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Varietal Evaluation of French bean for Higher Productivity and Nutritional Security under the Foot Hill Ecosystem of Nagaland

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ABSTRACT

On farm trial was conducted at farmers' field by Krishi Vigyan Kendra, Longleng, Nagaland for evaluation of high yielding French bean varieties for optimization of crop productivity and nutritional security of poor tribal community. Results revealed that yield attributes *i.e.* pod weight; pod length and pods/plant were markedly influenced by frenchbean cultivars among themselves. The highest pod weight (11.3g), pod length (11.3 cm) and pods/plant (24.1) were recorded with Arka Anoop, which were significantly higher as compared to Arka Komal and Arka Suvidha. However, the lowest values of these attributes were associated with local cultivar. Similarly, significantly higher green pod yield was recorded with Arka Anoop (6.5 t/ha) followed by Arka Komal (6.1 t/ha) and Arka Suvidha (5.8 t/ha). Hence, it may be concluded that Arka Anoop may be adopted for commercial cultivation for achieving higher productivity and profitability under foot hill ecosystem of Nagaland.

1. Introduction

French bean (*Phaseolus vulgaris*) commonly known as kidney bean, common bean or rajmash is highly nutritious crop and used as green vegetable as well as grain pulses. It fetches the highest price among the pulses and thus economically a remunerative crop. It is cultivated for vegetable purpose during the month of February-March and crop planted in the month of August is used for seed production. It have a yield potential of 15-19 t/ha of green pods and 3.0 t/ha of seeds in plains, and comparatively lower in hilly terrains. In Longleng district, agriculture is the main source of livelihood for the people and *Jhum* cultivation is the most common form of agriculture (District Contingency Plan, KVK Longleng, Nagaland, 2015). In Nagaland, French bean production is not able to meet the requirement. Though the climate and other natural resources are favourable, farmers are not able to take up vegetable production on a large scale for income generation due to lack of knowledge and high yielding varieties (Zeliang *et al.,*2014). Therefore, Krishi Vigyan Kendra, Longleng, conducted On Farm testing for HYVs of French bean for achieving higher productivity as well as nutritional security of poor tribal communities in Nagaland.

2. Materials and Methods

Field experiment was conducted at farmer's field by KVK Longleng during the pre-*kharif* season of 2015-16 and 2016-17 to compare the production potential of four varieties *viz.* Arka Komal, Arka Anoop and Arka Suvidha for trial along with local check with five replications, farmers as replication. The experimental site was located at 26°26'0"N Latitude, 94°52'0"E Longitude with altitude of 1366 m MSL. It falls under the monsoon type of climate with a minimum temperature of 6.9° C in winter and a maximum of 31.3°C in summer.

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During the experimental period, the distribution of rainfall over time and intensity in the rainy season was very erratic. The lowest rainfall of 5.2 mm was recorded in the month of May (2015) and 5.4 mm in month of June (2016) and the highest rainfall (11.7 mm) in the month of June, 2015 and 11.0 mm in the month of July 2016 with an average rainfall 7.73mm (2015) and 8.00 mm (2016). The lowest minimum temperature was recorded 13.4 °C (2015) and 15.3 °C (2016) and highest temperature was recorded 31.3°C and 29.9°C in the year 2015 and 2016 respectively. The maximum temperature was found 31.3°C (2015) in month of May and the lowest 13.4 (2015) in the month of April of the cropping cycle. The mean rainfall and temperature data of two year was presented in Figure1.Crops were planted across the slope with a spacing of 45 cm row to row and 15 cm plant to plant. Experiment was laid out in complete randomized block design. Recommended dose of NPK *i.e.*80:60:40 kg/ha was applied for cultivation of French bean. Half dose of N, full doses of P and K were applied as basal in the form of urea, di-ammonium phosphate (DAP) and muriate of potash (MOP), respectively. Remaining half doses of N was applied as top dressing 30 days after sowing (DAS). Five French beanplants were selected randomly in each plot to record the observation on growth and yield attributes *i.e.* plant height, pod/plant, and pod weight and pod length. The green pod yield was recorded on plot basis and converted into kg/ha. Production efficiency was calculated by yield of pod and divided by the duration of crop (Kumawat *et al.,* 2012). Economics was calculated as per rate of prevailing local market price of Longleng. Economic efficiency was calculated by Net income and divided by duration of crop

(Kumar *et al.,* 2016). Nutrient contents, *viz.* N, P and K of French bean was determined by following standard procedures. The uptake of these nutrients was estimated from concentration of nutrients and dry yield of green pod of frenchbean and their straw during both the years of study. The experiment was laid out in Complete Randomized Block Design. Mean data of all the observation was calculated and statistically analysed using F-test (Gomez and Gomez (1984). The test of significance of treatment was done on 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

Effect of weather

The weather conditions prevailing during the crop season was found to be more or less conducive. The result of the present investigation in general indicated that temperature was normal but amount of rainfall varied appreciably from normal during the crop growth period. It is a well known fact that each crop species has a definite range of temperature for different growth stages. Beyond the upper and lower threshold of temperature, metabolic activity proceeding germination is reduced. Protinase activity during germination for supplying energy to germinating and developing plant is controlled by appropriate temperature. In the present study, the meteorological data showed remarkable variation in weather condition in two years of study. Rainfall received in the year 2016 was quite high as compared to 2015. Further, temperature particularly at reproductive phase of crop was more conducive in second year. Therefore, resulted in slightly better performance of crops in the year 2016 than 2015.

