THE ASIAN JOURNAL OF HORTICULTURE
Volume 7 | Issue 1 | June, 2012 | 55-59

Research Paper

Article history :
Received : 20.10.2011
Revised : 02.02.2012
Accepted : 18.03.2012

Correlation studies in french bean (*Phaseolus vulgaris* L.)

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Abstract **:** Twelve genotypes of french bean were assessed for correlation at Main Agriculture Research Station, Raichur. Highly significant differences were observed in the genotypes for all the characters under study. Pod yield per hectare had positive and highly significant association with pod yield per plant, pod length, weight of pod, plant height, leaf area, leaf area index, ovule number per pod, number of seeds per pod at both phenotypic and genotypic level.

Key words **:** French bean, Correlation, *Phaseolus vulgaris* L.

How to cite this article **:** Angadi, Praveenkumar, Patil, M.G. and Angadi, Akshay (2012). Correlation studies in french bean (*Phaseolus vulgaris* L.), *Asian J. Hort.*, **7**(1) : 55-59.

For any crop improvement, basic information on the variability present in the crop is essential. Yield being a complex trait, is collectively influenced by various yield attributes, which are polygenically inherited and influenced by environmental variations. The effective selection for improvement of these traits is determined by magnitude and nature of interaction between genotypic and phenotypic variability. It is, therefore, required to know the heritable and non-heritable components with genetic parameters such as genotypic and phenotypic coefficient of variation, heritability and genetic advance. French bean, *Phaseolus vulgaris* L. (2n = 2x = 22) also known as snap bean, kidney bean, garden bean or string bean, is one of the most important leguminous vegetables grown for its tender fleshy green pods, shelled green seeds and also dry beans. It has anti-diabetic property and is good for natural cure of bladder burns and cardiac problems, diarrhoea, sciatica and tenesmus. It is a nutritive vegetable, rich in protein (1.7 g), calcium (132 mg), thiamin (0.08 mg) and vitamin C (24 mg per 100 g of edible pods). French bean originated from Central America and Peruvian Andes in South America. It could spread to Europe during 16th and 17th centuries and reached England by 1594. It was introduced to India during 17th century from Europe. The statistics with respect to this crop is very deficient owing to the small area of production and short duration. However, as per as the FAO estimates, it is grown in the world in an area of 0.83 m ha with annual production of 5.64 m t with productivity of 6.76 t per ha. In India, it is mainly grown in Himachal Pradesh Punjab, Haryana, Uttar Pradesh, Bihar, Gujarat, Madhya Pradesh, Maharashtra, Karnataka, Andhra Pradesh and Tamil Nadu. Annually, french bean is grown in an area of 0.15 m ha with annual production of 0.42 m t and productivity of 2.8 t per ha (FAO STAT, 2002). Improvement made in crop varieties is mainly concentrated on increasing yield and yield attributing characters. Studies of correlation between different quantitative characters provide an idea of association. It could

be effectively exploited to formulate selection strategies for improving yield and quality. Correlation study does not reveal the direct and indirect contributions of individual character towards yield. In order to have clear picture of yield components for effective selection programme, it would be desirable to consider the relative magnitude of various characters contributing towards yield. Keeping in view the above, correlation coefficient between yield and its components.

RESEARCH METHODS

The field experiment was conducted on sandy loam soil in the new orchard of Main Agriculture Research Station (MARS), Raichur, which is situated in the north eastern dry zone of Karnataka; the location corresponds to at 16° 12' N latitude and 77° 20' E longitude with an altitude of 389 meters above the mean sea level. The daily climatological data during the study period were obtained from the meteorological observatory at MARS, Raichur. The investigation was carried out during *Rabi* season of 2010. It consisted of 12 genotypes collected from different sources. The experiment was laid out by adopting Randomised Block Design with three replications. Thirty plants per genotype per replication were maintained. The experimental field was brought to fine tilth by repeated ploughing and harrowing. Twenty-five tonnes of FYM and recommended dose of fertilizers (62.5:100:75 kg NPK/ha) were incorporated in the soil. Ridges were prepared at a distance of 30 cm. The seeds of different genotypes were sown on November 13th, 2010 by dibbling two to three seeds per hill at a distance of 15 cm on one side of the ridges. The plots were irrigated immediately after the completion of sowing. Thinning of excess seedlings and gap filling was undertaken one week after germination. Plant protection practices were undertaken as per the package of practice of UAS, Dharwad. The observations were recorded from 5 randomly selected plants from each genotype in each replication for days to 50 per cent flowering, plant height, number of branches per plant, stem thickness, leaf area, leaf area index, chlorophyll content, number of pods per plant, ovule number per pod, pod length, pod width, weight of 10 pods, number of seeds per pod, tenderness of pods, pod yield per plant, pod yield per hectare. The collected pool data were subjected for statistical analysis by using indowstat software.

