches per plant, number of pods per plant, pod length (cm), number of seeds per pod, pod weight per plant, 100 seed weight (g), biomass(g), harvest index (%) and seed yield per plant (g) on five randomly selected plants in each entry across the replications(The observation on days to 50 % flowering,were recorded on plot basis). Correlation coefficients were computed as per method described by Webber and Moorty (1952) and these were further analyzed by path coefficient analysis to understand the direct and indirect effects of characters on yield. Path coefficient was computed as per the method described by Dewey and Lu (1959).

RESULTS AND DISCUSSION

The study of phenotypic correlation coefficient indicated the extent of relationship between different variables. The relationship among yield contributing characters as well as their influence on yield provides information for exercising selection pressure for genetic improvement in seed yield. The results of phenotypic correlation coefficient analysis are presented in Table 2.Seed yield per plant was found to be significant and positively correlated with days to 50 % flowering (0.3212*), plant height (0.3577*), number of branches per plant (0.5346**), number of pods per plant (0.8486**), pod weight per plant (0.9672**), 100 seed weight (0.7960**), biomass (0.9376**) and harvest index (0.8605**). Characters *viz.,* number of branches per plant, number of pods per plant, pod weight per plant,100 seed weight, biomass and harvest index were also positively and significantly correlated with each other.Similar results were also reported by HinaKausar (2005), Shivakumar *et al*. (2011), Radhika (2012) and Nagarajan *et al.* (2015).This implies that improvement in one character would simultaneously improve the other related traits and finally increase the seed yield. Similarly, strong and positive associations among pod weight per plant, number of pods per plant, harvest index, biomass and seed yield per plant, also indicated the possibility of selecting for these component traits to improve soybean yields. The results, thus, revealed that pod weight per plant, number of pods per plant, biomass and harvest index were the important attributes, which contributed towards higher yield. Therefore, more emphasis should be given to these components during selection for higher yield.

Seed yield in soybean is the sum total of several components characters which directly or indirectly contributes to it. The information derived from correlation studies indicated only mutual association among the characters. Whereas, path coefficient analysis helped in understanding the magnitude of direct and indirect contribution of each character on the dependant characters like seed yield. Partitioning of correlation coefficient into direct and indirect effects provided the information about the nature and magnitude of effects of other characters on seed yield. The results of the present investigation on path analysis (Table 3.) revealed that the harvest index had maximum and positive direct effect (0.5039) on seed yield per plant followed by biomass (0.3382), pod weight per plant (0.2076) and days to 50% flowering (0.1003). While number of branches per plant (-0.0742) and 100 seed weight (-0.0044) had negative direct effect on seed yield per plant. The path analysis also indicated that maximum indirect effect was exhibited by seed yield through pod weight per plant (0.4150), 100 seed weight (0.3752), biomass (0.3221), harvest index (0.2162) and number of pods per plant (0.3396) followed through seed yield per plant. Pod weight per plant exhibited positive and indirect effect through harvest index (0.4150) and biomass (0.3128). Pod length exhibited negative indirect effect through most of the characters. The low residual effect (0.0074) signified that the characters other than those studied had no significant impact on seed yield. Similar results were reported by Basavaraja (2002), Hinakausar (2005), Gaikwad

Table 1: Pedigree of the genotypes used in the study

Sl.No.	Genotypes	Pedigree
1	DSb 21*	JS 335 x EC 241778
2	DSb 23-2	JS 335 x EC 241780
3	DSb 28-3	JS 93-05 x EC 241780
4	Line Number .9-1	DSb 12 x EC241780
5	Line Number .9-2	DSb 12 x EC241780
6	Line Number .9-3	JS 335x EC241780
7	Line Number .30-2	JS 335x EC241780
8	Line Number .15-3-2	JS 335x EC241780
9	EC241778(P)	An exotic germplasm line
10	EC241780(P)	An exotic germplasm line
11	DSb 12(P)	JS 335 x PS 73-7
12	JS 93-05(P)	Selection from PS 73-22
13	JS 335(P/C)	JS78-77 x JS71-05

*Released by AICSIP, Indore for southern zone during 2014

Table 2: Phenotypic correlation coefficients for seed yield and its components in soybean

Traits	DFF	PH	NB	NPP	PL	NSP	PWT	100SW	BM	HI	SYP
DFF	1.0000	0.7487**	0.4652**	0.2940	- 0.1228	-0.3355*	0.2705	0.4614**	0.5570**	-0.0639	0.3212*
PH		1.0000	0.4593 **	0.4984**	-0.1574	- 0.0698	0.3132	0.3189*	0.6131**	-0.0992	0.3577*
NB			1.0000	0.7383**	-0.6600**	-0.2128	0.4719**	0.7069**	0.5261**	0.4727 **	0.5346**
NPP				1.0000	-0.6714**	0.1233	0.7938**	0.6610**	0.8218**	0.6740**	0.8486**
PL					1.0000	0.2262	-0.7155**	-0.8038**	-0.6251**	- 0.7977**	-0.7421**
NSP						1.0000	-0.2090	-0.2129	-0.1633	-0.0830	-0.0752
PWT							1.0000	0.7266**	0.9251**	0.8236**	0.9672**
100SW								1.0000	0.7259**	0.7446**	0.7960**
BM									1.0000	0.6392**	0.9376**
HI										1.0000	0.8605**
SYP											1.0000

