Assessment of French bean (*Phaseolus vulgaris* L.) Genotypes for Yield Traits

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ABSTRACT

The study was conducted at Amritsar and Tarn Taran districts of Punjab to find out the status of French bean cultivation. At district Amritsar, it is cultivated in various blocks namely Jandiala, Attari, Majitha and Verka while in district Tarn Taran, this crop is mainly cultivated in block Khadoor Sahib. The total area under this crop in both districts was around 460 ha. The main varieties grown in both districts include pencil type bean *i.e.* Falguni, Aishwarya and Anushka. Farmers were obtaining a profit of Rs 20,000/ to 32,000/ per ha by cultivation of this crop at both of districts. In other experiment various genotypes of French bean were evaluated for yield and its contributing traits at district Amritsar and Tarn Taran during 2020-2021. The genotypes Arka Anoop, Arka Sharat and Falguni showed highest yield and its contributing traits like germination days, days to 50 per cent flowering, days to first picking and number of pods per plant. These genotypes were suitable for cultivation.

Key Words: Days to first picking, French bean, Genotypes, Number of pods per plant. Planting season, Yield.

INTRODUCTION

French bean (*Phaseolus vulgaris* L.) is an important vegetable and pulse crop. It belongs to family Fabaceae (2n=2x=22) and is highly self pollinated crop. Out of 150 species under *Phaseolus* genus, only 4 species are under cultivation which includes *Phaseolus vulgaris* (French bean), *Phaseolus coccineus* (Runner or Scarlet bean), *Phaseolus lunatus* (Lima bean), *Phaseolus acutifolius* var. *latifolius* (Tapery bean). All the given species are self-pollinated except *Phaseolus coccineus*, which is cross-pollinated. It is one of important winter season vegetable crop. French bean is mainly grown for its tender pods and dry beans (Rajmah). It is also known as kidney bean, haricot bean, snap bean, navy bean, string bean, garden bean. The100 g of green pods of French beans contains 1.7 g protein, 4.5 g carbohydrates, 221 I.U. vitamins - A, 11 mg vitamin-C, 50 mg calcium etc. (Gopalkrishanan, 2007). French bean can be used as carminative, diuretic and emollient.

India ranks first in area and production of French bean among Asian countries and occupies an area of 137.54 (000, ha) with an annual production of 1370.21 (000, mt) with average productivity of 9.96 mt/ha. In India, it is mostly gown in West Bengal, Andhra Pradesh, Jharkhand, Jammu and Kashmir and Himachal Pradesh. Punjab occupies an area of 1.9 (000, ha) with annual production of 1.9 (000, mt) and average productivity is 1.6 mt/ha (Anonymous, 2021).

French bean is a quick growing and short duration crop with high production potential and high nutritive value. Although it is short duration crop but requires specific range of temperature for growth and development. The optimum temperature for better growth of plants is 16-24° C and its growth ceases if temperature falls below 10° C. The temperatures above 35° C cause dropping of buds and flowers resulting in poor yield. It is also highly susceptible to frost (Dhaliwal, 2012), so under Punjab conditions autumn and spring are

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main season for French bean cultivation. Spring season is best for French bean cultivation because of frost free season. Therefore the present study was conducted with the objective to study yield and its contributing traits in French bean varieties at Amritsar and Tarn Taran districts.

MATERIALS AND METHODS

The assessment of French bean (*Phaseolus vulgaris* L.) genotypes for yield traits at Amritsar and Tarn Taran districts was performed during 2020-2021. For this purpose, a survey was conductive regarding cultivation and adoption of French bean crop in both districts. A total of 100 farmers were selected from different villages of Block Khadoor Sahib where this crop was cultivated. From each village 10 farmers were chosen randomly from whom the relevant information was collected through personal interview method on a pre-structured schedule. In another experiment, testing of different genotypes of French beans was performed at University Seed Farm Usman Tarn Taran and Krishi Vigyan Kendra, Amritsar during the year 2020-2021.Ten genotypes of French bean (Table 1) obtained from different sources (Public sector and private sector) were collected and evaluated at for yield and its contributing traits. The experiment was conducted in randomized block design with three replications. The field was prepared well by deep ploughing and cross harrowing followed by leveling and then dividing the area into plots for each genotype. The size of plot was 2.7 m^2 (2 m length of plot having width of 1.35m). To save irrigation water and crop from adverse effect of heavy rainfall the seeds were sown on beds of 67.5cm width (top 37.5 cm and furrow 30cm). Two rows were sown on 37.5 cm top of bed with plant to plant spacing of 15cm.The days to 50 per cent germination were regularly recorded from ten randomly taken plants from emergence of plant that were 50 per cent germination was work out from date of sowing and expressed in days. The days to 50 per cent flowering were recorded from ten randomly tagged plants from sowing date to the

