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Evaluation of Pole Type French Bean (*Phaseolus vulgaris* L.) Genotypes under Raichur Region

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A B S T R A C T

In the present investigation diverse genotypes of French bean were evaluated to identify higher yielding genotypes with important yield component traits. Seven genotypes of pole type French bean *viz.*, EC-530833, IC-320968, EC-500638, IC-319827, EC-540796, IC-319423 and EC-530838were assessed for performance at Main Agriculture Research Station, Raichur. Highly significant differences were observed in the genotypes for all the characters under study. An overall perusal on the performance of genotypes revealed that EC-530833 registered maximum yield hectare^{-1} (17.02 t) followed by IC-319827 (16.62t) and IC-319423 (16.32t) whereas; EC-530838 recorded minimum pod yield hectare^{-1} (15.13t). Plant height, number of branches plant^{-1}, stem thickness, leaf area, LAI, number of pods plant^{-1}, ovule number pod^{-1}, weight of 10 pods, number of seeds pod^{-1} and pod yield plant^{-1} showed significant difference among the genotypes. Among seven genotypes EC-530833 registered the highest in all the above characters (152.00cm, 50.47, 9.49mm, 98.22 cm^2, 5.46, 80.29, 7.40, 37.80g, 7.03 and 255.33g) also showed less number of leaf miner maggot's leaf^{-1}. It can be concluded that the difference in yield may be attributed mainly to the difference in their pod length, number of pods plant^{-1}, pod weight, leaf area, number of seeds pod^{-1}, number of branches plant^{-1}.

Introduction

It is an essential to evaluate high yielding genotypes since a superior genotype may exhibit its potentiality when grown under a set of agro climatic condition. 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. 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 100g^{-1} of edible pods). French bean originated from Central America and Peruvian Andes in South America (Vavilov, 1950). 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 ha^{-1}. 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 mt and productivity of 2.8 t ha^{-1} (FAO STAT, 2002). Selection for architectural traits along with some yield components is expected to produce bean plant ideotypes possessing higher yield potential through enhanced adapting to specific cropping system (Durate and Adams, 1972). In the present investigation diverse genotypes of French bean were evaluated to identify higher yielding genotypes with important yield component traits.

Materials and 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^{o} 12' N latitude and 77^{o} 20' E longitude with an altitude of 389 m 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 *Kharif* season of 2010. It consists of seven 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 experiment was conducted as per the package of practice of UAS, Dharwad. The observations were recorded from five randomly selected plants from each genotype in each replication for days to 50 % flowering, plant height, number of branches $plant^{-1}$, stem thickness, leaf area, leaf area index, chlorophyll content, number of pods $plant^{-1}$, ovule number pod^{-1}, pod length, pod width, weight of 10 pods, number of seeds pod^{-1}, tenderness of pods, pod yield $plant^{-1}$, pod yield $hectare^{-1}$, shelf life and leaf minor maggots $leaf^{-1}$ using standard procedures. The collected pool data were subjected for statistical analysis.

Results and Discussion

The comparison of French bean genotypes indicated that they differed significantly in pod yield $plant^{-1}$, days to 50% flowering, plant height, number of branches $plant^{-1}$, stem thickness, leaf area, leaf area index $plant^{-1}$, chlorophyll content, number of pods $plant^{-1}$, Pod length, pod width and Pod yield $hectare^{-1}$. The variation for pod yield $plant^{-1}$ was noticed by many workers like Korla *et al.,* (1998), Singh *et al.,* (2000), Singh *et al.,* (2007a), Atilla Duursum (2007). EC-530833 ranked first for pod yield (255.33 g $plant^{-1}$). IC-319827 (249.33 g $plant^{-1}$) and IC-319423 (244.73 g $plant^{-1}$) were next in the order. On the other hand EC-530838 (227.00g $plant^{-1}$) was the least.