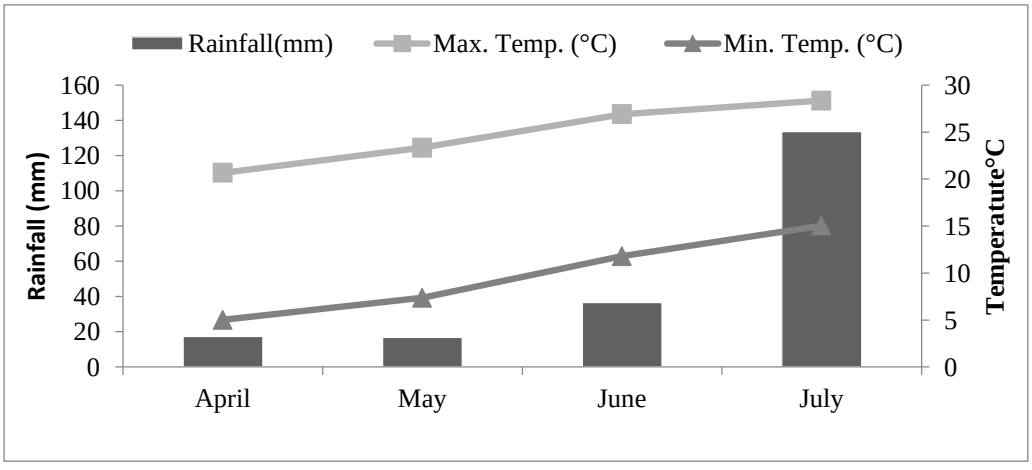

Figure 1. Rainfall and Temperature of cropping season (mean 2 years)

Table 1. Growth, yield attributes and economics as influenced by frenchbean cultivars (Pooled data of two years)

Varieties	Plant height (cm)	Days to 50% flowering	Pod weight (g)	Pod length (cm)	Pod/ plant (no.)	Green pod yield (t/ha)	Production efficiency (kg/ha/day)	Gross income (Rs./ha))	Net income (Rs./ha)	Benefit : cost ratio	Economic efficiency (Rs./ha/day)
Komal	41.6	41.7	10.1	16.2	22.7	6.1	99	244000	183000	4.0	2962
Anoop	46.6	40.7	11.3	16.9	24.1	6.4	102	253800	192800	4.2	3109
Suvidha	42.8	41.5	9.4	15.0	18.6	5.8	93	231400	170400	3.8	2748
Local	33.4	46.2	7.1	11.2	10.97	4.6	70	182800	121800	3.0	1873
SEm ±	1.4	1.5	0.4	0.5	1.3	0.2	-	-	-	-	-
CD (P=0.05)	4.2	4.3	1.1	1.4	3.6	0.6	-	-	-	-	-

Growth and yield attributes

Pooled data revealed that growth attributes like plant height was markedly influenced by French bean cultivars among themselves (Table 1). Significantly taller plant was recorded with Arka Anoop (46.6 cm) as compared to Arka Komal (41.6 cm) and Arka Suvidhda (42.8 cm). However, the lowest values of these attributes were associated with local cultivar (33.4 cm). This variation might be due to genetic differences among varieties since they were grown under same environmental conditions (Kumar *et al.,*2016 a, b, c). All yield attributing characters like pod weight, pod length and pods/plant were also markedly influenced with frenchbean cv. among themselves (Table 1). The highest pod weight (11.3), pod length (11.3 cm) and pods/plant (24.1) were with Arka Anoop, which were significantly higher compared to Arka Komal and Arka Suvidha. However, the lowest values of these attributes were associated with the local cultivar. Difference in growth characters may be due to genetic variability within genotype itself or due to the environmental effects. Genotypes greatly vary in their performance under different agro climatic conditions of country, which often creates confusion among farmers about their choice of variety. In IIHR, Hessaraghatta, Arka Anoop and Arka Komal were recorded to take 32 days for flowering and 45 days for pods to mature by Aghora *et al.* (2007), while it took 47-50 days for flowering and 51-55 days for pod maturity in Arka Suvidha, Arka Anoop and Arka Komal by Das *et al.* (2014. In Longleng district of Nagaland it took 40-42 days for flowering and 62-65 days for pods to mature. This may signify that availability of nutrients may also be playing a factor as our experiment was conducted under *jhum* farming. Difference in days to maturity could also be attributed to photoperiod, since different bean varieties respond differently to specific photoperiod (Santhi *et al.,*2015). In our experiment, it was found that size of the pod was also found to be reduced in Arka Komal, Arka Anoop and Arka Suvidha in second and subsequent pickings but remained unchanged in local cultivar. The pictures of the French bean was shown in the Figure 3 to Figure 9.