RESEARCH FINDINGS AND DISCUSSION

In the present study, results obtained in correlation computed among 15 characters revealed that pod yield per hectare was significant and positively correlated with pod yield per plant, pod length, weight of 10 pods, plant height, leaf area, leaf area index, ovule number per pod, pod width, number of seeds per pod and pod yield per plant at both genotypic and phenotypic levels as presented in Table 1 and 2 and shown in Fig. 1 and 2. Thus it can be concluded that selection based on these characters will bring about improvement in yield. Positive and significant association of these characters with pod yield per hectare were in accordance with earlier reports by Shah *et al.* (1986) observed between pod yield and pod length. Singh *et al.* (2000), Shinde and Dumbre (2001), Rai *et al.* (2004) and Atilla Dursum (2007) observed between pod yield and plant height, pod length, pod width, pod weight, number of seeds per pod at both phenotypic and genotypic level. In the present study negative and significant association of yield with days to 50 per cent flowering was observed. Similar results were realized by Singh *et al.* (2000).

Plant height exhibited significant association with number of pods per plant, pod length, pod width, number of seeds per pod, pod yield per plant and negative significant association with days to 50 per cent flowering and stem thickness. Similar results were observed by Shinde and Dumbre (2001) for number of pods per plant, pod length, pod yield per plant and Singh *et al.* (2000) for plant height with pod yield per plant for both phenotypic and genotypic. Number of branches exhibited significant association with stem thickness, number of pods per plant. Similar results were observed by Shah *et al.* (1986) at phenotypic level. Leaf area had significant and positive association with LAI, ovule number per pod, weight of 10 pods, pod length, number of seeds per pod and pod yield per plant while significant negative correlation with days to 50 per cent flowering and tenderness of pod. Similar results were observed by Atilla Dursun (2007) for pod length, pod weight and number of seeds per pod. Leaf area index confirmed its association with ovule number per pod, weight of 10 pods, pod length, number of seeds per pod and pod yield per plant strongly and positively both at genotypic and phenotypic level. Negative and significant correlation was observed with days to 50 per cent flowering and pod width. Similar results were observed by Kumar Swamy (1990) for pod width, pod yield per plant and days to 50 per cent flowering with LAI. Days to 50 per cent flowering had negative and significant correlation with ovule number per pod, weight of 10 pods, pod length and pod yield per plant at both, phenotypic and genotypic level. These are in conformation with the findings of Pandey *et al.* (2004) and Singh *et al.* (2004). Ovule number per pod had positive significant correlation with weight of 10 pods, pod length, number of seeds per pod and pod yield per plant. Weight of 10 pods had positive and significant correlation with pod length, pod width, number of seeds per pod and pod yield per plant at both phenotypic and genotypic level. This is in conformity with the findings of Rai *et al.* (2004). Pod length had strong positive correlation with number of seeds per pod and pod yield per plant at both phenotypic and genotypic level. These results were supported by the findings of Shah *et al.* (1986), Singh *et al.* (2000), Singh *et al.* (2004) and Rai *et al.* (2004). Pod width

Table 1 : Genotypic correlation coefficients of different characters in French bean