date when 50 per cent plants show at least one flower open and expressed in days. The number of days from sowing date to the date of first pod picking at marketable stage were recorded and averaged to determine the first harvest of each genotype. The total numbers of pods per plant in each treatment from ten randomly tagged plants were counted and average was worked out and expressed as number of pods per plant. The yield of French bean from all the pickings of ten tagged plants for each entry was weighed and averaged to get the yield per plant and recorded in grams. Data recorded for all the characters were subjected to analysis of variance by using randomized complete block design using software SAS (1996).

Table 1. French bean genotypes and their sources.

Sr. No.	Genotype	Name of Source
1.	Falguni	Seminis Seeds
2.	Arka Suvidha	Arka Seeds, IIHR, Bangalore
3.	Arka Sharath	Arka Seeds, IIHR, Bangalore
4.	Arka Anoop	Arka Seeds, IIHR, Bangalore
5.	Shakira	Pahuja Seeds, India
6.	Aishwarya	R.K Seeds, India
7.	Rani Beans	Bioseed, India
8.	Palam Mirinda	CSKHPKV, Palampur
9.	FBB Var-1	IIVR, Varanasi
10.	Contender (C)	IARI, Katrain

RESULTS AND DISCUSSION

The results (Table 2) obtained regarding survey of French bean crop in different villages and blocks in indicated that French bean is an important short duration crop cultivated for its tender pods in both of districts. At Amritsar district, it is cultivated in various blocks such as Jandiala, Attari, Majitha and Verka covering villages like Naushehra Dhala, Ibban Kalan, Kotli Nasir Khan, Fatehpur Rajputtan, and Nawan pind, Nizampur, Mallowal, Dadduana, Dashmesh Nagar, Ballian, Jahangir and Nag Kalan. The total area of this crop in these villages was around 400 ha.

Table 2. French bean cultivation in various blocks showing village, approximate area per cluster and marketing and processing infrastructure in Amritsar and Tarn Taran.

Sr. No.	District and Block	Villages in a cluster	Area per cluster (ha)	Marketing
1.	Attari	Naushehra Dhala, Ibban Kalan, Kotli Nasir Khan	100	Local market
2.	Jandiala	Fatehpur Rajputtan, Nawan pind, Nizampur, Mallowal, Dadduana, Dashmesh Nagar, Ballian	220	Local market
3.	Majitha and Verka	Jahangir, Nag Kalan, Fategarh Shukarchak, Khapar Kheri	80	Local market
4.	Khadoor Sahib	Chabhal, Ghasitpur, Takhtuchak, Dhota, Nagoke, Bahaderpur, Sra Talwandi, Malla, Voin Poin, Kalla, Khadoor, Sahib,Jawandpur, Miawind, Verowal, Darapur, Kidi Shahi, Dhota,	60	Local market
	Total Area		460	

In Tarn Taran district, this crop is mainly cultivated in block Khadoor Sahib covering villages like Ghasitpur, Takhtuchak, Dhota, Nagoke, Bahaderpur, Sra Talwandi, Malla, Voin Poin, Kalla, Khadoor Sahib,Jawandpur, Miawind, Verowal, Darapur, Kidi Shahi and Dhota covering the total area around 60ha . In both the districts, this crop covered total area of 460 ha. The pods were locally consumed as fresh pods.