Thus, these four genotypes can safely replace the other genotypes whose yield is much lower (Table 1). IC-320968 recorded minimum number of days (40.33) for 50 % flowering and closely followed by EC-500638 (41.00) and EC-530833 (43.67) whereas, IC-319423 (48.33) had taken maximum number of days to 50 % flowering. On an average, genotypes took 44.29 days for 50 % flowering. The population mean for plant height was 133.52 cm. Plant height was maximum in EC-530833 (152.00cm) followed by IC-319827 (150.33cm) and IC-320968 (140.33 cm). All these were statistically on par with each other whereas, EC-500638 (111.87) recorded least plant height.

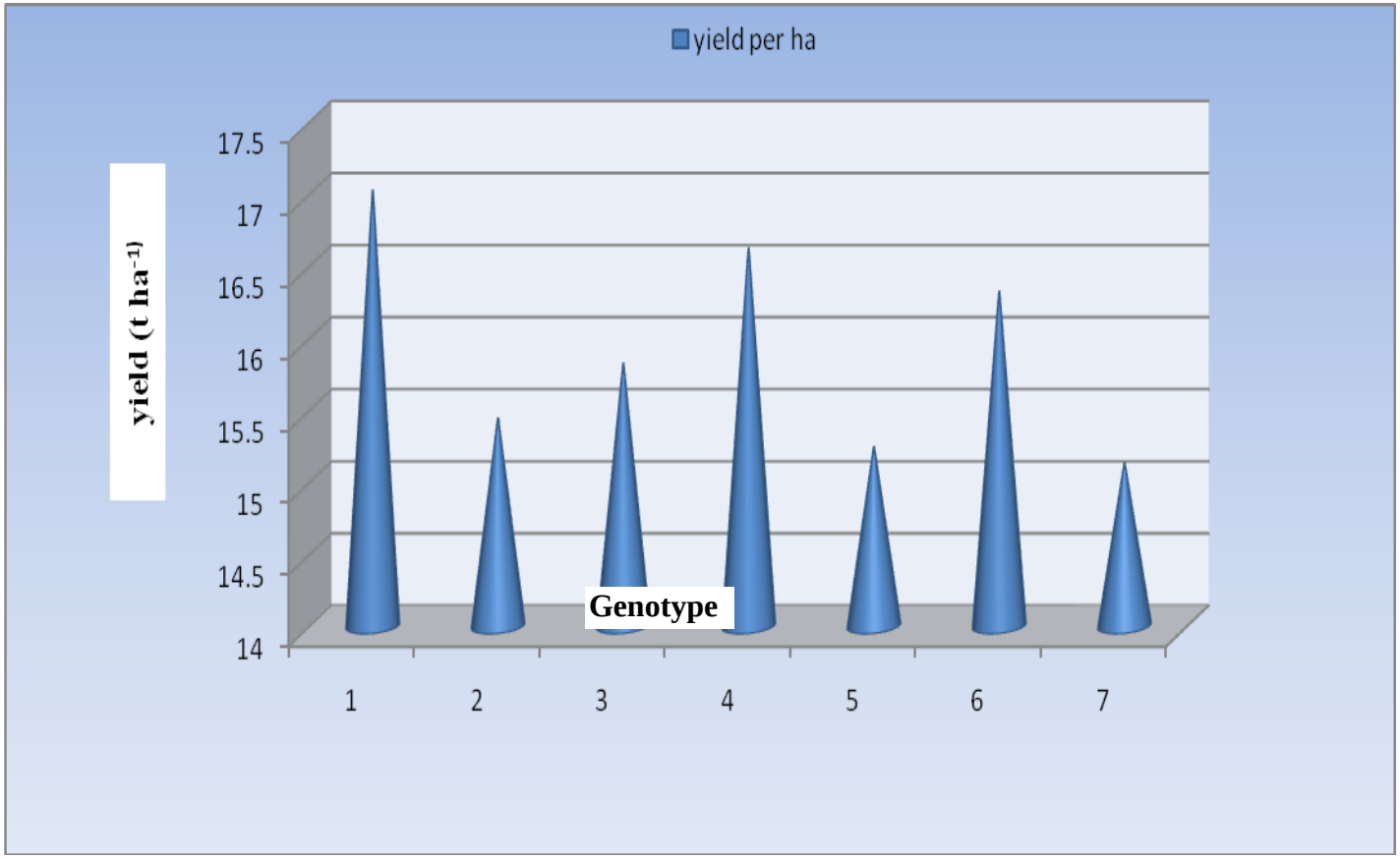
Table.1 Growth performance of pole type French bean genotypes

