Indian Res. J. Genet. & Biotech. 6(2) : 397-401 (2014)

Genetic Variability, Character Association and Path Coefficient Analysis in French bean (*Phaseolus vulgaris* L.) Genotypes of Nagaland

Bendangkumzuk Walling[1] and H. P. Chaturvedi[2]

[1-2]Department of Genetics and Plant Breeding, Nagaland University, SASRD, Medziphema- 797106

(Received : March, 2014 : Revised : April, 2014; Accepted : May, 2014)

Abstract

Genetic variability, correlation and path coefficient analysis was studied in twenty French bean (*Phaseolus vulgaris* L.) genotypes of Nagaland for grain yield and its attributing characters. The analysis of variance revealed significant differences among the genotypes for all the characters studied indicating a high degree of variability in the material. The highest PCV and GCV were recorded for plant height at maturity, 100 seed weight, yield per plant, protein content, pods per plant and seeds per pod indicating the presence of ample variation for these traits in the present material. In the present study high estimates of heritability and genetic advance as percent of mean were obtained for plant height at maturity, 100 seed weight, yield per plant, protein content, pods per plant, seeds per pod and pod length. Thus, selection of these traits is likely to accumulate more additive genes leading to further improvement of their performance and these traits may be used as selection criteria in French bean breeding program. The grain yield exhibited significant positive correlation with 100 seed weight indicating relative utility of this trait for selection. 100 seed weight exerted maximum positive direct effect and exhibited significant positive correlation with yield indicating a true relationship among the traits.

Key words : Genetic variability, Heritability, Genetic advance, Correlation coefficient, Path coefficient

Inroduction

French bean *(Phaseolus Vulgaris L.)* is an important and highly profitable crop of North Eastern Hill Region of India. Considering the nutritive value, 100 g of green pod contains 1.7 g protein, 0.1 g fat, 4.5 g carbohydrate, 1.8 g fibre, and is also rich in minerals and vitamins. However, at present its average yield is low in farmers filed as compared to its potential yield. Therefore, there is need to enhance the productivity potential of French bean by evolving high yielding genotypes, which depends on the availability of variability for yield and its component traits in the population. In Nagaland an array of local genotypes are in cultivation since long. Though many of them are low yielding but they are valuable with reference to many rare physiological and quantitative traits. Systematic attempts have not been made on the collection of information on genotypes with reference to quantitative traits. Keeping these in view, the present study was undertaken to assess the nature and magnitude of genetic variability present in different indigenous collections of French bean. An attempt has also been made to study the correlation and path coefficient which are helpful in selecting the desirable traits.

Corresponding author's e-mail : *hpchaturvedi68@gmail.com*
Published by Indian Society of Genetics, Biotechnology Research and Development, 5, E Biotech Bhawan, Nikhil Estate, Mugalia Road, Shastripuram, Sikandra, Agra 282007
Onlince management by www.isgbrd.co.in

Materials and Methods

The present investigation was conducted in the experimental farm of School of Agricultural Sciences And Rural Development, Nagaland University, Medziphema, Nagaland during rabi 2013. Twenty French bean genotypes of Nagaland were grown in randomized complete block design with three replications. All the recommended agronomic practices were followed for raising a good crop. Observations were recorded on five plants sampled randomly in each replication for plant height, pod length, seeds per pod, pods per plant, days to 50% flowering, days to 80% maturity, 100 seed weight, protein content and yield per plant. Analysis of variance was done using standard statistical procedure. Heritability (broad sense) was estimated according to Allard (1960). Genotypic and phenotypic coefficients of variation were estimated as per Burton (1952). Genetic advance as per cent of mean was estimated according to Johnson *et al*. (1955). Genotypic and phenotypic correlation coefficients for all possible comparisons were computed as per formulae suggested by Al- Jibouri *et al* (1958).The partitioning of genotypic correlation coefficient of traits into direct and indirect effects was carried out using the procedure suggested by Dewey and Lu (1959).

