

Original Research Article

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Growth, Phenology and Yield of Fenugreek (*Trigonella foenum-graecum* L.) as Influenced by Date of Sowing

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ABSTRACT

An experiment was carried out at Horticultural Research Station, Mondouri, BCKV, West Bengal, India during 2013-14 and 2014-15 with an objective of evaluating the effects of different sowing dates on growth, phenology and yield of fenugreek cultivar AFg-3 under new alluvial plains of West Bengal. Six sowing dates viz. 15 days interval starting from 15th October to 30th December were considered. The experiment was laid out in RBD with four replications. Significant difference on growth, phenology and yield of fenugreek was observed for different sowing dates. Sowing date of 30th October recorded maximum plant height (61.96 cm), number of branches (7.50), pods per plant (39.21), seed weight per pod (0.417 g), test weight (12.38 g), seed yield per plot (552.58 g), seed yield per hectare (1.45 tonnes), shelling percentage (68.16 %) and harvest index (31.14 %). Maximum pod length (12.41 cm) and seeds per pod (16.38) was associated with 15th November. Minimum days taken for 50% flowering (49.25 days) and maturity (111.00 days) was observed in 30th November sowing, while 50% seed germination (9.38 days) was recorded with 30th October sowing. Therefore, planting fenugreek on 30th October was recommended for getting good net return due to better growth and yield.

Keywords

Fenugreek, Growth, Phenology, Sowing, yield.

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Introduction

Fenugreek (*Trigonella foenum-graecum* L., family -Leguminosae) an annual herb is well known as flavour, curry powder and spice (Betty, 2008). It is originated in South Eastern Europe and West Asia. Today it is widely cultivated in India, Egypt, Argentina, China and America. Both seeds and green leaves are used as vegetables, food additives and fodder in South and Central Asian countries (Petropoulos, 2002). Fenugreek is grown for the purpose of green manuring in America.

Fenugreek seeds are frequently used in human medicine to manage hypercholesterolemia, cancer and diabetes mellitus as they possess hypoglycemic, antilipidemic, anticarcinogenic and cholagogic properties (Meghwal and Goswami, 2012). Fenugreek is a short duration crop and is suitable for various cropping system. Soon after harvesting of main *kharif* crops like chillies, cotton and paddy, fenugreek is grown as *rabi* crop. Among all the factors planting date has found to have direct influence on growth and yield

attributing factors of fenugreek. However, variation in the monsoon has delayed the sowing time which hampers the growth, yield as well as quality of the crop (Seghat and Ahmadi, 2010; Abou Shleel, 2014). This paper focuses on the influence of different sowing dates on the growth and development of fenugreek under new alluvial plains of West Bengal.

Materials and Methods

Research was carried out at Horticultural Research Station, Mondouri, BCKV, West Bengal, India during 2013-14 and 2014-15 in the month of October to April for each year. The research location site is 23.5° North latitude and 80° E longitude and at an altitude of 9.75 m above mean sea level. The research location experience a sub-tropical sub-humid type of climate and soil is Gangetic alluvial (entisol) with sandy clay loam texture having pH 6.9, good water holding capacity and medium fertility status. Fenugreek variety AFG-3 collected from NRCSS, Ajmer, India was used for this research.

The experiment was laid out in Randomized Block Design with four replications. The size of the main plot was made 3.24m² (1.8 x 1.8 m). Sowing of the seeds were carried out in six different dates viz., D₁ (15th October), D₂ (30th October), D₃ (15th November), D₄ (30th November), D₅ (15th December) and D₆ (30th December). Farm yard manure @ 20 t/ha and NPK @ 30:40:30 kg/ha were applied during land preparation. Sowing rate was 25 kg/ha and sowing depth was 2-3cm. The seeds were sown in continuous rows with a distance of 30 cm between rows. Irrigation immediately after planting was done in order to facilitate seed germination.