Genotypes	Plant growth parameters					
	Plant height (cm)	No. of branches	Stem thickness (mm)	Leaf area (cm^2)	Leaf area index	Chlorophyll estimation (mg $100g^{-1}$)
EC-530833	152.00	50.47	9.49	98.22	5.46	35.89
IC- 320968	140.33	29.40	7.49	66.82	3.71	31.44
EC-500638	111.87	26.60	8.27	75.21	4.18	28.57
IC- 319827	150.33	48.07	9.21	93.78	5.21	33.42
EC-540796	139.87	35.40	7.78	60.70	3.37	27.63
IC- 319423	118.47	33.20	8.40	95.46	5.30	26.95
EC-530838	121.80	27.80	9.33	76.93	4.27	32.71
Mean	133.52	35.85	8.57	81.02	4.50	30.94
SEm±	4.85	1.66	0.25	2.70	0.15	1.09
CD (p <0.05)	14.94	5.10	0.77	8.32	0.46	3.35

Table.2 Yield and yield attributing characters of pole type French bean genotypes

Genotypes	Yield parameters											
	Days to 50 % flowering	No. of pods per plant	Tenderness of pod (tr value)	Ovule no. Pod^{-1}	Av. Wt. Of 10 pods (g)	Pod length (cm)	Pod width (mm)	Av. No. Seeds pod^{-1}	Pod yield $plant^{-1}$ (g)	Yield $hectare^{-1}$ (t)	Shelf life (days)	No. of Leaf miner maggots $leaf^{-1}$
EC-530833	43.67	80.29	40.33	7.40	37.80	11.17	11.14	7.03	255.33	17.02	5.00	5.96
IC- 320968	40.33	70.63	51.68	4.67	35.60	12.66	11.96	4.53	231.58	15.44	6.00	9.19
EC-500638	41.00	71.73	51.75	5.33	32.53	9.20	9.52	5.03	237.33	15.82	4.00	8.07
IC- 319827	45.00	77.43	39.83	6.87	35.53	11.07	10.14	6.37	249.33	16.62	5.00	9.22
EC-540796	45.33	63.70	51.42	6.67	35.40	10.63	9.90	6.53	228.67	15.24	4.00	11.15
IC- 319423	48.33	74.14	36.58	6.00	35.27	10.88	10.54	5.03	244.73	16.32	7.00	9.15
EC-530838	46.33	66.76	50.33	6.67	30.13	10.07	9.50	6.53	227.00	15.13	4.00	9.63
Mean	44.29	72.10	45.99	6.23	34.61	10.81	10.39	5.87	239.14	15.94	5.00	8.91
SEm±	1.02	2.45	1.52	0.23	1.11	0.34	0.31	0.24	4.94	0.33	0.32	0.42
CD (p <0.05)	3.15	7.56	4.68	0.70	3.43	1.04	0.94	0.75	15.21	1.01	0.99	1.28

Fig.1 Performance of seven pole type French bean genotypes with respect to yield ha^{-1}



