

Performance of French Bean Genotypes (*Phaseolus vulgaris* L.)

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Abstract

Twelve genotypes of french bean were assessed for performance. Highly significant differences were observed in the genotypes for all the characters. An overall perusal on the performance of genotypes revealed that Arka Anoop, Arka Suvidha, Arka Komal and Selection-9 were found to be most promising and higher yielding genotypes; Selection-9, Arka Suvidha and Arka Komal for earliness; Arka Anoop, Arka Suvidha and Saguni for more number of pods per plant; Arka Anoop, Pencil beans, Anjali, Master, EC-530843 and Black Beauty for more number of branches per plant; Arka Anoop, Arka Komal, Selection-9 for more pod weight and pod length; while Arka Anoop, Anupama, Pencil Beans, Arka Komal and Selection-9 for more number of seeds per pod. Pencil Beans and INDAM-II for more shelf life; Arka Anoop for less number of leaf miner maggots per leaf; and Anupama, Saguni, Anjali, Black Beauty, Pencil Beans, and INDAM-2 were resistant to anthracnose disease.

Key words : French bean, Performance, Genotypes, *Phaseolus vulgaris* L.

It is 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 per 100 g of edible pods). French bean originated from Central America and Peruvian Andes in South America (1). It 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 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 mt 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 mt and productivity of 2.8 t per ha (2). 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 (3). In the present investigation diverse genotypes of french bean were evaluated to identify higher yielding genotypes with important yield component traits.

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

Table 1. Performance of 12 french bean genotypes for quantitative and qualitative characters.

Genotypes	Days to 50% flowering	Plant height (cm)	No. of branches per plant	Stem thickness (mm)	Leaf area (cm ²)	Leaf area index	Chlorophyll content (spad value)
Arka Anoop	36.67	52.83	18.00	8.76	110.83	36.94	35.45
Arka Suvidha	33.33	44.27	16.60	7.75	103.63	34.54	30.97
Arka Komal	33.33	51.63	13.80	7.20	103.02	34.34	30.86
Anupama	47.33	34.40	12.67	8.63	99.01	33.00	28.68
Selection-9	32.33	51.93	13.67	7.16	101.48	33.83	31.71
Pencil Beans	44.00	44.03	17.80	8.37	91.01	30.34	33.44
Saguni	39.67	46.70	15.80	7.59	101.30	33.77	33.21
Anjali	38.67	40.03	17.67	8.69	94.11	31.37	27.19
Black Beauty	44.00	48.17	17.03	8.36	89.86	29.95	32.81
Master	39.00	47.60	16.53	6.84	103.40	34.47	32.97
INDAM-2	36.67	42.50	14.60	8.36	94.27	31.42	34.07
EC-530843	42.67	49.67	17.40	7.98	73.44	24.48	32.81
Mean	38.97	46.15	15.96	7.97	97.11	32.37	32.01
SE ±	0.84	1.49	0.79	0.28	3.68	1.23	0.96
CD (5%)	2.46	4.38	2.3	0.83	10.79	3.60	2.81

Table 1. Continued.

Genotypes	No. of pods per plant	Ovule no. per pod	Pod length (cm)	Pod width (mm)	Weight of 10 pods (g)	Av. no. seeds per pod	Tender-ness of pod (tr)	Pod yield per plant (g)	Yield per hectare (t)	Shelf life (days)	Leaf miner (maggots/leaf)	Anthra-nose (PDI)
Arka Anoop	27.00	8.20	17.53	10.75	67.47	6.90	36.17	98.00	14.46	6.00	6.70	12.00
Arka Suvidha	24.67	7.60	14.67	9.29	53.00	5.47	33.50	96.00	13.77	6.00	7.63	18.64
Arka Komal	16.67	7.47	16.79	10.23	67.00	6.53	32.08	93.00	13.26	4.00	9.63	24.00
Anupama	12.00	6.83	13.71	8.45	53.67	6.70	41.92	64.67	8.03	6.00	9.22	0.00
Selection-9	17.67	7.60	16.95	10.35	67.13	6.40	26.83	93.33	13.41	4.00	8.19	24.00
Pencil Beans	20.00	7.00	12.63	7.17	33.53	6.67	32.33	64.67	9.12	7.00	10.59	8.00
Saguni	24.33	7.40	12.61	6.33	29.53	5.87	33.08	64.67	9.23	6.00	11.11	0.00
Anjali	23.00	6.60	14.37	8.16	47.47	6.33	31.00	66.33	9.12	4.00	7.96	5.20
Black Beauty	22.33	7.80	9.45	10.34	31.80	6.17	58.25	69.33	8.96	6.00	10.67	6.40
Master	14.00	7.47	15.12	9.23	51.67	6.47	34.42	69.67	9.38	4.00	11.11	24.00
INDAM-2	15.00	6.87	12.49	8.55	42.33	5.60	33.08	64.00	8.78	7.00	8.22	8.00
EC-530843	21.67	6.47	10.52	10.81	32.67	5.87	48.67	65.67	9.46	4.00	10.11	13.20
Mean	19.86	7.25	13.90	9.14	48.11	6.25	36.78	75.78	10.58	5.33	9.26	—
SE ±	0.94	0.23	0.51	0.34	1.57	0.25	1.81	2.26	0.17	0.17	0.40	—
CD (5%)	2.76	0.67	1.48	1.00	4.59	0.75	5.31	6.64	0.50	0.49	1.19	—