The list of important farm operations and practices for French bean cultivation at Amritsar and Tarn Taran district is presented in Table 3.In both districts French bean was grown during autumn (September and October) and spring season (February and March). During autumn season less care of crop with respect to incidence of insect pests and diseases were required as compared to spring season. Farmers were using 3.2 t of well rotten farmyard manure followed by 7.2 kg urea and 8.8 kg diammonium phosphate per hectare at the time of sowing. Bush type genotypes of French bean like Pencil beans, Falguni, Aishwarya, Anushka etc. has been successfully cultivated in both districts. Farmers were using seed rate of 12-16 kg per ha and spacing of 45 cm between line to line and 12-15cm between plants. To control weeds Stomp 30 EC 0.4 l/ha as pre-emergence weedicides was applied within two days of sowing. The first irrigation

Table 3. List of important farm operations and practices for French bean cultivation at Amritsar and Tarn Taran district.

Sr. No	Farm Operation	Farmers' Practice
1.	Genotypes	Pencil Beans like Falguni, Aishwarya and Anushka
2.	Sowing Time	Autumn (September and October) and Spring season (February and March)
3.	Seed Rate	12-16 kg per ha
4.	Fertilizer Used	18 kg Urea and 55 kg Diammonium phosphate per ha
5.	Irrigation First irrigation after 15 days of sowing	
6.	Maturity Days	60-65 days
7.	Income	Rs 20,000 to 32,000 per ha

Table 4. Yield and related traits of French bean genotypes tested at district Tarn Taran.

Sr. No	Genotype	Germination days	Days to 50 per cent flowering	Days to first picking	Number of pods per plant	Green pod yield per plant (g)
1.	Falguni	13.50	50.00	58.00	21.50	113.00
2.	Arka Suvidha	11.50	48.50	58.00	26.50	96.00
3.	Arka Sharath	14.50	51.50	62.00	24.50	116.00
4.	Arka Anoop	12.50	44.00	53.50	25.50	121.00
5.	Shakira	14.50	50.00	58.50	20.00	84.50
6.	Aishwarya	15.50	47.50	56.50	23.00	73.50
7.	Rani Beans	14.00	48.50	62.00	26.50	96.00
8.	Palam Mirinda	13.00	51.50	62.50	32.00	111.50
9.	FBB Var-1	12.00	47.50	60.00	30.00	83.00
10.	Contender(C)	12.50	45.00	54.50	25.00	88.50
	Grand Mean	13.35	48.40	58.55	24.45	98.30
	Range	11.50-15.50	44.00-51.50	53.50-62.50	20.00-32.00	73.50-121.00
	CD (p=0.05)	1.40	1.72	2.13	0.84	1.01

was applied after 15 days of sowing followed by subsequent irrigation at flowering and then fruit set if necessary. Harvesting of pods was done at the proper edible maturity stage and do not allow the pods to over mature which lower quality of French beans. Harvesting was to be completed in a number of pickings depending upon the maturity. Farmers were obtaining good profit of Rs 20,000/- to 32,000/-ha by cultivation of this crop at both of districts. Deka *et al* (2021) studied impact of management practices on pea cultivation in Baksa district of Assam and suggested that Aman variety under improved practices recorded higher yield of 37.80 and 33.92 per cent during 2019-20 and 2020-21 and the recommended practice gave higher net returns of Rs 26,500/- and 28,300/- per ha.

Evaluation of French bean genotypes at district Tarn Taran (Table 4) indicated that the germination days of French bean ranges from 11.50 to 15.50 with average of 13.35 d. Genotype Falguni showed earliness in germination as compared to other varieties Days to fifty percent flowering in French bean genotypes ranges from 44.00 days to 51.50 d having average of 48.40 d. The genotype Arka

Anoop taken lesser days to fifty percent flowering while Palam Miradula taken more days. The days to first fruit picking ranged between 53.50 to 62.50 having average of 58.55 d. The genotype Arka Anoop was early in picking. The number of pods per plant ranged between 20.00 to 32.00 having average of 24.45. The total green pod yield per plant ranged between 73.50 to 121.00 g with average of 98.30. The highest total yield of green pods per plant was obtained in genotype Arka Anoop 121.00 g/ plant followed by genotype Arka Sharat 116.00 g/plant and Falguni 113.00 g/plant. Singh *et al* (2013) evaluated sixty five genotypes and sufficient variation found among genotypes. Ten genotypes showed better pod yield potential. A similar result was obtained by Noor *et al* (2014) and Meena *et al* (2017). Magalingam *et al* (2013) also carried out investigation on Field bean (*Dolichos lablab L.)* to study the variability present in twenty three genotypes of Dolichos bean.

