

Short Communication

Genetic variability, character association and path coefficient analyses in faba bean

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ABSTRACT

Present investigation was carried out involving seventy diverse germplasm lines of Faba bean. Seed yield/plant showed highly significant and positive correlation with number of pods/plant, biological yield/plant, number of branches/plant, number of seeds/pod, 100-seed weight and harvest index. Path analysis identified biological yield/plant, harvest index, number of pods/plant, 100-seed weight, number of seeds/pod and plant height as important components having high order direct effects, while number of pods/plant, number of branches/plant, plant height and number of seeds/pod via biological yield/plant showed maximum indirect effect on seed yield.

Key words: Character association, Fababean, Genetic variability, Path coefficient analysis.

Faba bean (*Vicia faba* L.) is an important pulse crop of the world cultivated under both irrigated and rainfed conditions. It is grown as *Rabi* crop in diverse agro-ecological situations from hills to plains and even under poor management. In India, it is grown in a sizeable acreage in Bihar, Madhya Pradesh and some parts of Uttar Pradesh. Its green pods are used as vegetable and dry seeds are used as split dal and in the preparation of besan. It has great production potential which has not been realized so far. Accordingly, the present study was carried out to evaluate the available germplasms to work out the character association and, direct and indirect effects of different attributes with respect to yield.

The experimental material for the present investigation consisted of 70 germplasm lines of Faba bean along with check varieties e.g., 'PRT-7', 'PRT-12' and 'Vikrant', grown in Augmented Block Design with three checks repeated after every 10 lines of the test entries. The experiment was carried out at the Student's Instructional Farm, Narendra Dev University of Agriculture and Technology (NDUAT), Faizabad (U.P.). Each accession was grown in double row of 4 m length with inter row spacing of 30 cm. All the recommended cultural practices were adopted to raise a good crop. The observations on plant height, number of branches/plant, number of pods/plant, number of seeds/pod, 100-seed weight (g), biological yield/plant (g), seed yield/plant (g), harvest index (%), and protein content, were recorded on five randomly selected plants, while days to 50% flowering and days to maturity on

plot basis. The mean data were subjected to analysis of variance following Federer (1956). Estimation of correlation coefficient was done following Searle (1961). Path coefficient analysis was done as suggested by Dewey and Lu (1959).

Analysis of variance exhibited significant differences for all the accessions indicating presence of sufficient genetic variability among the accessions. Correlation analysis (Table 1) revealed that seed yield/plant was significantly and positively correlated with number of pods/plant, biological yield/plant, number of branches/plant, number of seeds/pod, 100-seed weight and harvest index indicating that selection based on these characters may result in higher yield, which was in close agreement with earlier findings of Vandana and Dubey (1993), Abo-Elwafa and Bakheit (1999) and Patel and Acharya (2011). Biological yield/plant was highly significant and positively correlated with number of pods/plant, number of branches/plant, plant height and number of seeds/pod. Interestingly, there were significant correlations existing among the above characters as well as seed yield/plant which, suggested that these characters may be considered for improvement of seed yield. Further, based on these relationships, it can be presumed that for improving yield in faba bean, a model plant type would be that with high biological yield, higher number of pods/plant, increased number of branches/plant and higher seeds/per pod. Harvest index also showed positive correlation with seed yield/plant while negatively correlated with plant height, biological yield/plant and days to 50% flowering. Association of these characters with grain yield/plant elucidates the importance of proper source to sink relationship. It would be rational to expect that a genotype which has smaller vegetative period as in present case i.e., early flowering will have greater ability to give more yield than a genotype with delayed flowering. Similarly a genotype which has more number of branches, more number of pods, more number of seeds, higher 100-seed weight and high biological yield is expected to fill the sink to larger extent (Pace et al., 1979; Huang, 1983 and Ramgiry and Bansal 1997).

Path analyses showed highest positive direct effects on the grain yield through biological yield/plant followed by harvest index and number of pods per plant (Table 2). Considering both correlation and path coefficient, it is crystal clear that these characters are the most important for realizing maximum genetic gain through selection in faba bean.

