Original Research Article

Performance of French Bean Genotypes at Late Season Sowing in Sylhet, Bangladesh

ABSTRACT

Performance of four French bean genotypes were evaluated at late sowing condition in Randomized Complete Block design with three replications at the experimental field of Sylhet Agricultural University, Bangladesh toassesstheyieldperformanceofFrenchbeangenotypesunderlate-season sowing conditions in Sylhet, Bangladesh. Seeds of four French bean genotypes including BARI Jharsheem-1, Jharsheem-2, Jharsheem-3 and Local were sown in the main field at 25 November and 25 December 2022. The highest number of pods per plant was found in the genotype BARI Jharsheem-1 (32.14), which was statistically at par with the genotype BARI Jharsheem-2 (30.46). The lowest number of pods per plant was found in the genotype BARI Jharsheem-3 (20.10) which was closer to local genotypes (21.68). The highest pod yield per plant was found in BARI Jharsheem-1 (194.45 g) and the lowest in BARI Jharsheem-2 (125.62 g) which was statistically similar with the remaining two genotypes. The highest yield per decimal was produced by the genotype BARI Jharsheem-1 (95.04 Kg) but the lowest yield per decimal was produced by BARI Jharsheem-2 (61.41 Kg). Significant variation was found of sowing date on yield and yield attributes of French bean except some parameters. Maximum yield per decimal was produced from 25 December sowing (73.57 Kg) than 25 November sowing (68.09 Kg). However, interaction effect showed appreciable amount of green pods from BARI Jharsheem-1 at 25 November (87.17 kg/decimal) and 25 December sowing (102.91 kg/decimal) indicating bright scope during late winter season. The results conclude that among the genotypes, BARI Jharsheem- 1 had the highest pod yield and yield per decimal. Sowing on December 25 produced higher yields (73.57 kg/decimal) than November 25 (68.09 kg/decimal). These findings suggest the potential to improve French bean yield and market availability during late winter through optimized genotype selection and sowing dates.

Key words: French bean; Jharsheem; pod; sowing dates

1. INTRODUCTION

French bean (*Phaseolus vulgaris* L. 2n=2x=22) is a vegetable and pulse crop belonging to Fabaceae family [4] and native to central and South America [14]. This is widely cultivated in the temperate and subtropical regions and in many parts of the tropics [8]. French bean is also known by different names viz snap bean, kidney bean, haricot bean, navy bean, garden bean or string bean, pole bean, bush bean etc. In Bengali it is commonly known as Forashi sheem or Jhar sheem [11]. It is an important dual purpose legume crop grown as pulse and also consumed as immature tender fruits. According to the USDA, one basic cup of canned French beans (approximately 150 grams) includes 0.55 g of fat, 5.66 g of carbohydrates, 2.6 g of fibre, 1.94 g of sugar, 1.42 g of protein, 17 mg of calcium, 1.2 mg of iron, 18 mg magnesium, 30 mg of phosphorus, and 130 mg potassium. In Bangladesh it is mostly cultivated in the areas of Jessore, Rangpur, Comilla, Chittagong and Sylhet region. In 2017, Bangladesh produced 137495 tons of French beans from an area of 20880 hectares [1]. French bean is a very quick growing vegetable crop and can be harvested green pods for consumption within 60-65 days after sowing[2,21] hence duration of market availability is very short. It displays excellent variability in seed attributes, size, shape and shading, development habit and versatile qualities [16]. Its optimum sowing date is the first fortnight of October in Bangladesh [9]. Improving pod availability beyond winter, evaluation of genotypes at late sowing might be a good alternative. To enhance the production Bangladesh Agricultural Research Institute (BARI) released three genotypes of French beans, namely, BARI Jharsheem-1, BARI Jharsheem -2 and BARI Jharsheem-3 in the years 1996, 2002 and 2010 respectively. But their performance were not evaluated in Sylhet region. Actually, Sylhet is one of the special Agro Ecological Zone of Bangladesh due to its acidic soil with pH ranges from 4.5 to 6.5. Generally, plants grown in acidic soil differs in growth habit than normal soil [12]. Again, in this area farmers are cultivating some local cultivars of different in colour, shape, size and also vary in taste. Some of these are high yielder, disease and drought resistant. Moreover, optimum yield and quality of a crop mainly depends on the most appropriate sowing dates [3]. The optimal sowing date of french bean under Bangladesh condition ranges from the last week of October to the first week of November [2]. Farmers often sow the seeds of French bean early or late without knowing the optimum sowing time. During the winter a short cool season (November–February) prevails in Bangladesh, which starts with the fall of temperature, humidity and ends with sudden rise in temperature. Hence, planting time for bean is very critical in Bangladesh and sowing of seed should be done carefully so that the crop can take the best advantage of the entire cool period. For this reason, this experiment was designed to evaluate the performance of French bean genotypes at varied sowing dates in the Sylhet region to maximize their yield and high economic return.

