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PATH COEFFICIENT ANALYSIS OF QUANTITATIVE TRAITS IN SOYBEAN (*GLYCINE MAX* L. MERRILL.)

M. Shivakumar, R.T Maruthi[*], C Gireesh, and T.L Prakash[**]

Direcorate of Soybean Research, Indore, M.P
[*]Division of Genetics, Indian Agricultural Research Institute, New Delhi-12
[**]IARI, Regional Station Indore, M.P

ABSTRACT

An investigation was undertaken to find out direct and indirect effect of traits on seed yield by path coefficient analysis in F_3 populations of two crosses (JS335 x EC 241780 and JS93-05 x EC241780) of soybean during *kharif* 2007 at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad. The experiment was laid out in randomized complete block design (RCBD) with two replications. The observations were recorded on days to flowering, plant height, number of branches per plant, pods per plant, pod length, pod weight, number of seeds per pod, number of seeds per plant, 100 seed weight, biomass, harvest index and seed yield per plant. The maximum positive direct effect on seed yield per plant was exhibited by biomass followed by harvest index in both the crosses, rest of the traits exhibited negative to moderate effect. Thus, direct selection for the traits for biomass and the harvest index are very effective in soybean yield improvement.

Key words: biomass, harvest index, soybean, direct and indirect effect

Introduction

Although Correlation coefficient is useful in quantifying the size and direction of trait associations, it can be misleading due to the indirect effect of other traits (Dewey and Lu, 1959). Wright (1921) proposed a method called path analysis, which partitions the estimated correlations into direct and indirect effects for better understanding of the association among traits. In soybean, it was earlier carried out by Pandey and Torrie (1973), Wakankar et al. (1974), Ali et al. (1989), Akther and Sneller (1996), and Board *et al*.(1997). In order to obtain a clear picture of the contribution of each componential character in the total genetic architecture of yield in Soybean (*Glycine max* (L.) Merrill) path analysis was employed in the present study.

Material and Methods

The experimental material comprised of F_3 populations of two crosses involving three diverse parents *viz*., JS335, JS93-05 and EC 241780. Eighteen progenies from the cross JS335 x EC241780 and 44 progenies from JS93-05 x EC241780 were used. Among the parents, JS335 and JS93-05 are most widely cultivated varieties. JS 93-05 is a narrow leaflet variety which matures earlier than JS335, whereas EC241780 is a rust resistant germplasm line. The seeds of two F_3 populations *viz*., JS 335 x EC 241780 (Cross-1) and JS 93-05 x EC 241780 (Cross-2) were obtained from AICRP on Soybean, Main Agricultural Research Station, University of Agricultural Sciences, Dharwad. The seeds were sown at a spacing of 30X10 cm, and the standard package of practice was followed to raise a good crop. For genetic analysis, observations for traits were recorded on fifteen randomly selected plants in each line with two replications. The targeted traits were days to flowering, plant height (cm), number of

branches per plant, number of pods per plant, pod length(cm), pod weight (g), number of seeds per pod, number of seeds per plant, seed yield per plant (g), hundred seed weight (g), biomass (g) and harvest index. The genotypic and phenotypic coefficient of variation, heritability and genetic advance for each character was computed as per standard formulae (Allard, 1960; Burton and Devane, 1953; Johnson et al 1953)

Results and Discussion

The results obtained are presented in Tables 1 and 2. The direct effect of number of branches per plant with seed yield was very low in Cross-2 (0.061) and negative in Cross-1 (-0.019). Its indirect effect through the biomass was more than its direct effect in both the crosses. Similar results were reported by Showkat and Tyagi (2010). In Cross-2 (JS 93-05 x EC 241780), pods per plant exerted low negative direct effect on seed yield (-0.067). Similar results were reported by Mishra *et al*. (1994). But in Cross-1 (JS 335 x EC 241780) it showed low positive direct effect on seed yield (0.018). It had high positive indirect effect through biomass. Hence, direct selection for pods per plant may not result in substantial improvement in seed yield.

In cross-1 (JS 335 x EC 241780) pod weight had exhibited low positive direct effect on seed yield (0.128), but it was negative (-0.039) direct effect in cross-2 (JS 93-05 x EC 241780). This reveals low degree of contribution of this trait on seed yield. Seeds per plant exerted moderate positive effect (0.224) on seed yield in Cross-2 (JS 93- 05 x EC 241780) and in Cross-1 (JS 335 x EC 241780) it showed low negative direct effect on seed yield which had high positive indirect effect through biomass and harvest index. Therefore the direct selection of seeds per plant alone may not be effective in improvement of seed yield. However, high positive direct effect of seeds per plant on seed yield was reported by Patil et al., (2011) and Yadav (2006).