Table 1. Estimates of simple correlation coefficients between different pairs of characters in faba bean

Characters	Days to 50% flowering	Days to maturity	Plant height	Branches/ plant	Pods/ plant	Seeds/ pod	100-seed weight	Biological yield/ plant	Seed yield/ plant	Harvest index	Protein content
Days to 50% flowering (no.)	1.00	-0.046	0.068	-0.167	-0.130	0.062	0.007	-0.065	-0.066	-0.467**	-0.090
Days to maturity (no.)		1.00	0.217	-0.071	-0.096	0.004	-0.043	0.110	-0.030	-0.210	0.355**
Plant height (cm)			1.00	0.150	0.167	0.120	-0.063	0.442**	0.192	-0.406**	0.066
Branches/ plant (no.)				1.00	0.655**	0.253*	0.226	0.607**	0.633**	-0.026	-0.104
Pods/plant (no.)					1.00	0.369**	0.208	0.663**	0.855**	0.141	-0.088
Seeds/pod (no.)						1.00	0.041	0.329**	0.429**	0.059	0.035
100-seed weight (g)							1.00	0.170	0.405**	0.286*	0.085
Biological yield/ plant (g)								1.00	0.700**	-0.441**	0.081
Seed yield/ plant (g)									1.00	0.281**	-0.017
Harvest index (%)										1.00	-0.117
Protein content (%)											1.00

*, **: Significant at P=0.05 & 0.01, respectively

Table 2. Direct and indirect effects of different characters on seed yield/plant in faba bean

Characters	Days to 50% flowering	Days to maturity	Plant height	Branches/ plant	Pods/ plant	Seeds/ pod	100-seed weight	Biological yield/ plant	Harvest index	Protein content	Correlation with seed yield
Days to 50% flowering	0.0378	-0.0015	0.0032	-0.0029	-0.0322	0.0031	0.0004	-0.0471	-0.0268	0.0003	-0.0655
Days to maturity	-0.0017	0.0314	0.0103	-0.0012	-0.0238	-0.0002	-0.0028	0.0800	-0.1202	-0.0013	-0.0295
Plant height	0.0026	0.0068	0.0477	0.0026	0.0414	0.0059	-0.0041	0.3219	-0.2329	-0.0002	0.1917
Branches/ plant	-0.0063	-0.0022	0.0071	0.0173	0.1626	0.0125	0.0145	0.4421	-0.0149	0.0004	0.6331
Pods/plant	-0.0049	-0.0030	0.0080	0.0113	0.2483	0.0182	0.0133	0.4828	0.0806	0.0003	0.8551
Seeds/pod	0.0023	-0.0001	0.0057	0.0044	0.0915	0.0495	0.0026	0.2394	0.0338	-0.0001	0.4290
100-seed weight	0.0003	-0.0013	-0.0030	0.0039	0.0516	0.0020	0.0642	0.1238	0.1640	-0.0003	0.4051
Biological yield/ plant	-0.0024	0.0035	0.0211	0.0105	0.1646	0.0163	0.0109	0.7284	-0.2526	-0.0003	0.6999
Harvest index	-0.0018	-0.0066	-0.0194	-0.0005	0.0349	0.0029	0.0184	-0.3210	0.5732	0.0004	0.2807
Protein content	-0.0034	0.0112	0.0031	-0.0018	-0.0217	0.0017	0.0055	0.0593	-0.0670	-0.0037	-0.0169

Residual effect= 0.0529, Direct effect: diagonal (bold)

Simultaneously, low value of direct effects recorded in positive direction for 100-seed weight, number of seeds/pod, plant height, days to 50% flowering, days to maturity and number of branches/plant indicating that direct contribution of these traits might lead to increase in grain yield if other variables remain constant, which was in conformity with earlier findings of Salem (1982) and Bora *et al.* (1998). The indirect contribution of biological yield/plant *via* number of pods/plant, 100-seed weight *via* harvest index and number of branches/plant *via* number of pods/plant also showed high order positive effect indicating that these characters are important contributors of grain yield. Biological yield/plant and plant height *via* harvest index had considerable negative indirect effect on seed yield. Some of earlier reports have also identified these characters as important indirect contributors in the expression of seed yield in faba bean (Reddy *et al.* 2002). Thus, harvest index and number of seeds/pod emerged as most important traits to be considered in the development of high yielding genotypes of faba bean.

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