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CHARACTER ASSOCIATION OF SOYBEAN (*Glycine max*) LINES FOR YIELD CONTRIBUTING TRAITS

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ABSTRACT

The present study was conducted with ten soybean genotype on correlation, path coefficient and genetic component of some important traits. Ten characters were studied to find out the suitable traits for the improvement of soybean yield. It was observed that yield per plot was positively correlated with pods per plant, seeds per pod, branches per plant, harvest index, days to maturity and plant height which revealed that selection based on these traits could significantly improved the grain yield of soybean. From the path coefficient analysis, it was observed that among the different yield contributing characters pods per plant, seeds per pod, plant height, 100 seed weight contributed maximum direct positive effect to yield per plot. Negative direct effect was observed for days to flowering and days to maturity, but its correlation with yield was positive. It was due to its positive indirect effect. The residual effect was found 0.175 which indicated that 82.50% of the variability was accounted for 10 yield and yield contributing traits included in the present study. Rest 17.50% variability might be controlled by other yield contributed traits that was not included in the present investigation.

Keywords: Correlation; path analysis; soybean; yield; *Glycine max* L.

INTRODUCTION

Soybean *(Glycine max* L. Meril) is the world's most important oil producing grain legume crop in terms of total production and international trade. The crop is grown throughout the world accounts for approximately 50% of the total production of oil seed crops in the world. The largest soybean producing countries are: The USA, Brazil, Argentina, Mexico, China and Indonesia. The acreage of soybean in Bangladesh is around 22,000 acre and production was 6000 metric tons in the year of 2008-09 (BBS, 2010). With the growth of population, Bangladesh needs more protein, fat and minerals. But our protein source is limited. Soybean can play a significant role in providing protein support. Soybean can be grown, as a source of protein and of oil crops as well as has become a cash crop in our country. Information on correlation coefficient between yield and its contributing characters has always been helpful as a basis for selection for yield in a breeding programme. Thus determination of correlation between the characters are a matter of considerable importance in selection practices since it helps in construction of selection indices also permit the prediction of correlated response. Following correlation analysis, the path coefficient analysis provides a true picture of genetic association

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between different traits. Path coefficient analysis specificies the cause and effect, and measures their relative importance. Therefore, correlation with the path coefficient analysis quantifies the direct and indirect contribution of one character upon another. Considering these facts, the present study was conducted with 10 soybean genotypes to observe the nature of relationship of different morphological characters and yield attributes among themselves and to estimate the direct and indirect effects of important characters on yield through co-efficient analysis.

MATERIALS AND METHODS

Ten soybean genotypes [AVRDC-14(SI-4), AVRDC-62(SI-14), AVRDC-73(SI-11), AVRDC-78(SI-01), Sohag, BAU-S/70, BAU-S/80, BARI Soybean-5, BAU-S/109, BAU-S/147] were grown in randomized complete block design (RCBD) with three replications during Rabi 2011. Plot size was 4m × 2.5m, block to block 1m, plot to plot 60cm, line to line 30cm and plant to plant 5-7cm distance were maintained. Urea, TSP and MP were applied @ 60-150-70 kg/ha respectively, and rhizobium inoculants 25g/kg seed recommended for soybean cultivation. The seeds were sown in continuous rows keeping the row-to-row distance of 30 cm. Normal intercultural practices and plant protection measures were followed to raise the crop successfully. Crop was successfully harvested. Total plot was harvested for measuring grain yield. Data were collected from 10 randomly selected pods of each genotype. Data were recorded on days to flowering, days to maturity, plant height, branches per plant, pods per plant, seeds per pod, 100 seed weight, flowers per plant, pod setting efficiency, yield per plot and harvest index. All data obtained from each trait were statistically analyzed. The genotypic and phenotypic correlation was estimated by the formula suggested by Miller *et al.* (1958). Path coefficient analysis was done according to Wright (1921) and Dewey and Lu (1959).