2. MATERIALS AND METHODS

2.1 Description of the Study Area

The experiment was carried out to evaluate the effect of genotypes and sowing dates on French beans during November 2021 to January 2022. The site is located in the north eastern part of Bangladesh, with 24.8993□' north latitude and 91.8700□ East longitudes. Basically, this falls under the Eastern Surma-Kusiyara Flood Plain (Agro-ecological Zone-20) [19]. Soil of this region is clay loam type with acidic in nature and pH is around 4.83. Frequent heavy rainfall and high temperature during Kharif season with profound sunshine and cloudy weather are the common scenario of this region.

2.2 Experimental Material and Design

The experiment was laid out in a Randomized Complete Block Design (RCBD) considering two factors (Factor A. Four French bean genotypes viz. BARI Jharsheem-1, BARI Jharsheem-2, BARI Jharsheem-3, local and factor B. two sowing dates viz. 25 November and 25 December). Unit plot size was 1.5 m x 1.2 m and 24 plants were accumulated in each plot. The seeds of French bean were sown at a depth of 2 cm in lines with a spacing of 0.30 m and 0.25 m for row to row and plant to plant, respectively. 4-5 seeds were sown in the pits to obtain a higher germination rate. After sowing, a thin layer of soil was applied to the seeds. The seeds sprouted within 5-7 days of sowing. Irrigation, weeding, and mulching were done as and when needed to give the best conditions to the development of the seedlings. Cattle dung, Urea, P_2O_5 and K_2O were applied @ 10 ton/ha, 120 kg/ha, 60 kg/ha and 50 kg/ha respectively [10]. Locally available wooden sticks and twigs of forest trees were used for staking purposes in each treatment. Data on growth and yield parameters such as Plant height at 45 DAS, number of leaves per plant 45 DAS, chlorophyll at 45 DAS, days to flowering, days to harvest, number of pods per plant, individual pod weight (g), pod yield per plant (g), pod length (cm), pod width (cm), Dry matter (%), yield kg per decimal were collected. The data were subjected to analysis of variance (ANOVA) using the MSTAT-C software and the means were separated according to Duncan's Multiple Range Test (DMRT).

3. RESULTS AND DISCUSSION

3.1 Effect of genotypes on yield and yield attributes of French bean

Effect of genotypes on yield and yield attributes of French bean was presented in Table 1. Most of the parameters were significantly affected due to genotypes except number of leaves per plant 45 DAS and chlorophyll at 45 DAS. The tallest plants (48.68 cm) at 45 DAS were produced by the genotype Jharsheem-3 which was followed by BARI Jharsheem-1 (38.46 cm), BARI Jharsheem-2 (37.28 cm) and the smallest plants were produced by local genotypes (43.30 cm). Early flowering and early harvesting was reported on BARI Jharsheem-3 (37.50 and 58.66 days respectively). Contrary, statistically similar days were required to 1st flowering for reaming three genotypes viz. BARI Jharsheem-1 (42 days), BARI Jharsheem-2 (43 days) and local (44 days). Maximum days to harvest were required for local genotype (64.50 days). The highest number of pods per plant was found in the genotype BARI Jharsheem-1 (32.14), which was par with the genotype BARI Jharsheem-2 (30.46). The lowest number of pods per plant was found in the genotype BARI Jharsheem-3 (20.10) which was closer to local genotypes (21.68). Maximum individual pod weight was identified in the genotype Bjs3 (6.46 g) that was statistically similar with BARI Jharsheem-1 (6.04g) and local (5.96g). The highest pod yield per plant was found in BARI Jharsheem-1 (194.45 g) and the lowest in BARI Jharsheem-2 (125.62 g) which was statistically similar with the remaining two genotypes. The longest pod was produced by BARI Jharsheem-3 (14.60 cm) on the other hand the shortest pod was produced by BARI Jharsheem-2 (11.80 cm). The widest pod was found in BARI Jharsheem-1 (2.38 cm). The highest dry matter was produced by local (7.08%), which was statistically similar with BARI Jharsheem-3 (7.00%). Contrary, the lowest dry matter was produced by BARI Jharsheem-1 (5.48 %). The highest yield per decimal was produced by the genotype BARI Jharsheem-1 (95.04 Kg) but the lowest yield per decimal was produced by BARI Jharsheem-2 (61.41 Kg). Significant variation among the genotypes may be due to their different genetic makeup. Similar variation also found in some previous studies [5, 13, 7, 6].