After 21 days of seeds germination, thinning of the plants was carried out to keep the distance between plants at 20cm and to retain one plant per hill, maintaining 54 plants per

plot. Immediately after thinning, first weeding and hoeing were carried out to control the weed growth. Subsequent weeding was carried out as per requirement. Irrigation was given by flooding at an interval of 15-20 days depending upon the moisture requirement of the soil and weather conditions.

Collection of data

Growth, phenological, yield and yield attributing parameters were studied during the experimental course. Growth parameters such as plant height, number of branches per plant were recorded during the end of vegetative phase. The seeds were harvested during the full maturation stage and thereafter yield and yield attributing parameters such as pods per plant, pod length, seeds per pod, seed weight per pod, test weight, seed yield per plot, seed yield per hectare, shelling percentage and harvest index were recorded. Three phenological parameters viz., days to 50% germination, days to 50% flowering and maturity duration was also recorded for each plot. Data were collected from the inner rows of each plot to avoid the border effect. In each unit plot, 10 plants were selected randomly for recording data on different morphological and yield contributing characters for seed. Shelling percentage and harvest index for individual plots was calculated using the given formula mentioned as follows:

$$\text{Shelling \%} = \frac{\text{Weight of seeds}}{\text{Weight of pods}} \times 100$$

$$\text{Harvest Index (\%)} = \frac{\text{Economic yield}}{\text{Biological Yield}} \times 100$$

Statistical analysis

The data collected were subjected to analysis of variance (ANOVA) by using the MSTATC statistical package (MSTAT-C, Version 1.41,

Crop and Sciences Department, Michigan State University, USA). The mean comparison was done following the Duncan's Multiple Range Test (DMRT).

Results and Discussion

The pooled analysis (Tables 1 and 2) of the two years data indicated that the sowing dates under evaluation varied significantly in all the characters under study. The results pertaining to different parameters are mentioned below.

Days to 50% germination

Different sowing dates differed significantly for days to 50% germination (Table 1), which ranged from 9.38 to 14.13 days. The sowing date of 30th December recorded maximum number of days (14.13 days) to reach 50% germination. The second maximum days required for 50% germination was obtained from 15th December sowing date (12.63 days) which was having no significant difference with 30th November sowing date (12.25 days).

The minimum days required for 50% germination was achieved by fenugreek plants sown during 30th October (9.38 days) which was at par with 15th October sowing date (9.63 days). Late sowing exposed plants to low temperature at the time of emergence, which caused slow germination of the seeds. This result is in close conformity to that of Sultana *et al.*, (2016) who observed that the days taken for germination of fenugreek seed was least on 2nd November.

Days to 50% flowering

The days required for 50% flowering (from the date of sowing) in different sowing dates differed significantly, which ranged from 49.25 to 61.50 days (Table 1). The sowing date of 30th November took minimum number of days (49.25 days) to reach 50% flowering stage followed by 30th December (52.00 days)

and 15th December (54.63 days). The maximum days taken to reach the 50% flowering stage was observed with 15th October sowing (61.50 days). The results regarding days to 50% flowering are more or less in consonance with the results of Sultana *et al.*, (2016) who stated that the minimum number of days required for 50% flowering was observed with 28th November sowing date.

Maturity duration

The sowing dates varied significantly in this trait (Table 1). Different planting dates took 111.00 to 133.00 days for maturity. The sowing date of 30th November (111.00 days) took minimum number of days to reach maturity stage followed by 30th December (115.75 days) and 15th December (124.50 days). Maximum time taken for reaching maturity duration was observed with fenugreek plants sown during 15th October (133.00 days). Under late sowing, prevalence of low temperature at early stage and high temperature at terminal phase of the crop might have caused forced maturity. Sultana *et al.*, (2016) reported that fenugreek plants sown during 28th November took least time for attaining crop maturity. Therefore the present findings support the result of Sultana *et al.*, (2016).