1. EC-530833
2. IC- 320968
3. EC-500638
4. IC- 319827
5. EC-540796
6. IC- 319423
7. EC-530838

The population mean for number of branches plant^{-1} was 35.85 and number of branches plant^{-1} was maximum in EC-530833 (50.47) followed by EC-319827 (48.07) and EC-540796 (35.40) whereas, EC-500638 (26.60) showed least number of branches plant^{-1}. Stem thickness was significantly superior in EC-530833 (9.49); this is on par with EC-530838 (9.33) and IC-319827 (9.21) whereas, least stem thickness recorded in IC-320968 (7.49). The population mean for leaf area was 81.02 cm^2. The maximum leaf area plant^{-1} was in EC-530833 (98.22 cm^2) followed by IC-319428 (95.46 cm^2) and IC-319827 (93.78 cm^2) whereas, least was recorded in EC-540796 (60.70 cm^2). The leaf area index plant^{-1} was maximum in IC-530833 (5.46) followed by IC-319423 (5.30) and IC-319827 (5.21) whereas, lesser leaf area index observed in EC-540796 (3.37). There was a significant difference between genotypes for chlorophyll content and it was maximum in EC-530833 (35.89) followed by IC-319827 (33.42) and EC -530838 (32.71) whereas, minimum chlorophyll content was recorded in IC-319473(26.95). For number of pods plant^{-1} EC-530833(80.29) recorded maximum followed by IC-319827(77.43) and IC-319423(74.14) whereas, least number of pods plant^{-1} was found in EC-540796 (63.70). The population mean for number of pods plant^{-1} was 72.10. Significant difference was obtained even for ovule number pod^{-1} among the genotypes. Maximum number of ovules pod^{-1} was found in EC-530833 (7.40) followed by IC-319827 (6.87) whereas, least was recorded in IC-320968(4.67). The population mean for pod length was 10.81 cm. Pod length was maximum IC-320968 (12.66) followed by EC-530833 (11.17), IC-319827 (11.07) whereas, least pod length recorded in EC-500638 (9.2). Pod width was recorded maximum in EC-320968 (11.96) followed by EC-530833 (11.14) and IC-319423 (10.54) whereas, it was least observed in EC-530838 (9.50) and the population mean for weight of 10 pods was 34.61 g. Maximum weight was recorded by EC-530833 (37.80) followed by IC-320968 (35.60) and IC-319827 (35.53) whereas, it was least observed in EC-530838 (30.13). On an average number of seeds pod^{-1} were 5.87. Number of seeds pod^{-1} recorded maximum in EC-530833 (7.03) followed by EC-540796 (6.53) and EC-530838 (6.53). All these genotypes were statistically on par with each other, whereas least number of seeds pod^{-1} was recorded in IC-320968 (4.53). IC-319423 recorded minimum tr value (36.58) followed by IC-319827 (39.83) and EC-530833 (40.33). Whereas, EC-500638 (51.75) showed maximum tr value. Pod yield hectare^{-1} was recorded maximum in EC-530833 (17.02t) followed by IC-319827 and IC-319423 (16.62 t & 16.32 t respectively) whereas, it was least in EC-530838 (15.13 t). The population mean for total yield hectare^{-1} was 15.94 t ha^{-1}. The maximum shelf life was recorded in IC-319423 (7.00) followed by IC-320968 (6.00), EC-530833 and IC-319827 (5.00) whereas, minimum shelf life was observed in EC-500638, EC-540796 and EC-530838 (4.00). There were minimum leaf miner maggots leaf^{-1} in EC-530833(5.96) followed by EC-500638 (8.07) and IC-319423 (9.15) whereas, maximum was observed in EC-540796 (11.15) (Table 2; Fig. 1).

From the present investigation it can be concluded that the difference in yield may be attributed mainly to the difference in their pod length, number of pods plant^{-1}, pod weight, leaf area, number of seeds pod^{-1}, number of branches plant^{-1}. In the study, number of branches plant^{-1}, leaf area, number of pods plant^{-1}, pod length, pod width, weight of 10 pods, and number of seeds pod^{-1} showed significant difference among the genotypes. Among several genotypes EC-530833 registered the highest in all the above characters. This might be one of the reasons for higher yield which is recorded in EC-

530833. This is in conformity with the studies of Singh *et al.*, (2000), Nimbalkar *et al.*, (2002), Singh *et al.*, (2007a) and Atilla, (2007).

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