Table 1. Effect of genotypes on yield and yield attributes of French bean

Genotypes	Plant height at 45 DAS	Number of leaves per plant 45 DAS	Chlorophyll at 45 DAS (SPAD value)	Days to flowering	Days to harvest	Number of pods per plant	Individual pod weight (g)	Pod yield per plant (g)	Pod length (cm)	Pod width (cm)	Dry matter (%)	Yield kg/ decimal
V1	38.46c	9.03	44.98	42.00a	61.00b	32.14a	6.04a	194.45a	13.11b	2.38	5.48b	95.042a
V2	37.28c	9.13	41.75	43.66a	61.50b	30.46a	4.12b	125.62b	11.80c	0.82	5.78b	61.412b
V3	48.68a	10.3	43.13	37.50b	58.66b	20.10b	6.46a	130.24b	14.60a	1.43	7.00a	63.668b
V4	43.30b	8.95	44.19	44.00a	64.50a	21.68b	5.96a	129.35b	14.33ab	1.31	7.08a	63.233b
F-Test	**	NS	NS	**	**	**	**	**	**	*	**	**
CV	3.89	9.06	5.09	4.05	2.67	14.05	5.25	13.51	5.69	12.3	3.45	13.51

NS indicates non-significant**,** * indicates significant at 5% level of probability**,** ** indicates significant at 1% level of probability; V1: BARI Jharsheem-1, V2: BARI Jharsheem-2, V3: BARI Jharsheem-3, V4: Local

3.2 Effect of sowing date on yield and yield attributes of French bean

Significant variation was found of sowing date on yield and yield attributes of French bean except some parameters (Table 2). The maximum plant height (44.13 days) and Chlorophyll (46.28) at 45 DAS were found from 25 December sowing. Early flowering (41.66 days) and harvesting (58.08 days) were noticed from 25 November sowing than the 25 December sowing. Though the longest pods (14.20 cm) were found from 25 November sowing, the widest pods were found from 25 December (1.85 cm). Higher dry matter was observed in case of 25 November sowing (6.82%) than 25 December sowing (5.85%). Maximum yield per decimal was produced from 25 December sowing (73.57 Kg) than 25 November sowing (68.09 Kg). [17, 15] observed significant variation in all yield contributing characters due to different sowing dates from second fortnight of October to first fortnight of December and varieties of French bean. They found that November is the most suitable sowing time to get maximum seed yield which was in conformity with Jena [20].

Table 2. Effect of sowing date on yield and yield attributes of French bean

Sowing date	Plant height at 45 DAS	Number of leaves per plant 45 DAS	Chlorophyll at 45 DAS	Days to flowering	Days to harvest	Number of pods per plant	Individual pod weight (g)	Pod yield per plant (g)	Pod length (cm)	Pod width (cm)	Dry matter (%)	Yield kg/ decimal
25 November	39.73	9.26	40.75	41.66	58.08	25.76	5.56	139.30	14.20	1.12	6.82	68.09
25 December	44.13	9.46	46.28	41.91	64.75	26.43	5.73	150.53	12.71	1.85	5.85	73.57
F-test	**	NS	**	NS	**	NS	NS	NS	**	NS	**	NS
CV	3.89	9.06	5.09	4.05	2.67	14.05	5.25	13.51	5.69	12.3	3.45	13.51

NS indicates non-significant**,** * indicates significant at 5% level of probability**,** ** indicates significant at 1% level of probability