*- significant at 5%, **- significant at 1%; DFF = days to fifty percent flowering, PH = Plant height (cm), NB = Number of branches per plant, NPP = Number of pods per plant, PL = Pod length (cm) NSP = Number of seeds per pod, PWT = pod weight per plant, 100 SW = 100 seed weight (g), BM = Biomass, HI = Harvest index (%), SYP = Seed yield per plant (g).

Table 3: Phenotypic path coefficients of component traits to yield in soybean

Traits	DFF	PH	NB	NPP	PL	NSP	PWT	100SW	BM	HI	r
DFF	0.1003	0.0570	-0.0345	0.0157	-0.0012	-0.0264	0.0562	-0.0020	0.1884	-0.0322	0.3212*
PH	0.0751	0.0761	-0.0341	0.0265	-0.0015	-0.0055	0.0650	-0.0014	0.2074	-0.0500	0.3577*
NB	0.0467	0.0350	-0.0742	0.0393	-0.0063	-0.0168	0.0980	-0.0031	0.1779	0.2382	0.5346**
NPP	0.0295	0.0379	-0.0548	0.0532	-0.0064	0.0097	0.1648	-0.0029	0.2779	0.3396	0.8486**
PL	-0.0123	-0.0120	0.0490	-0.0357	0.0096	0.0178	-0.1486	0.0035	-0.2114	-0.4020	-0.7421**
NSP	-0.0337	-0.0053	0.0158	0.0066	0.0022	0.0788	-0.0434	0.0009	-0.0552	-0.0418	-0.0752
PWT	0.0271	0.0238	-0.0350	0.0423	-0.0069	-0.0165	0.2076	-0.0032	0.3128	0.4150	0.9672**
100SW	0.0463	0.0243	-0.0525	0.0352	-0.0077	-0.0168	0.1509	- 0.0044	0.2455	0.3752	0.7960**
BM	0.0559	0.0467	-0.0390	0.0438	-0.0060	-0.0129	0.1921	-0.0032	0.3382	0.3221	0.9376**
HI	-0.0064	-0.0076	-0.0351	0.0359	-0.0077	-0.0065	0.1710	-0.0033	0.2162	0.5039	0.8605**

*- significant at 5%, **- significant at 1%; Residual effect = 0.0074 r = Phenotypic correlation; Diagonal values represent direct effects; DFF = days to fifty percent flowering, PH = Plant height (cm), NB = Number of branches per plant, NPP = Number of pods per plant, PL = Pod length (cm) NSP = Number of seeds per pod, PWT = pod weight per plant, 100 SW = 100 seed weight (g), BM = Biomass, HI = Harvest index (%).

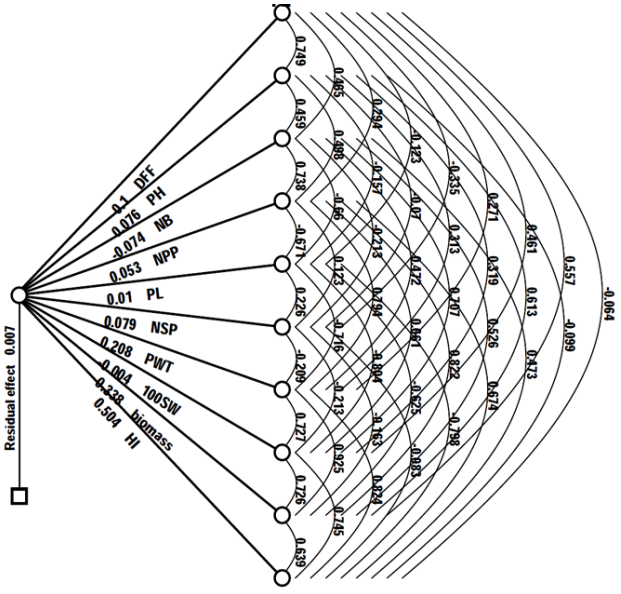

Figure 1: Path diagram showing direct and indirect effect of various traits on seed yield per plant

(2007),Showkat and Tyagi(2010) and Nagarajan *et al*. (2015).Hence, the characters having direct positive influence *viz*.,harvest index,biomass, pod weight per plant and days to 50% flowering should be given due importance, while breeding for high yielding types in soybean.

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