Results and Discussion

The analysis of variance revealed significant differences among the genotypes for all characters studied (Table 1), indicating a high degree of variability in the material. The estimates of phenotypic coefficient of variation (PCV) were higher than those of genotypic coefficient of variation (GCV) for all the traits indicating environmental factors influencing the characters (Table 2). The highest PCV and GCV were recorded for plant height at maturity, 100 seed weight, yield per plant, protein content, pods per plant and seeds per pod indicating presence of ample variation for these traits in the present material. Similar results have also been reported by Singh *et al* (1994) for yield per plant and pods per plant; Asati & Singh (2008) for yield per plant, pods per plant, plant height and 100 seed weight; Pandey et al. (2013) for pods per plant. Burton (1952) has suggested that genotypic coefficient of variation together with heritability estimates gives best option expected for selection. A fair measure of efficiency of selection for any quantitative traits can be derived from the estimates of heritability for the characters under consideration. But reliability of selection depends not only on heritability but it should also be accompanied by high genetic advance (Johnson *et al*., 1955). High heritability coupled with high genetic advance shows that a progress can be made through selection as it suggests the presence of additive gene effects (Panse, 1957). In the present study, high estimates of heritability and genetic advance were obtained for plant height at maturity, 100 seed weight, yield per plant, protein content, pods per plant, seeds per pod and pod length. Thus selection for these traits is likely to accumulate more additive genes leading to further improvement of their performance and these traits may be used as selection criteria in French bean breeding program. Similar observation was reported by Singh *et al* (1994) for yield per plant, pod length and pods per plant; Asati & Singh (2008) for yield per plant, pods per plant, plant height and 100 seed weight

To utilize various quantitative characters in breeding program, interrelationship between the characters are of immense value. Therefore, in the present study, correlations between 9 characters were studied in all possible combinations at phenotypic and genotypic level. The genotypic and phenotypic correlation coefficients between grain yield and its components are presented in Table 3

In general magnitude of genotypic correlation tended to be higher than phenotypic correlation. This suggested a strong genetic association between the traits and the phenotypic expression was suppressed

Table 1. Analysis of Variance for yield per plant and component character in French bean

Sources of Variation	Df	Mean square								
		Days to 50% Flowering	Days to 80% Maturity	Plant height at maturity	Pods per plant	Seeds per pod	Pod length weight	100 seed per plants	Protein content	Yield
Replications	2	0.43	2.41	413.82	16.17	1.66	5.53	1.22	1.09	0.34
Genotypes	19	61.48**	139.33**	6571.09**	5.99**	1.98*	6.72**	118.85**	139.01**	5.17**
Error	38	3.21	4.82	45.11	1.15	0.33	0.89	0.43	0.28	0.13

*and ** Significant at 5% and 1% respectively

Table 2. Estimates of mean, coefficient of variation, heritability and genetic advance as percentage of mean for various characters in French bean

Characters	Mean± SE	Coefficient of Variation		Heritability(%)	Genetic advance as % of mean	
		GCV	PCV	ECV		
Days to 50% Flowering	39.302 ±1.463	11.2075	12.0997	4.5599	85.80	21.38
Days to 80% Maturity	77.673 ±1.793	8.6207	9.0726	2.8277	90.29	16.87
Plant height at maturity	58.679 ±5.484	79.4835	80.3035	11.4463	97.97	162.06
Pods per plant	4.236 ±0.877	29.9785	39.2606	25.3513	58.30	47.15
Pod length	9.624 ±0.774	14.4706	17.5047	9.8497	68.34	24.64
Seeds per pod	3.519 ±0.470	21.0772	26.6844	16.3649	62.39	34.29
100 seed weight	13.490 ±0.536	46.5743	46.8277	4.8648	98.92	95.42
Protein content	20.148 ±0.434	33.7522	33.8551	2.6377	99.39	69.31
Yield per plant	3.414 ±0.298	37.9722	39.4511	10.7007	92.64	75.29

Table 3. Estimates of genotypic and phenotypic correlation coefficients between different characters in French bean

Characters	Plant Height	Pod length	Seeds per pod	Pods per plant	Days 50% flowering	Days 80% maturity	100 seed weight	Protein content	Yield per plant
Plant Height	**G-P**	0.0570.030	0.0110.016	-0.185-0.148	-0.102-0.085	-0.151-0.140	-0.109-0.110	0.2030.199	-0.385-0.363
Pod length		**G-P**	0.803**0.518*	-0.080-0.050	-0.274-0.234	-0.381-0.261	0.495*0.425	-0.042-0.031	0.171 0.133
Seeds per pod			**G-P**	0.136-0.031	-0.106 -0.080	-0.068-0.065	0.711**0.561**	-0.020 -0.023	0.2940.276
Pods per plant				**G-P**	0.1980.060	0.3880.268	0.3330.253	-0.103-0.085	0.3100.176
Days 50% flowering					**G-P**	-0.047-0.045	0.0620.052	-0.323 -0.298	0.2620.254
Days 80% maturity						**G-P**	0.0260.026	0.1810.172	0.2660.237
100 seed weight							**G-P**	-0.178-0.177	0.748**0.719**
Protein content								**G-P**	-0.305-0.299

