



On-farm assessment of french bean (*Phaseolus vulgaris* L.) cultivars for seed production in Nilgiri hills of Tamil Nadu

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ABSTRACT

On farm trial was conducted at Farmers field for evaluation of high yielding varieties and to guide farmers about seed production in Nilgiri hills. Two cultivars of french bean namely Arka Anoop and Mohanpur local were compared with Nilgiri Local and Arka Komal cultivars. The cultivars were tested on 10 farmers field federated in to 5 villages. Results revealed that growth and yield attributes were significantly higher with Arka Anoop followed by Mohanpur Local. However, the lowest values were associated with Nilgiri Local. Highest seed yield of 1.84 t/ha was recorded with Arka Anoop followed by Mohanpur Local (1.47 t/ha). Highest net return of Rs.1,98,100/ha with 3.61 B:C ratio was recorded with Arka Anoop. The production as well as economic efficiencies was also higher with Arka Anoop cultivar. It can be concluded that Arka Anoop and Mohanpur Local are suitable for cultivation as well as seed production for making available seed at on farm level and for higher productivity and profitability under Nilgiri Hill ecosystem of Tamil Nadu.

1. Introduction

French bean (*Phaseolus vulgaris* L.) is an important vegetable as well as pulse crop in the world covering about half of the world pulse acreage. It is short duration and nutritious crop known by different names; viz. kidney bean, haricot bean, snaps bean, navy bean, pole bean, bush bean etc. French bean originated from Central America and Peruvian Andes in South America and spread in Europe during 15th century. It was introduced to India during 17th century from Europe. In India it is grown in Himachal Pradesh, Uttarakhand, J&K, Punjab, Haryana, Uttar Pradesh, Bihar, Gujarat, Madhya Pradesh, Maharashtra, Karnataka, Andhra Pradesh and Tamil Nadu. It is considered as food and nutritional security crop of hill farmers (Noopur *et al.*, 2019_a) as the tender green pods are used as vegetables while dry seeds are consumed as rajmash (Noopur *et al.*, 2019_b).

This vegetable not only plays a vital role in nourishment of human population, but also being nitrogen fixing crop improves soil health and can be successfully grown under vertical cropping (Panwar *et al.*, 2019) and protected cultivation (Singh *et al.*, 2017). Despite the fact french bean has economical potential, the average productivity is due to complex constraints such as lack of improved varieties, poor agronomic practices, biotic and abiotic stress. Therefore, improved varieties will help the farmers to increase french bean production in the hilly region.

Seed is the basic critical input for enhancing productivity of french bean. Scarcity of quality seed is one the major constraints faced by Nilgiri farmers and hence most of the farmers are maintaining their own seed of local varieties but for high yielding varieties, they rely on market which is not timely available and costly input, necessitating the need to produce seed at farmers level in his field. However, few farmers are cultivating old variety i.e. Arka Komal. Though

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the numbers of varieties are available but little is known about their performance in the agro-climatic conditions of Nilgiri hills. Hence the study was undertaken on farmer's field to evaluate bush type french bean varieties for seed yield with the participation of farmers and to guide and develop confidence amongst the farmers about high yielding cultivars.

2. Material and Methods:

A field study was undertaken in five villages situated nearer to Ooty town in Nilgiri Hills of Tamil Nadu. Two farmers in each village were selected and interviewed to understand the problems and constraints being faced by them in french bean production. Most of the farmers were growing Nilgiri local and Arka Komal varieties of French bean. The farmers were provided with the seeds of high yielding cultivars i.e. Mohanpur Local, Arka Komal and Arka Anoop and were asked to grow and compare it with Nilgiri local variety during kharif 2017 and pre-kharif 2018. The experimental site was located at 11°24' N Latitude, 76°59' E Longitude with altitude of 1500 m MSL. The rainfall during experimental period was erratic as maximum rainfall of 343.3 mm and 305.4 mm was recorded in the month of September and August and lowest rainfall of 00 and 1.9 mm in January during 2017 and 2018, respectively. Maximum temperature of 23.4°C and 24.6°C in April and minimum of 6.4°C and 6.6°C in January during 2017 and 2018, respectively.

Crop was sown during 5 June and 21 March during 2017 and 2018, respectively. Each cultivar was sown at 45 x 10 cm spacing in 20 square meter plots of each farmer (2 farmers in a village) and all the recommended package of practices were followed for healthy crop stand. Growth, and yield attributes were recorded from the ten randomly selected plants from each plots, while seed yield recorded from 20 m² from each plot was converted in to t/ha. Production efficiency was calculated by dividing yield with duration of crop. Economics in terms of cost of cultivation and gross return were calculated as per prevailing market rate in Ooty. Net return was calculated by subtracting cost of cultivation from gross return and B:C ratio was estimated by dividing gross return with cost of cultivation. Economic efficiency was calculated by net return and divided by crop duration. Mean data of two farmers in each village was considered as one replication and villages were taken as replication for analysis. Mean data of all the observations was calculated and statistically analysed using F-test (Gomez and Gomez (1984). The test of significance of treatment was done on the basis of

the t-test. The differences between treatments means, which were higher than the respective critical differences (CD) values were considered as significant at the 5% level of probability (P=0.05).

3. Results and Discussion:

Growth attributing characters:

The mean data of various growth and flowering characters of French bean varieties are presented in Table 1. Tallest plants were found in case of the Mohanpur Local genotype (41.13 cm) and lowest was recorded with Nilgiri Local (35.77 cm). The number of branches per plant was recorded highest with Arka Anoop (3.48) and lowest with Mohanpur Local (2.65). This finding was in conformity with those of, Mehra and Singh (2012). Leaf number per plant registered maximum with Arka Anoop (20.29) and minimum with Nilgiri Local (15.82). The differences in the plant growth characters may be due to the genetic variability within the genotype itself or environmental effects.

