ADAPTABILITY IN FRENCH BEAN
(*PHASEOLUS VULGARIS* L.)*

B.D. Joshi and K.L. Mehra[1]

National Bureau of Plant Genetic Resources,
Regional Station, Phagli, Shimla 171 004 (Himachal Pradesh)

Forty two varieties of french bean, studied for their phenotypic stability in five environments (i.e., 3 *Kharif* and 2 spring seasons), indicated presence of significant genotype-environment interactions for all the eleven characters including seed yield. Most of the genotype-environment interactions were attributed to linear component except in case of plant height, numbr of leaves, number of seeds, 100-seed weight, days to flower and days to maturity in which both linear and non-linear components were significant. Keeping in view all the three parameters of adaptability, EC 44624, EC 109975, PLB14-1, EC 43893, and PLB-256 proved to be the best adaptables and can be utilised in breeding as parents for yield stability in french bean.

Key words : Frenchbean, adaptability, joint regression, G×E interaction, genetic stability

The information on stability aspects in Frenchbean (*Phaseolus vulgaris* L) is insufficient in India. It is imperative to identify stable and adaptable genotypes of Frenchbean over a number of environments for various yield and yield contributing attributes. The information on the stable yield contributing characters would provide selection criteria which would help the breeders in tailoring new high yielding cultivars for a wider range of environments. The present studies were carried out to identify stable varieties for breeder's use.

MATERIALS AND METHODS

Forty-two varieties of Frenchbean originating from different geographical regions of the world were tested in five environments i.e. three *kharif* (July-October) and two spring (February - April) seasons in a randomised complete block design with four replications at Shimla. Each accession was

sown in 2.25 m long rows and spaced 50cm apart. Seeds were dibbled 15 cm apart in the rows. Five randomly selected plants in each single row plot were marked for taking observations on 11 characters, viz., days to flower, plant height (cm), number of leaves, number of branches, number of clusters, number of pods, pod length (cm), days to maturity, number of seeds per pod, 100-seed weight (g) and yield per plant (p). The mean values were computed for each character, using five seasons data. The stability analysis was carried out following the model proposed by Eberhart and Russel (1966).

RESULTS AND DISCUSSION

Joint regression analysis for eleven characters studied is presented in Table 1. The variance due to genotypes was significant for all the traits suggesting presence of variation among genotypes. The variance due to genotype-environment interactions were also significant for all the traits. All the parameters of adaptability, viz., mean (m), coefficient of regression (bi) and deviation from regression (S^2d) estimated for yield are presented in Table 2. Differences were found among 42 Frenchbean varieties in respect of deviation from regression. The genotypes EC 44624, EC 109975 and PLB 14-1 had mean values for seed yield above the grand mean, low S^2d and were thus rated the most stable genotypes.

Out of 42 genotypes, EC 18600, EC 26399, EC 43893 and EC 44758 were found to be high yielding. They showed response to better environment. EC 43893 also showed sufficiently high adaptability to unpredictable environmental conditions due to non-significant S^2d values. Over five environments EC 18600 gave maximum yield but was found to be most unstable genotype.

The stability parameters for components of yield and fitness revealed that most stable and high yielding variety PLB14-1 had higher mean value than the grand mean for plant height, number of branches, number of clusters, number of pods, pod length, 100 seed weight and days to maturity. EC 18611 (B) was found to be most stable genotype for days maturity and number of leaves. PLB14-1 and EC 43900 were observed to be most stable for characters number of clusters and number of pods. These character have significant correlation with seed yield. EC 109977, EC 93621 and PLB14-1 were observed to be most stable for pod length and genotype EC 109975 and EC 77005 for number of seeds. Genotypes EC 44790 and EC 94469 showed the highest consistency and stability for 100-seed weight under changing environments.