Pod yield

In the case of yield, significantly higher green pod yield was recorded with Arka Anoop (6.5 t/ha), which was found at par with Arka Komal (6.1 t/ha). However, significantly the lowest green pod yield was recorded by local (Table 1). The French bean cultivars Arka Komal, Anoop and Suvidha were recorded to increase the green pod yields to the tunes of 32.6, 39.1 and 26.1% over the local cultivars. This might be due to yield attributes associated with the respective cultivars, which ultimately increased or decreased green pod yield. Similarly, the maximum production efficiency was recorded with Arka anoop (102.3 kg/ha/day) closely followed by Arka komal (98.5 kg/ha/day). However, lowest value of these attributes was associated with local. This might be due to higher yield associated with respective cultivars responsible for the higher production efficiency of the respective treatment (Kumar *et al.,*2016).

Nutrient uptake

Maximum total N, P & K uptake were recorded as 91.49, 3.46 & 63.81 kg/ha, respectively, with Arka Anoop compared to other variety. This might be due to Arka anoop recorded maximum total dry matter of plant than other variety (Figure 2)

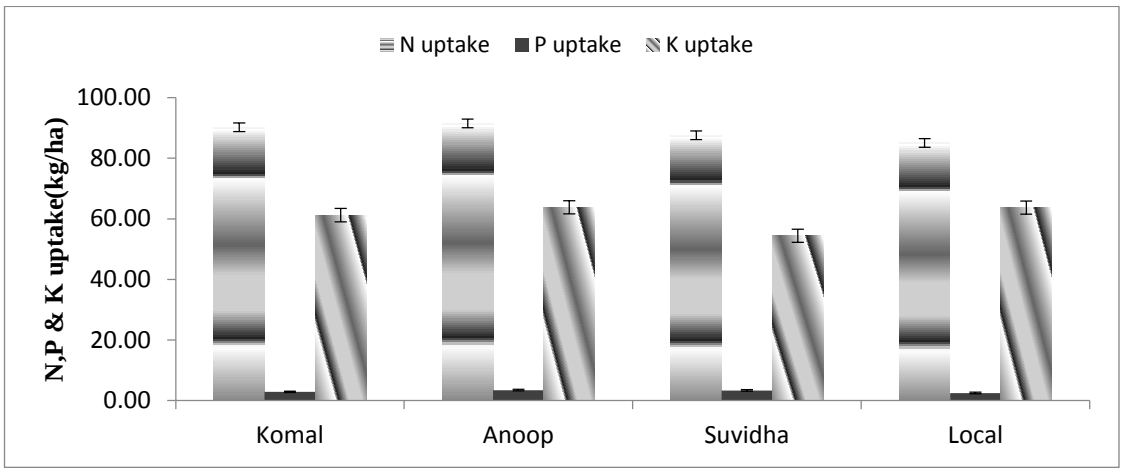

Figure 2. Nutrient uptake (N, P & K uptake) as influenced by French bean cultivars (Pooled data of two years)

Figure 3. Line sowing demonstration

Figure 4. Germinated seedlings after 3 weeks

Figure 5. Flowering after 6 weeks

Figure 6. Harvesting and weighing

Figure 7. Comparison of 4 varieties

Figure 8. Harvested produce

Economics

Economic attributes like gross income, net income, benefit: cost ratio were markedly influenced with French bean cultivars among themselves. Markedly higher gross income (Rs. 2, 53,800/ha), net profits (Rs. 1,92,800/ha) and benefit: cost ratio (4.3) was recorded with Arka Anoop compared to Arka Komal and Arka Suvidha. However, these attributes were recorded lowest with the local cultivar. Frenchbean cv. Arka Komal, Anoop and Suvidha were recorded to increase the net profits to the tunes of 50.2, 58.3 and 39.9% over the local cultivar. This might be due to higher yield associated with the respective cultivars. Similarly, economic efficiency was also recorded to be highest in Arka Anoop (Rs.3109/ha/day) followed by Arka Komal (Rs.2962/ha/day). This might be due to the higher yield and net profit associated with the respective cultivars (Kumar *et al.,*2014).

Conclusion

From the above On Farm Trial study, it can be concluded that Frenchbean Cv. Arka Anoop gave the best performance in respect of productivity and profitability under prevailing Agro-climatic condition of Longleng, among the varieties tested. Therefore Frenchbean var. Arka Anoop can be adopted for large scale cultivation for livelihood improvement of farmers in Longleng district or with similar agro- climatic conditions in Nagaland. The local cultivar has good potential for breeding purpose to improve its productivity.

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