study period were obtained from the meteorological observatory at MARS, Raichur. The investigation was carried out during *kharif* season of 2010. It consisted of 12 genotypes collected from different sources. The experiment was laid out by adopting randomized 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 13, 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

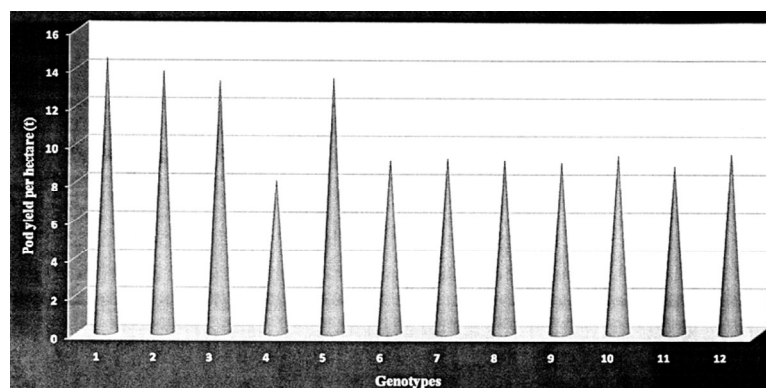


Figure 1. Performance of twelve french bean genotypes with respect to yield per ha. 1. Arka Anoop, 2. Arka Suvidha, 3. Arka Komal, 4. Anupama, 5. Selection-9, 6. Pencil Beans, 7. Saguni, 8. Anjali, 9. Black Beauty, 10. Master, 11. INDAM-II, 12. EC-530843.

protection practices were undertaken following 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 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, shelf life, anthracnose scoring and leaf minor maggots per leaf using standard procedures. The collected pool data were analyzed statistically.

Results and Discussion

The comparison of french bean variety indicated that they differed significantly in pod yield per plant. The variation for pod yield per plant was noticed by many workers (4–7). Arka Anoop ranked first for pod yield (98.00 g/plant). Arka Suvidha (96.00 g/plant), Selection-9 (93.33 g/plant) and Arka Komal (93.00 g/plant) were next in the order. On the other hand Anupama (64.00 g/plant) was the least. Thus, these four genotypes can safely replace the other genotypes whose yield is much lower (Table 1). Selection-9 recorded minimum number of days (32.33) for 50% flowering and closely followed by Arka Suvidha (33.33) and Arka Komal (33.33), whereas, Anupama recorded maximum number of days for 50%

flowering. On an average, genotypes took 38.97 days for 50% flowering. The population mean for number of branches per plant was 46.15 cm. Plant height was maximum in Arka Anoop (52.83 cm) followed by Selection-9 (51.93 cm), Arka Komal (51.63 cm) and EC-530843 (49.67 cm). All these were statistically at par with each other, whereas, Anupama (34.40 cm) recorded least plant height. The population mean for number of branches per plant was 15.96 and number of branches per plant was maximum in Arka Anoop (18.00) followed by Pencil Beans (17.80), whereas Anupama (12.67) showed least number of branches per plant. Stem thickness was maximum in Arka Anoop (8.76 mm) and closely followed by Anjali (8.69 mm), Anupama (8.63 mm), Pencil Beans (8.37 mm), Black Beauty (8.36 mm), INDAM-2 (8.36 mm) and EC-530843 (7.98 mm), whereas, Master (6.84 mm) recorded least stem thickness. The leaf area per plant showed significant difference between the genotypes. The population mean for leaf area was 97.11 cm². The leaf area per plant is maximum in Arka Anoop (110.83 cm²) followed by Arka Suvidha (103.63 cm²), Master (103.40 cm²), Arka Komal (103.02 cm²), Selection-9 (101.48 cm²), Saguni (101.30 cm²), whereas, least was recorded in EC-530843 (73.44 cm²). The leaf area index per plant showed significant difference between genotypes. Leaf area index was maximum in Arka Anoop (36.94) followed by Arka Suvidha (34.54), Master (34.47), Arka Komal (34.34), Selection-9 (33.83), Saguni (33.77). All these were statistically at par with each other. Least

Table 2. Grouping of genotypes for anthracnose reaction.