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	X_{13}	X_{14}	X_{15}	X_{16}
X_1	1	0.2659	0.1824*	0.1016	0.1052	0.5028**	0.6162**	0.3879*	0.0829	0.5167**	0.3078	0.1000*	0.6189**	0.9961**	0.6137**	0.6961**
X_2		1	0.1787*	0.2099	0.2173	0.2206	0.0962	0.7637**	0.1973	0.1588	0.2698	0.1173	0.036	0.1296	0.0035	0.0766
X_3			1	0.1078	0.1095	0.1859	0.5785**	0.1871	0.3293*	0.1639	0.1269	0.2276	0.1198	0.1769	0.2971	0.3109
X_4				1	0.9997**	0.1020	0.5702**	0.0266	0.5758**	0.6660**	0.6651**	0.7281**	0.0855	0.6768**	0.6729**	0.6897**
X_5					1	0.1111	0.5696**	0.0298	0.5888**	0.6708**	0.6657**	0.7279**	0.0807	0.6779**	0.6739**	0.6309**
X_6						1	0.0627	0.1193	0.0373	0.7579**	0.1389	0.0779	0.1566	0.3978*	0.1037	0.1660
X_7							1	0.1123	0.6303**	0.3528*	0.6736**	0.7188**	0.3172	0.3007	0.8116**	0.829**
X_8								1	0.1887	0.2760	0.2937	0.1255	0.0108	0.2397	0.1919	0.2727
X_9									1	0.0707	0.8476**	0.7123**	0.3995**	0.0791	0.3707**	0.392**
X_{10}										1	0.7777**	0.7528**	0.2670	0.9998**	0.6988**	0.6573**
X_{11}											1	0.9238**	0.7353**	0.7509**	0.7911**	0.7356**
X_{12}												1	0.1971	0.5110**	0.7766**	0.7705**
X_{13}													1	0.2981	0.5775**	0.7928**
X_{14}														1	0.6172**	0.6273**
X_{15}															1	0.9999**

* and ** indicate significance of values at P 0.05 and 0.01, respectively

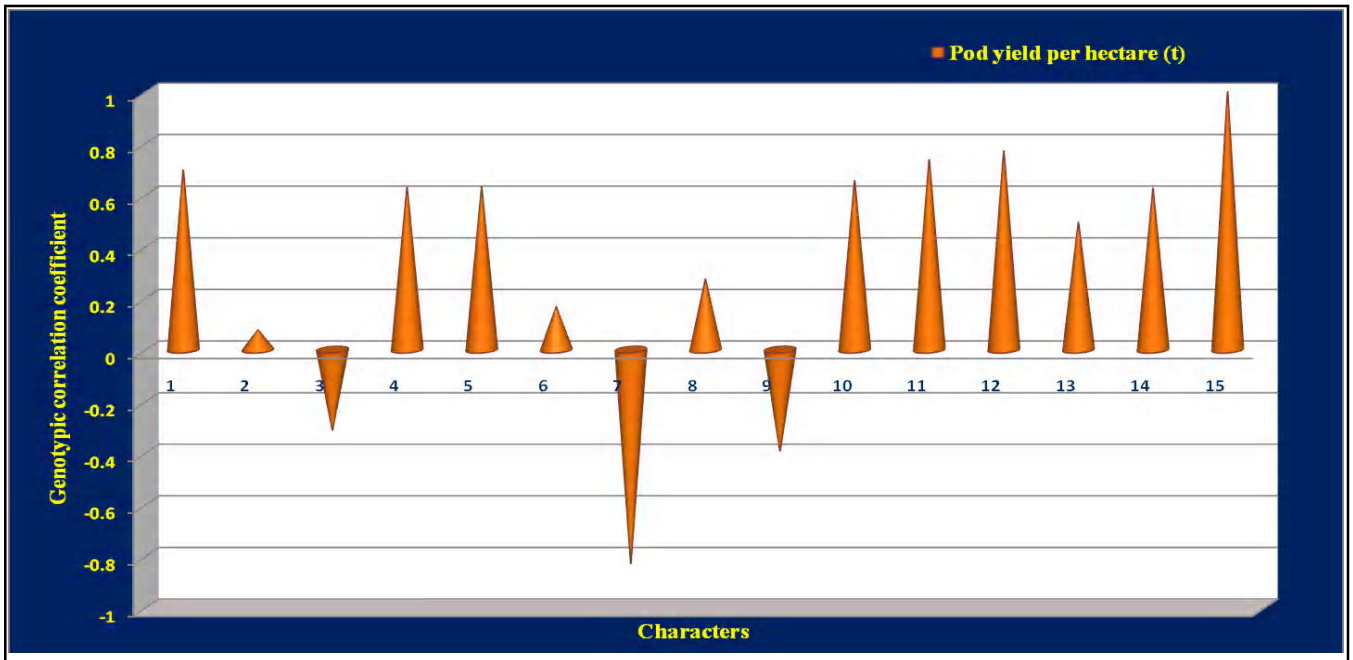
X_1 Plant height; X_2 Number of branches per plant; X_3 Stem thickness; X_4 Leaf area; X_5 Leaf area index; X_6 Chlorophyll content; X_7 Days to 50% flowering; X_8 Number of pods per plant; X_9 Hardness of pod; X_{10} Ovule number per pod; X_{11} Weight of 10 pods; X_{12} Pod length; X_{13} Pod width; X_{14} Number of seeds per pod; X_{15} Pods yield per plant; X_{16} Total yield per hectare