Evaluation of French bean genotypes at district Amritsar (Table 5) indicated that the germination days of French bean ranges from 10.90 to 16.10 with average of 14.35 d. Genotype Arka Suvidha

Table 5. Yield and related traits of French bean genotypes tested at district Amritsar.

S. No	Genotype	Germination days	Days to 50 per cent flowering	Days to 1st picking	Number of pods per plant	Green pod yield per plant (g)
1.	Falguni	14.50	52.00	59.10	22.50	114.10
2.	Arka Suvidha	10.90	49.10	58.00	27.50	96.90
3.	Arka Sharath	14.90	52.20	63.00	31.10	117.20
4.	Arka Anoop	13.30	45.00	53.90	33.10	122.00
5.	Shakira	14.70	51.10	59.50	21.00	84.90
6.	Aishwarya	16.10	48.50	57.50	23.10	74.10
7.	Rani Beans	14.40	49.20	62.80	26.90	97.10
8.	Palam Mirinda	13.90	52.50	64.50	25.90	112.10
9.	FBB Var-1	12.70	47.90	61.00	25.50	84.10
10.	Contender(C)	12.30	46.00	56.50	26.10	89.40
	Grand Mean	14.35	47.90	59.15	25.45	99.30
	Range	10.90-16.10	45.00-52.50	53.90-64.50	21.00-33.10	74.10-122.00
	CD (p=0.05)	1.60	1.75	2.13	0.87	1.10

showed earliness in germination as compared to other varieties Days to fifty percent flowering in French bean genotypes ranges from 45.00 d to 51.00 d having average of 47.90 d. The genotype Arka Suvidha taken lesser days to fifty percent flowering while Palam Miradula takes more days. The days to first fruit picking ranged between 53.90 to 64.50 having average of 59.15d. The genotype Arka Anoop was early in picking. The number of pods per plant ranged between 21.00 to 33.10 having average of 25.45. The highest numbers of pods were obtained in genotype Arka Anoop and Arka Sharath. The total green pod yield per plant ranged between 74.10 to 122.00 g/plant having average of 99.30. The highest total yield of green pods per plant was obtained in genotype Arka Anoop 122.00 g/plant followed by genotype Arka Sharath 117.20 g/plant and Falguni 114.10 g/plant. These varieties were successfully cultivated for their tender pods. Kamaluddin and Ahmed, (2011) evaluated ten red type germplasm lines of French bean namely, Uri-Red, Red Dwarf, Local Red, Jir-Ala, EC- 285549, EC-285550, EC-285551, EC-285553, EC- 285555 and EC-285558 were evaluated in randomized block design and concluded that the number of pods per plant in

EC-285558 (15 pods) followed by EC-285549 (13 pods). Singh *et al* (2021) studied variation in yield and contributing traits in pigeon pea and found that variety LRG41 gave better yield and pods. Mamta *et al* (2011) showed that the variety Varun recorded significantly higher grain yield over remaining three varieties. However varieties contender, (Arka komal and Waghya) were at par with each other. Variety Waghya recorded significantly lowest seed yield. Similar results was obtained by Shwetha *et al* (2012) in French bean, Reddy *et al* (2014) in cluster bean, Srinivasan *et al* (2015) and Kamble *et al* (2016) in French bean, Singh and Kumar (2016) in cluster bean and Mohanty *et al* (2017) in French bean.

CONCLUSION

The results of present studies indicated that French bean is important short duration vegetable crop in district Amritsar and Tarn Taran and farmers were getting good income during spring and autumn season from its cultivation. The highest total yield of green pods per plant was obtained in genotype Arka Anoop followed by genotype Arka Sharath and Falguni. The pencil type beans were found best

for cultivation in both of districts for their tender pods.

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Received on 19/02/2022   Accepted on 15/07/2022