Biomass exerted high positive direct effect on seed yield in both the crosses (0.838 and 0.593). Therefore, one can improve the yield by direct selection for this character. Similar results were obtained by Ramgiry and Raha (1997) and Hina Kausar (2005). Harvest index exhibited high positive direct effect on seed yield, hence it is possible to improve the yield by direct selection for this trait. Similar results were obtained by Basavaraja (2002) and Hina Kausar (2005).

The characters with high positive correlation and high direct effects are amenable for selection. Hence, path analysis studies of present investigation revealed that biomass and harvest index were important yield components with high direct effects on improvement for seed yield.

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Table 1. Phenotypic path coefficients of eleven yield components to yield in F_3 population of Cross-1 (JS 335 x EC 241780)

Characters	Days to flowering	Plant height	Branches/ plant	Pod length	Number of pods/ plant	Pod weight (g)	Number of seeds/ pod	Seeds/ plant	100 seed weight	Biomass / plant (g)	Harvest index (%)	r
Days to flowering	**-0.005**	-0.011	0.003	-0.005	-0.001	-0.023	0.00	0.002	-0.007	0.083	-0.206	-0.170
Plant height	-0.002	**-0.030**	-0.003	-0.012	0.006	0.038	0.004	-0.015	-0.014	0.162	0.029	0.162
Number of branches per plant	0.001	-0.005	**-0.019**	0.032	0.016	0.117	0.005	-0.056	-0.007	0.597	0.186	0.803
Pod length	-0.001	-0.010	-0.016	**-0.039**	0.016	0.111	0.006	-0.055	-0.004	0.712	0.086	0.806
Pods per plant	0.00	-0.010	-0.018	-0.035	**0.018**	0.123	0.007	-0.060	-0.009	0.629	0.198	0.844
Pod weight	0.001	-0.009	-0.018	-0.034	0.017	**0.128**	0.007	-0.059	-0.007	0.636	0.200	0.862
Number of seeds per pod	0.00	-0.010	-0.008	-0.022	0.011	0.076	**0.012**	-0.039	-0.006	0.319	0.192	0.524
Number of seeds per plant	0.00	-0.007	-0.017	-0.033	0.017	0.118	0.007	**-0.064**	-0.006	0.642	0.217	0.873
100 seed weight	0.001	-0.012	0.014	0.004	-0.014	-0.025	-0.002	0.021	**0.038**	0.176	-0.062	0.151
Biomass per plant	-0.001	-0.006	-0.014	-0.033	0.014	0.097	0.004	-0.049	0.008	**0.838**	-0.023	0.837
Harvest index	0.002	-0.002	-0.007	-0.006	0.007	0.050	0.004	-0.027	-0.005	-0.037	**0.514**	0.494

Residual = 0.0143
Diagonal values indicate the direct effects

Table 2. Phenotypic path coefficients of eleven yield components to yield in F_3 population of Cross-2 (JS 93-05 x EC 241780)

Characters	Days to flowering	Plant height	Branches/ plant	Pod length	Number of pods/ plant	Pod weight (g)	Number of seeds/ pod	Seeds/ plant	100 seed weight	Biomass / plant (g)	Harvest index (%)	r
Days to flowering	**-0.043**	0.003	-0.007	-0.011	-0.002	0.005	-0.010	-0.022	0.011	0.024	-0.147	-0.197
Plant height	-0.003	**0.046**	0.027	0.013	-0.034	-0.022	0.002	0.108	-0.010	0.244	0.036	0.408
Number of branches per plant	0.005	0.021	**0.061**	0.025	-0.050	-0.030	0.005	0.171	-0.043	0.259	0.164	0.389
Pod length	0.009	0.011	0.030	**0.051**	-0.029	-0.024	0.001	0.103	-0.011	0.247	0.071	0.459
Pods per plant	-0.001	0.024	0.045	0.023	**-0.067**	-0.033	0.005	0.197	-0.016	0.369	0.162	0.7074
Pod weight	0.006	0.026	0.046	0.032	-0.057	**-0.039**	0.006	0.189	-0.019	0.425	0.137	0.751
Number of seeds per pod	0.020	0.004	0.016	0.002	-0.017	-0.010	**0.020**	0.082	-0.033	-0.042	0.276	0.315
Number of seeds per plant	0.004	0.022	0.046	0.024	-0.059	-0.033	0.007	**0.224**	-0.032	0.371	0.198	0.772
100 seed weight	-0.003	-0.003	-0.016	-0.004	0.007	0.005	-0.004	-0.046	**0.157**	0.123	0.006	0.221
Biomass per plant	-0.002	0.019	0.026	0.021	-0.042	-0.028	-0.002	0.140	0.032	**0.593**	0.007	0.766
Harvest index	0.014	0.004	0.022	0.008	-0.023	-0.012	0.012	0.096	0.002	0.008	**0.462**	0.592

Residual = 0.0483
Diagonal values indicate the direct effects

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