Genotypes	Per cent disease index	Grade	Reaction
1. Arka Anoop	12.00	2	Moderately resistance
2. Arka Suvidha	18.64	2	Moderately resistance
3. Arka Komal	24.00	2	Moderately resistance
4. Anupama	2.00	1	Resistance
5. Selection-9	24.00	2	Moderately resistance
6. Pencil Beans	8.00	1	Resistance
7. Saguni	4.00	1	Resistance
8. Anjali	5.20	1	Resistance
9. Black Beauty	6.40	1	Resistance
10. Master	24.00	2	Moderate resistance
11. INDAM-2	8.00	1	Resistance
12. EC-530843	13.20	2	Moderately resistance

LAI was recorded in EC-530843 (24.48). Chlorophyll content was maximum in Arka Anoop (35.45) followed by INDAM-2 (34.07), Pencil Beans (33.44), Saguni (33.21), Master (32.97), Black Beauty (32.81). All these were statistically at par with each other, whereas, least chlorophyll content was recorded in Anjali (27.19). There was significant difference between genotypes for number of pods per plant and recorded maximum in Arka Anoop (27.00) followed by Arka Suvidha (24.67), Saguni (24.33), whereas, Anupama (12.00) recorded least number of pods per plant. The population mean for number of pods per plant was 19.86. There was a significant difference between genotypes for Ovule number per pod. Maximum number of ovules per pod were found in Arka Anoop (8.20) followed by Black Beauty (7.80). Arka Suvidha (7.60) and Selection-9 (7.60) had same ovule number per pod, whereas, least was recorded in EC-530843 (6.47). The population mean for pod length was 13.90 cm. Pod length was maximum in Arka Anoop (17.53 cm) followed by Selection-9 (16.95 cm) and Arka Komal (16.79 cm), whereas, least pod length recorded in Saguni (6.33 cm).

Pod width showed significant difference between genotypes. Pod width was recorded maximum in EC-530843 (10.81 mm) followed by Arka Anoop (10.75 mm), Selection-9 (10.35 mm), Black Beauty (10.34 mm) and Arka Komal (10.23 mm), whereas least pod width recorded in Saguni (6.33 mm). The population mean for weight of 10 pods was 48.94 g. Maximum weight was recorded by Arka Anoop (67.47 g) fol-

lowed by Selection-9 (67.13 g) and Arka Komal (67.00 g), whereas, least weight recorded in Saguni (29.53 g). Number of seeds per pod showed significant difference between genotypes. On an average number of seeds per pod was 6.25. Number of seeds per pod recorded maximum in Arka Anoop (6.90) followed by Anupama (6.70), Pencil Beans (6.67), Arka Komal (6.53), Master (6.47), Selection-9 (6.40), Anjali (6.33) and Black Beauty (6.17). All these genotypes were statistically on par with each other, whereas, least number of seeds per pod was recorded in Arka Suvidha (5.47). Selection-9 recorded minimum tr value (26.83) followed by Anjali (31.00) and Arka Komal (32.08). Whereas, Black Beauty (58.25) showed maximum tr value. The significant difference among the genotypes with respect to yield per hectare was noticed. Pod yield per hectare was recorded maximum in Arka Anoop (14.46 t) followed by Arka Suvidha (13.77 t) and selection-9 (13.41 t), whereas, least pod yield per hectare was recorded in Anupama (8.03 t). The population mean for total yield per hectare was 10.58 t per ha. The maximum shelf life was observed in INDAM-2 and Pencil Beans (7.00 days) followed by Arka Anoop, Arka Suvidha, Anupama, Saguni, Black Beauty (6.00 days), whereas, least shelf life recorded in Arka Komal, Selection-9, Anjali, Master and EC-530843 (4.00 days). Anthracnose causes considerable damage in this region as it affects foliage, stems and pods. Anupama (2.00), Saguni (4.00), Anjali (5.2), Black Beauty (6.4), Pencil Beans (8.00), and INDAM-2 (8.00) are resistance, whereas, Master (8.00), Arka Anoop (12), EC-530843 (13.2), Arka Suvidha (18.64), Arka Komal (24) and Selection-9 (24) are moderately resistance (Table 2). There was minimum leaf miner maggots per leaf in Arka Anoop (6.70) followed by Arka Suvidha (7.63) and Anjali (7.96) whereas, maximum in Saguni and Master (11.11).

Thus it can be concluded that the difference in yield may be attributed mainly to the difference in their pod length, number of pods per plant, pod weight, leaf area, number of seeds per pod, number of branches per plant. In the present investigation, number of branches per plant, leaf area, number of pods per plant, pod length, pod width, weight of 10 pods, and number of seeds per pod showed significant difference among the genotypes. Among several genotypes Arka Anoop registered the highest in all the above characters. This might be one of the reasons

for higher yield which is recorded with Arka Anoop. This is in conformity with the studies of Singh et al. (5), Nimbalkar et al. (8), Singh et al. (6) and Atilla Dursum (7).

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