Table 2 : Phenotypic correlation coefficients of different characters in French bean

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	X_{13}	X_{14}	X_{15}	X_{16}
X_1	1	0.2577	0.1717	0.102	0.1036	0.4886**	0.6111**	0.3833*	0.0817	0.5167**	0.3055	0.3938*	0.6022**	0.7686**	0.6299**	0.6890**
X_2		1	0.3978	0.2033	0.2111	0.2159	0.0928	0.7275**	0.1923	0.1238	0.2597	0.1337	0.0318	0.098	0.0032	0.0778
X_3			1	0.1076	0.1085	0.1845	0.5716**	0.1832	0.3258	0.1521	0.1242	0.2235	0.1158	0.1375	0.2913	0.3107
X_4				1	0.9998**	0.1102	0.568**	0.0255	0.5778**	0.6269**	0.6676**	0.7231**	0.0835	0.6728**	0.6630**	0.6257**
X_5					1	0.1091	0.5663**	0.03	0.5388**	0.6256**	0.6633**	0.7191**	0.0775	0.6705**	0.6635**	0.6261**
X_6						1	0.0627	0.1177	0.0328	0.7387**	0.1353	0.0728	0.1152	0.3877*	0.1037	0.1671
X_7							1	0.11	0.6286**	0.3282	0.6718**	0.7129**	0.3073	0.285	0.8006**	0.825**
X_8								1	0.1877	0.2636	0.2899	0.1302	0.021	0.2259	0.1863	0.2677
X_9									1	0.0353	0.8471**	0.7076**	0.3911*	0.0737	0.336*	0.388**
X_{10}										1	0.3937*	0.7328**	0.239	0.9898**	0.6533**	0.6172**
X_{11}											1	0.9195**	0.7282**	0.7267**	0.7857**	0.7331**
X_{12}												1	0.1815	0.8716**	0.7579**	0.7678**
X_{13}													1	0.1872	0.5191**	0.7753**
X_{14}														1	0.6298**	0.5919**
X_{15}															1	0.9866**