*and** Significant at 5% and 1% respectively

TABLE: 4. Direct and indirect effects of different characters on seed yield per plant at genotypic level in French bean

Characters	Days to 50% Flowering	Days to 80%	Plant height at Maturity	Pods per plant maturity	Pod length	Seeds per pod	100 seed weight	Protein content	r_g for yield per plant
Daysto50% Flowering	**0.26030**	-0.02070	0.02171	-0.03092	-0.14209	0.08231	0.06402	0.02724	-0.385
Days to 80%Maturity	-0.01223	**0.44042**	0.03210	-0.06065	-0.19782	0.05280	0.02669	-0.01527	0.171
Plant height at maturity	-0.02651	-0.06631	**-0.21319**	0.02898	0.02946	-0.00816	-0.11199	-0.01707	0.294
Pods per plant	0.05150	0.17094	0.03954	**-0.15625**	-0.04145	-0.10521	0.34257	0.00871	0.310
Pod length	0.07129	-0.16794	-0.01211	0.01248	**0.51880**	-0.62144	0.50858	0.00357	0.262
Seeds per pod	-0.02770	-0.03006	-0.00225	-0.02125	0.41673	**-0.77363**	0.73063	0.00166	0.266
100 seed weight	0.01622	0.01144	0.02324	-0.05209	0.25678	-0.55009	**1.02755**	0.01498	0.748
Protein content	-0.08417	0.07983	-0.04321	0.01616	-0.02199	0.01528	-0.18280	**-0.08423**	-0.305

Residual effect= 0.3546

due to environmental influence. Similar observation was also recorded by Singh *et al* (1994), Asati & Singh (2008) and Pandey et al. (2013). The yield per plant exhibited significant positive correlation with 100 seed weight indicating relative utility of this trait for selection. Significant positive correlations were also observed between pod length & seeds per pod, pod length &100 seed weight and seeds per pod & 100 seed weight. The path analysis (Table- 4) revealed that 100 seed weight (1.02755) contributed maximum positive direct effect on yield followed by pod length (0.5188) and days to 80% maturity (0.44042). 100 seed weight exerted positive direct effect and also exhibited significant positive correlation with yield indicating a true relationship between the traits. This suggested that the direct relation for 100 seed weight would likely be effective in increasing seed yield. The residual effect estimated was 0.3546 indicating that the traits under study are not sufficient to account for variability and there might be a few more pertinent characters other than those studied in the present investigation and thus solicits inclusion of some more characters. Inclusion of some physiological characters like leaf area index, chlorophyll content, harvest index etc could be considered important in order to derive a much clear picture of the causal relationship. The present study suggested that while selection, emphasis should be given for 100 seed weight for improvement in seed yield.

References

1. **Al-Jibouri, N.A.; Miller, P.A. and Robin, H.F.**(1958)Genotypic and environmental variances, co-variances in an upland cotton cross of inter-specific origin. Agronomy Journal, 50: 633-637.
2. **Allard, R.W.** (1960) Principles of Plant Breeding. John Wiley and Sons Inc, New York.
3. **Asati, B. S. and Singh, A. K.(**2008) Genetic components studies in French bean (*Phaseolus vulgaris* L.). New Agriculturist, 19(1/2):117-123.
4. **Burton, G. W.** (1952) Quantitative inheritance in grasses. Proc. 6th Int.

Grassland Cong., 1: 227-83.

5. **Dewey, D. R. and Lu, K.H.** (1959) Correlation and path coefficient analysis of components of crested wheat grass seed production. Agron. J., 57: 515-18.
6. **Johnson, H.W.; Robinson, H.F. and Comstock, R.E.** (1955) Estimates of genetic and environmental variability in soybean. Agron. J., 47: 314-18.
7. **Pandey, V.; Singh, V. K. and Upadhyay, D. K.** (2013) Determination of green pod yield components in French bean (*Phaseolus vulgaris* L.) through correlation and path coefficient analyses. Vegetos, 26(2):438-443.
8. **Panse, V.G.** (1957) Genetics of quantitative characters in relation to plant breeding. Indian J. Genet. 47: 318- 328.
9. **Singh, D. N.; Nandi, A. and Tripathy, P.** (1994) Genetic variability and character association in French bean (Phaseolus vulgaris). Indian Journal of Agricultural Sciences, 64(2):114-116.

***