RESULTS AND DISCUSSION

Relationship between yield and yield contributing characters including growth index were studied using genotypic and phenotypic correlation coefficient (Table 1). Yield per plot was positively correlated with days to maturity, plant height, branches per plant, pods per plant, seeds per pod, 100 seed weight, flowers per plant, harvest index and pod setting efficiently. In this study, it was found that plant height had significantly positive correlation with pods per plant and flowers per plant. At the same time negative correlation with seeds per pod suggesting increasing plant height will decrease the seeds per pod. This is in confirmation with the results as stated by Dogney *et al.* (1998). Branches per plant showed significantly positive correlation with yield per pods and positive correlation with pods per plant, seeds per pod and flowers per plant. Pods per plant gave highly positive significant with flowers per plants, pod setting efficiency and plot yield. That suggesting that plant having more number of pods proportionately increases the yield. Saka *et al.* (1996) observed that the number of pods per plant was significantly correlations with flowers per plants and plot yield. Seeds per pod showed positive correlation with harvest index and negative correlation with flowers per plant. It indicating increasing the number of flowers per plant will decrease the seeds per pod. According to Singh *et al.* (1995), number of seeds per plot showed negative association with the flowers per plant. 100 seed weight had positive correlation with flowers per plant, harvest index, pod setting efficiency and plot yield. Flowers per plant showed highly positive significant with plot yield and pod setting efficiency. Harvest index showed significantly positive correlation with pod setting efficiency.

Table 1. Phenotypic (r_p) and genotypic ($r_{g)}$ correlation coefficients between yield and yield contributing characters in soybean

Characters		Days to maturity	Plant height (cm)	Br/Plant	Pods/plant	Seeds /pod	100 seed wt.	Flowers/ plant	Harvest index	Pod setting efficiency	Plot yield
Days to flowering	r_p	0.90**	0.84*	0.56	0.81**	-0.03	0.52	0.81**	0.25	0.48	0.68
	r_g	0.81**	0.74*	0.47	0.77**	-0.01	0.30	0.78**	0.20	0.43	0.63
Days to maturity	r_p		0.39	0.45	0.47	0.24	-0.03	0.39	0.07	0.05	0.41
	r_g		0.33	0.41	0.45	0.21	-0.01	0.37	0.04	0.03	0.39
Plant height (cm)	r_p			0.49	0.69*	-0.26	0.27	0.75*	0.14	0.59	0.54
	r_g			0.47	0.65*	-0.23	0.25	0.73*	0.11	0.57	0.51
Br/Plant	r_p				0.65	0.24	-0.27	0.65	0.04	0.29	0.67*
	r_g				0.63	0.21	-0.27	0.63	0.02	0.27	0.65*
Pods/plant	r_p					0.30	0.45	0.98**	0.62	0.82**	0.99**
	r_g					0.23	0.38	0.93**	0.58	0.78**	0.94**
Seeds/pod	r_p						0.28	-0.13	0.71*	0.38	0.53
	r_g						0.26	-0.11	0.69*	0.35	0.51
100 seed wt.	r_p							0.31	0.71*	0.71*	0.44
	r_g							0.28	0.70*	0.69*	0.42
Flowers/ plant	r_p								0.42	0.77*	0.91**
	r_g								0.32	0.65*	0.78**
Harvest index	r_p									0.84**	0.71*
	r_g									0.83**	0.70*
Pod setting efficiency	r_p										0.83**
	r_g										0.81**

*= Significant at 5% level, **= Significant at 1% level

Table **2.** Partitioning of genotypic correlation into direct effect (bold) and indirect effect of different yield contributing characters on the yield in soybean genotypes

Characters	Days to flowering	Days to maturity	Plant height (cm)	Pods/plant	Seeds/pod	100 seed wt.	Flowers/ plant	Pod setting efficiency	Plot/ yield
Days to flowering	**-0.2271**	-0.0490	0.1395	0.8223	-0.0051	0.0381	0.0317	-0.1245	0.626
Days to maturity	-0.1841	**-0.0604**	0.0624	0.4803	0.0832	-0.0008	0.0152	-0.0078	0.388
Plant height (cm)	-0.1669	-0.0199	**0.1898**	0.6980	-0.0879	0.0322	0.0299	-0.1652	0.510
Pods/plant	-0.1742	-0.2708	0.1236	**1.0721**	0.0902	0.0477	0.0378	-0.2261	0.944
Seeds/pod	0.0030	-0.0129	-0.0427	0.2477	**0.3907**	0.0328	-0.0043	-0.1022	0.512
100 seed wt.	-0.0681	0.0036	0.0480	0.4020	0.1008	**0.1271**	0.0112	-0.1994	0.422
Flowers/plant	-0.1767	-0.0225	0.1393	0.9928	-0.0414	0.0350	**0.0408**	-0.1872	0.780
Pod setting efficiency	-0.0097	-0.0016	0.1080	0.8352	0.1375	0.0873	0.0263	**-0.2903**	0.805