Table 1 : Pooled analysis of variance for stability for 11 characters in french bean

Source	df	Plant height	Number of leaves/plant	Number of branches/plant	Number of clusters/plant	Number of pods/plant	Pod length	Number of seeds/plant	100-seed weight	Days to flower	Days to mature	Seed yield/plant
Genotypes	41	1943.37**	289.96**	0.37	21.50**	71.66**	15.35**	2087.44**	441.92**	165.26**	249.68**	72.46**
Environment	4	2662.97**	178.23**	9.20**	163.23**	268.17**	28.63**	6885.39**	357.32**	6722.42**	3345.55**	352.38**
Genotype × Environemnt	164	286.36**	44.98**	0.15**	9.96**	19.20**	3.01**	497.78**	21.54**	1912**	48.84**	26.09**
Heterogenity between regression	41	525.52**	64.23**	0.14	21.96**	47.70**	1.77**	1428.31**	30.55**	28.92**	108.90**	39.74**
Remainder	123	206.64	38.57	0.16	5.95	9.70	3.43	187.61	18.54	15.86	28.86	21.54
Pooled Error	630	23.15	7.19	0.13	7.50	12.00	9.75	80.48	5.50	5.09	24.35	24.26

$*$ = $P_{0.05}$, $**$ = $P_{0.01}$

Table 2 : Means and estimates of stability parameters for yields of 42 varieties of french bean

Variety	Mean	b_i	S^2d	Variety	Mean	b_i	S^2d
EC-18600	25.33	3.93	214.83*	EC-57260	9.96	1.15	−5.32
EC-18611	17.30	1.69	22.56	EC-77005	17.59	0.73	23.51*
EC-19038	11.77	−0.19	−2.57	EC-93621	9.48	−0.62	−0.96
EC-22365	9.03	0.03	0.21	EC-93625	17.49	1.24	27.66*
EC-24948	12.87	0.67	−0.11	EC-93828	8.93	0.48	−4.44
EC-26399	20.01	3.23	29.90*	EC-94453	15.27	1.30	4.40
EC-26402	17.97	0.23	20.96	EC-94455	12.19	0.90	1.55
EC-31230	11.29	0.56	−4.14	EC-94469	12.94	0.94	−2.39
EC-34023	15.96	3.84	51.87*	EC-99540	13.74	−0.55	96.70*
EC-36664	11.08	0.01	−5.41	EC-99541	14.05	0.42	−4.33
EC-42960	13.82	0.83	21.19	EC-100677	7.91	0.37	0.29
EC-43893	19.77	1.43	11.57	EC-100680	10.58	0.45	0.15
EC-43896	12.26	−0.02	2.00	EC-108101	11.72	0.25	−1.72
EC-43900	17.43	1.33	10.80	EC-109508	15.55	3.04	−4.92
EC-44624	17.47	2.75	3.00	EC-109975	17.14	0.33	1.03
EC-44747	18.85	1.99	84.95*	EC-109977	15.97	−0.10	17.27
EC-44758	20.35	1.54	29.03*	Premier	11.57	0.64	−3.62
EC-44760	8.80	0.46	−5.24	PLB10-1	13.43	0.85	−0.78
EC-44787	9.89	1.07	−4.93	PLB-14-1	16.49	0.82	−3.91
EC-44790	11.72	0.23	0.21	PLB-256	14.55	0.14	−2.60
EC-57080	12.16	1.26	−3.80	PLB-440	15.00	2.31	11.81

Mean	14.20						
Pooled error	24.26						

*p = 0.05

The occurrence of differential stability for various yield and adaptability influencing traits is reported in Frenchbean as also the information on stable genotypes varies for yield alone (Crispin, 1968: Stupar, 1978; Santos and Ramalho 1990; Abreu *et al.*, 1990). These studies support the findings reported in this paper in need to select germplasm with known adaptability for yield and /or its component traits alongwith high *per se* performance for further use in breeding programmes.

REFERENCES

Abreu, A., F.B. De, M.A.P. Ramalho, J.B. Dos, Santos and I.A. Funo Pereira. 1990. Effect of genotype×environment interaction on estimates of genetic and phenotypic parameters of common beans. *Revista Brasileira de Genetica* **13** (1) : 75-82.

Crispin, M.N. 1968. Bean varieties with a high capacity for adaptation. *Agric. Tec. Mex.* **2**: 412-416.

Eberhart, S.A. and W.A. Russell. 1966. Stability parameters for comparing varieties. *Crop Sci.* **6**: 36-40.

Santos, J.B. Dos and M.A.P. Ramalho. 1990. Selection of Frenchbean progenies adapted to autumn and winter conditions in the south of Minas Gerais. *Pesquisa Agropecuaria Brasileira* **25** (11) : 1655-1661.

Stupar, M. 1978. Comparative investigation of characters affecting the yield of Frenchbean under the conditions of the Sarajera valley. *Radori Polioprivrednog Fakuteta Univerzieta Surajeva* **26**(29): 49-59.