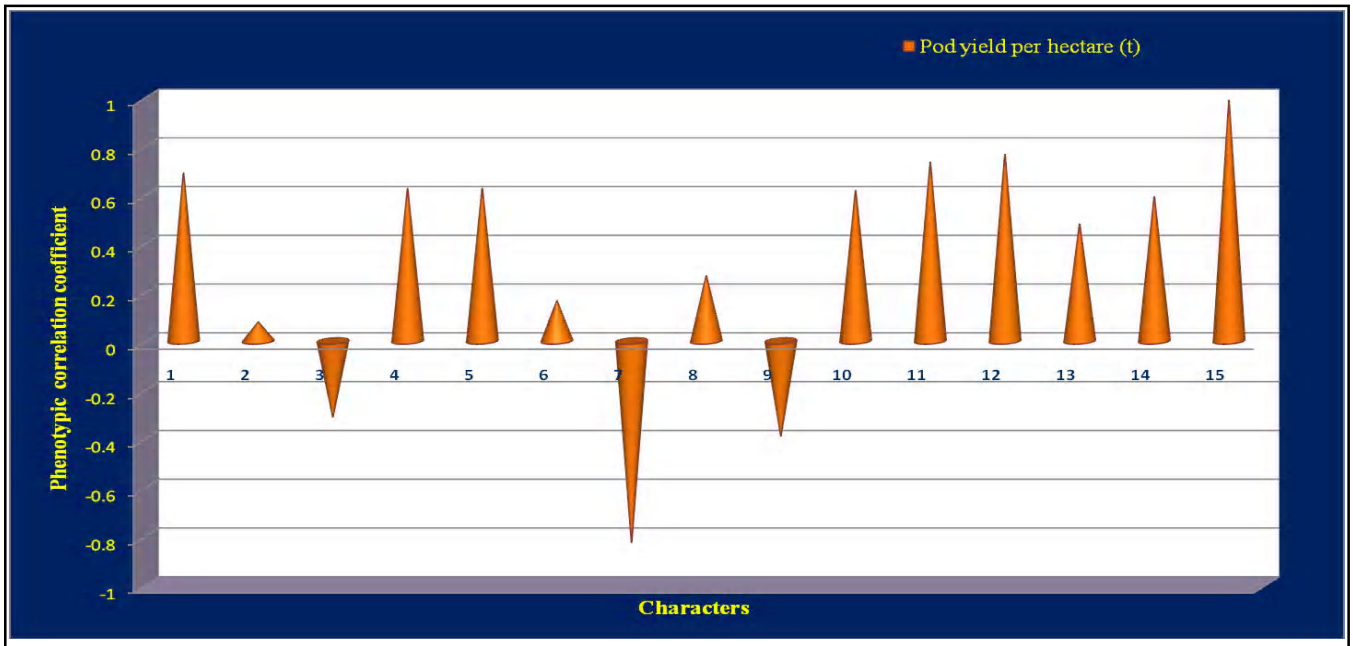
* and ** indicate significance of values at P 0.05 and 0.01, respectively

X_1 Plant height; X_2 Number of branches per plant; X_3 Stem thickness; X_4 Leaf area; X_5 Leaf area index; X_6 Chlorophyll content; X_7 Days to 50% flowering; X_8 Number of pods per plant; X_9 Hardness of pod; X_{10} Ovule number per pod; X_{11} Weight of 10 pods; X_{12} Pod length; X_{13} Pod width; X_{14} Number of seeds per pod; X_{15} Pods yield per plant; X_{16} Total yield per hectare



X_1 - Plant height
X_2 - Number of branches per plant
X_3 - Stem thickness
X_4 - Leaf area
X_5 - Leaf area index
X_6 - Chlorophyll content
X_7 - Days to 50% flowering
X_8 - Number of pods per plant
X_9 - Tenderness of pod
X_{10} - Ovule number per pod
X_{11} - Weight of 10 pods
X_{12} - Pod length
X_{13} - Pod width
X_{14} - Number of seeds per pod
X_{15} - Pods yield per plant

Fig. 1 : Genotypic correlation coefficient of yield with other characters in french bean



X_1 - Plant height
X_2 - Number of branches per plant
X_3 - Stem thickness
X_4 - Leaf area
X_5 - Leaf area index
X_6 - Chlorophyll content
X_7 - Days to 50% flowering
X_8 - Number of pods per plant
X_9 - Tenderness of pod
X_{10} - Ovule number per pod
X_{11} - Weight of 10 pods
X_{12} - Pod length
X_{13} - Pod width
X_{14} - Number of seeds per pod
X_{15} - Pods yield per plant

Fig. 2 : Phenotypic correlation coefficient of yield with other characters in french bean

exhibited strong positive significant association with yield per plant at both genotypic and phenotypic level. These results were supported by the findings of Saha *et al*. (1990). Number of seeds per pod has positive and significant association with pod yield per plant at both phenotypic and genotypic levels. These results were supported by the findings of Saha *et al*. (1990), Singh *et al*. (2000) and Singh *et al*. (2004). On the basis of these results obtained in the correlation studies it can be emphasized to improve pod yield per hectare by selecting plants based on maximum yield per plant, pod length, weight of pods, plant height, number of pods per plant both at phenotypic and genotypic level.

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