In case of days taken to 50 % flowering from sowing, Nilgiri Local and Mohanpur Local followed by Arka Anoop took minimum days and can be considered as early flowering cultivars, while Arka Komal (58.25 days) took longer days in attaining 50 % flowering and can be considered as late flowering genotype. Similar findings with respect to days taken to 50% flowering in French bean have been reported by Das *et al.*, (2014). Zeliang *et al.*, (2019) reported that Arka Anoop performed better than Arka Komal under agro-climatic conditions of Nagaland.

Yield attributing characters:

The data pertaining to yield attributing characters are presented in Table 2. The result reveals that Arka Anoop recorded maximum pods (19.60) and it was significantly higher than other cultivars. Pod length differed significantly among genotypes which was highest for Arka Anoop (17.04 cm) and lowest for Nilgiri Local (14.80 cm). These results are in accordance with the findings of Muthuramu *et al.* (2015) who reported highest number of pod and pod length in Arka Anoop. Highest pod girth was measured with Arka Komal (11.65 mm) which was on par with Mohanpur Local and Arka Anoop. Nilgiri Local had lowest pod girth (9.93 mm). It can be concluded that varieties like Arka Anoop, Arka Komal and Mohanpur Local, produced relatively larger pod than Nilgiri Local.

Table 1. Performance of different French bean genotypes for growth and flowering characters

Genotypes	Plant height (cm)	No. of branches /plant	No. of leaves /plant	Days to 50 % flowering
Nilgiri Local	35.77	2.90	25.82	56.83
Mohanpur Local	41.13	2.65	29.73	54.83
Arka Komal	36.04	3.41	27.76	61.25
Arka Anoop	36.32	3.48	30.29	55.51
CD (P=0.05)	2.16	0.57	1.78	0.26

Table 2. Performance of different French bean genotypes for yield attributes and yield.

Genotypes	No of Pods /plant	Pod length (cm)	Pod girth (mm)	No of seed/pod	100 Seed weight (g)	Seed yield (g/plant)
Nilgiri Local	11.81	14.80	9.93	3.24	39.79	23.70
Mohanpur Local	10.90	15.06	11.19	4.86	42.28	26.44
Arka Komal	11.54	16.62	11.65	4.46	38.78	24.60
Arka Anoop	19.60	17.04	11.57	5.14	45.92	32.87
CD (P=0.05)	1.39	1.68	0.21	0.32	2.36	3.14

The highest number of seeds/pod were recorded with Arka Anoop (5.14) followed by Mohanpur Local (4.86), Arka Komal (4.46). Nilgiri Local had significantly lowest seeds/pod (3.24). The results corroborate the findings of Shukla *et al.* (2006). Hundred seed weight was recorded to be highest for Arka Anoop (45.92 g) followed by Mohanpur Local (42.28 g), while lowest was registered by Arka Komal (38.78 g). Improvement in yield attributes reflected on seed yield as highest seed yield/plant and per hectare was obtained from Arka Anoop (32.87 g/plant and 1.84 t/ha respectively) followed by Mohanpur Local (26.44 g/plant and 1.47 t/ha) and lowest was observed in Nilgiri Local. This might be due to yield attributes associated with the respective cultivars, which contributed for significant difference in yield. These findings are corroborated with the results of Shukla *et al.* (2006) who stated that number of pods per plant had positive contribution to seed yield.

Yield, production efficiency and economics

As regard yield, significantly highest seed yield was recorded with Arka Anoop (184 t/ha) followed by Mohanpur local (1.47 t/ha). The lowest seed yield of 1.32 t/ha was recorded with Nilgiri Local (Table 3). The increase in yield might be due to improvement in growth and yield attributes with respective cultivars. Likewise, maximum production efficiency of 21.26 kg/ha/day was recorded with Arka Anoop which was 50.1, 33.5 and 31.6 % higher over Nilgiri Local, Arka Komal and Mohanpur Local, respectively, which might have been associated with yield of respective cultivar (Kumar *et al.*, 2014).

As indicated in Table 3, gross return, net return and B:C ratio markedly influenced by cultivars. Highest gross and net return of Rs.273900, and 198100 /ha with B:C ratio (3.61) was estimated with Arka Anoop, while lowest was observed with Nilgiri Local. The improvement in yield and net return improved economic efficiency as highest economic efficiency

Table 3. Yield, production efficiency and economics of french bean

Genotypes	Seed yield (t/ha)	Production efficiency (kg/ha/day)	Gross Return	Net Return	B:C Ratio	Economic efficiency (Rs/ha/day)
Nilgiri Local	1.32	14.38	197550	127050	2.80	1381
Mohanpur Local	1.47	16.32	220350	148250	3.06	1647
Arka Komal	1.36	16.48	205050	129250	2.71	1521
Arka Anoop	1.84	21.26	273900	198100	3.61	2331
CD (P=0.05)	0.28	-	-	-	-	-

of 2331 Rs/ha/day was worked out with Arka Anoop which was 68.8, 53.3 and 41.5 % higher over Nilgiri Local, Arka Komal and Mohanpur Local, respectively. The improvement in economic efficiency might be due to higher yield and net return associated with respective cultivars (Kumar *et al.*, 2014).

The findings of present study revealed that cultivating Arka Anoop and Mohanpur Local in Nilgiri hills were more suitable in respect of growth and seed yield than farmer's choice of Arka Komal and Nilgiri Local under agro-climatic conditions of Ooty. Hence, Arka Anoop and Mohanpuri Local can be adopted for seed production and making farmers self-sustain under high hill altitude of Nilgiri Hills.

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