Residual effect: 0.175

All this result suggest that the number of pods per plant, harvest index, seeds per pod, branches per plant and days to maturity are important yield contributing characters and addressed to be in the selection criteria for soybean. In order to find a clear picture of the interrelationship between seed yield and their yield contributing character, direct and indirect effects were worked out using path coefficients. The results of the path coefficients are presented in Table 2. The results of path coefficient analysis revealed that pods per plant had the highest direct effect (1.0721) on grain yield per plot followed by seeds per pod (0.3907), 100 seed weight (0.1271) and plant height (0.1898). Such results indicated that direct selection based on these characters would be effective for yield improvement of soybean. Flowers per plant (0.264) showed positive and negligible direct effect on yield. The positive indirect effect via plant height (0.1393), pods per plant (0.9928), 100 seed weight (0.0350) made the total correlation positive and significant on yield (0.780). Number of pods per plant had high positive direct effect (0.1898) on grain yield. It has positive indirect effect via plant height (0.1236), seeds per pod (0.0902) and 100 seed weight (0.0477). It showed negative indirect effect via days to flowering (-0.1742), days to maturity (-0. 278) and pod setting efficiency (-0.2261). However, overall, it produced positive effect on yield. Major *et al*. (1996) noticed that pods per plant had direct and positive effects on grain yield. Days to maturity had negative direct effect to yield (-0.0604) but strong positive effect of plant height (0.0624), pods per plant (0.4803) and seeds per pod (0.0832) made total positive effect on yield. Chettri *et al.* (2003) showed that days to maturity positively influenced grain yield. Similar results were found by Raut *et al.* (2001). Plant height registered considerable positive direct effect (0.1898) on yield per plot. It also had positive indirect effect via pods per plant (0.6980), 100 seed weight (0.0322), and flowers per plant (0.0299). However, it showed negative indirect effect via days to maturity (-0.1669), pod setting efficiency (-0. 1652), seeds per pod (-0.0879) and the total correlation between plant height and plot yield was highly positive and significant (0.510). Sridhara *et al.* (1998) observed that the plant height and number of pods per plant seemed to be significant contributors to seed yield.

Days to flowering had negative direct effect (-0. 2271) on plot yield. It also has positive indirect effect on yield via plant height (0.1395), pods per plant (0.8223) and the total correlation on yield was positive. Chamundeswari and Aher (2003) recorded a negative correlation between days to flowering and plot yield. Seeds per pod had highly positive direct effect (0.3907) on seed yield. It had negative effect via days to maturity (-0.0129), flowers per plant (-0.0043) on seed yield and the total correlation was positive (0.512). Due to highly positive indirect effect via pods per plant and 1000 seed weight. Pod setting efficiency had highly negative (-0.2903) direct effect on seed yield. Pod setting efficiency had negative indirect effect via days to flowering (-0.0097), days to maturity (-0.0016). On the other side positive indirect effect such as plant height (0.1080), pods per plant (0.8352), seeds per pod (0.1375), 100 seed weight (0.0873) and flowers per plant (0.0408) made total effect positive on plot yield. From the path coefficient analysis, it was observed that among the different yield contributing characters pods per plant, seeds per pod, plant height (cm) and 1000 seed weight contributed maximum direct positive effect to yield per plant. Therefore, it may be concluded that there is scope for improving yield in soybean through direct selection of these characters. The residual effect was found 0.175 which indicated that 82.50% of the variability was accounted for ten yield and yield contributing traits included in the present study. Rest 17.50% variability might be controlled by other yield contributed traits that was not included in the present investigation.

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