3.3 Interaction effect

Significant variation was found for interaction between genotypes and sowing dates on yield and yield attributes of French bean except number of leaves per plant 45 DAS, chlorophyll at 45 DAS and pod width (cm) (Table 3). Maximum plant height at 45 DAS was recorded from BARI Jharsheem-3 (51.76 cm) when sowing on 25 December. On the other hand minimum was recorded from BARI Jharsheem-2 (34.00 cm) on 25 November sowing. Early flowering was reported in the genotype BARI Jharsheem-3 (34.66 days) when sowing on 25 November and late flowering was found in the genotype Local under 25 November (49.66 days) sowing. Early harvesting was found in BARI Jharsheem-3 (53.33 days) from 25 November planting. Contrary, late harvesting were found in the genotypes BARI Jharsheem-2 (65.00 days) and BARI Jharsheem-3 (65.00 days) under 25 December sowing and which was statistically similar with the genotypes BARI Jharsheem-1 (64.33 days), Local (64.66 days) on 25 December and local (64.33 days) on 25 November sowing. Maximum number of pods per plant was produced by BARI Jharsheem-1 (34.53) when sowed on 25 December which was followed by BARI Jharsheem-2 (34.10) sowed on 25 November, and minimum number of pods per plant was produced by the genotype BARI Jharsheem-3 (18.23) sowed on 25 November. In case of individual pod weight the highest value was observed in the genotype BARI Jharsheem-3 (6.56g) sowed on 25 November and the lowest value was observed in the genotype BARI Jharsheem-2 (4.03g) sowed on 25 December. Again the highest pod yield per plant was produced by the genotype BARI Jharsheem-1 (210.60 g) sowed on 25 December which was closer to the genotype BARI Jharsheem-1 (178.31 g) sowed on 25 November. On the other hand the lowest pod yield per plant was produced by the genotype BARI Jharsheem-2 (107.50 g) sowed on 25 December which was statistically similar with the rest of the treatment combination. The longest pods were identified in the genotype BARI Jharsheem-1 (15.10 cm) sowed on 25 November and the shortest pods were identified in the genotype BARI Jharsheem-2 (11.03 cm) on 25 December. Maximum dry matter was produced by the

genotype Local (7.24%) when sowed on 25 November. on the other hand the minimum dry matter was produced by the genotype BARI Jharsheem-1 (4.77 %) when sowed on 25 December. The highest yield per decimal was produced by the genotype BARI Jharsheem-1 (102.91 Kg) upon 25 December sowing but the lowest yield per decimal was produced by BARI Jharsheem-2 (52.55 Kg) upon 25 December sowing. These results are in agreement with the findings of Yoldas and Esiyok, 2007 [18].

Table 3. Interaction effect between genotypes and sowing dates onyield and yield attributes of French bean

Genotypes ×Sowing dates	Plant height at 45 DAS (cm)	No. of leaves per plant 45 DAS	Chlorophyll at 45 DAS	Days to flowering	Days to harvest	Number of pods per plant	Individual pod weight (g)	Pod yield per plant (g)	Pod length (cm)	Pod width (cm)	Dry matter (%)	Yield kg/ decimal
V1T1	36.60d	8.633	43.06	39.33cd	57.66b	29.75ab	5.98bc	178.31ab	15.10a	0.92	6.20c	87.17ab
V1T2	40.33c	9.443	46.91	44.66b	64.33a	34.53a	6.10ab	210.60a	11.13c	3.83	4.77d	102.91a
V2T1	34.00d	9.467	39.88	43.00bc	58.00b	34.10a	4.22d	143.74c	12.56bc	0.80	6.65bc	70.27c
V2T2	40.56c	8.800	43.63	44.33b	65.00a	26.82bc	4.03d	107.50c	11.03c	0.85	4.92d	52.55c
V3T1	45.60b	10.400	39.88	34.66e	52.33c	18.23d	6.56a	119.84c	14.76a	1.46	7.19ab	58.58c
V3T2	51.76a	10.300	46.38	40.33bcd	65.00a	21.98cd	6.36ab	140.63c	14.43ab	1.41	6.82ab	68.75c
V4T1	42.73bc	8.567	40.19	49.66a	64.33a	20.97cd	5.50c	115.30c	14.40ab	1.30	7.24a	56.36c
V4T2	43.86b	9.333	48.20	38.33de	64.66a	22.40cd	6.43ab	143.40bc	14.26ab	1.32	6.91ab	70.10bc
F-Test	*	NS	NS	**	**	*	*	*	**	NS	**	*
CV	3.89	9.06	5.09	4.05	2.67	14.05	5.25	13.51	5.69	12.3	3.45	13.51

NS indicates non-significant**,** * indicates significant at 5% level of probability**,** ** indicates significant at 1% level of probability; V1: BARI Jharsheem-1, V2: BARI Jharsheem-2, V3: BARI Jharsheem-3, V4: Local; T1: 25 November, T2: 25 December

4. CONCLUSION

Based on the above results and discussion, it may be concluded that BARI Jharsheem-1 sowing on 25 December exhibited appreciable higher pod yield than sowing on 25 November, indicating a bright scope to improve the market availability of French beans during the late winter season in the Sylhet region of Bangladesh.

Disclaimer (Artificial intelligence)

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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