Plant height

The plant height for different treatments differed significantly and ranged from 32.96 to 61.96 cm (Table 1). Fenugreek plants sown during 30th October recorded maximum plant height (61.96 cm) followed by 15th November (55.13 cm) and 15th October planting (51.33 cm). The lowest plant height was observed with the plants sown during 30th December (32.96 cm). The increase in plant height of the crop seems to be on account of exposure of plants to many favourable climatic conditions. A decreasing trend on plant height was

observed from 30th October onwards. Nandre *et al.*, (2011) obtained highest fenugreek plant height on 1st November sowing date. They also observed decrease in plant height with an increment in sowing date at 15 days interval starting from 1st November to 1st December. The report of Nandre *et al.*, (2011) is line with the present findings. The results are also in conformity with Sultana *et al.*, (2016), as they obtained maximum plant height on 2nd November sowing date.

Number of branches

Significant variation was observed among different sowing dates with respect to number of branches per plant ranging from 4.95 to 7.50 (Table 1). Sowing date of 30th October produced the maximum number of branches (7.50) followed by 15th November (6.53) and least was noticed with 30th December sowing (4.95). Number of branches recorded for plants sown during 15th October (6.28) was comparable with 30th November (6.18) sowing date. This might be due to availability of favourable climatic conditions during early sowing that produced better vegetative growth. Similar results were observed by Korla and Saini (2003), Nandre *et al.*, (2011) and Sultana *et al.*, (2016).

Pods per plant

Marked variation was observed among the sowing dates in respect to number of pods per plant ranging from 23.83 to 39.21 (Table 2). The highest number of pods per plant was observed with 30th October sowing date, which was followed by 15th November (35.42) and 15th October (32.92). The lowest number of pods per plant was observed with 30th December sowing date.

This might be owing to favourable environmental conditions available to the crop during its initial growth and flowering stages. The present findings are in close agreement with the findings of Yadav *et al.*, (2000), Gill *et al.*, (2001), Korla and Saini (2003) and Bhutia and Sharangi (2016) in fenugreek.

Pod length

The pod length of different sowing dates differed significantly and ranged from 8.03 to 12.41 cm (Table 2). The sowing date of 15th November (12.41 cm) gave the maximum pod length followed by 30th October (11.36 cm) and 15th October (10.35 cm). While, significantly minimum (8.03 cm) pod length were produced under the treatment 30th December sowing date.

Table.1 Growth and phenological characters as influenced by different sowing dates (Pooled data of 2 years)

Sowing date	Days to 50% germination	Days to 50% flowering	Maturity duration (days)	Plant height (cm)	Number of branches per plant
D ₁	9.63d	61.50a	133.00a	51.33c	6.28c
D ₂	9.38d	59.25b	129.75b	61.96a	7.50a
D ₃	10.50c	57.00c	126.88c	55.13b	6.53b
D ₄	12.25b	49.25f	111.00f	46.13d	6.18c
D ₅	12.63b	54.63d	124.50d	38.83e	5.65d
D ₆	14.13a	52.00e	115.75e	32.96f	4.95e
SEm (±)	0.266	0.288	0.281	0.534	0.078
CD (P =0.05)	0.802	0.877	0.855	1.623	0.238

(D₁ – 15th October, D₂ – 30th October, D₃ – 15th November, D₄ – 30th November, D₅ – 15th December, D₆ – 30th December)

Table.2 Yield and its component as influenced by different sowing dates (Pooled data of 2 years)

Sowing date	Pods per plant	Pod length (cm)	Seeds per pod	Seed weight per pod (g)	Test weight (g)	Seed yield per plot (g)	Seed yield per hectare (tonnes)	Shelling percentage	Harvest Index (%)
D ₁	32.92c	10.35c	15.79b	0.366c	11.29c	474.79c	1.25c	65.71b	28.86b
D ₂	39.21a	11.36b	16.12a	0.417a	12.38a	552.58a	1.45a	68.16a	31.14a
D ₃	35.42b	12.41a	16.38a	0.386b	11.71b	505.07b	1.33b	63.55c	26.36c
D ₄	29.17d	9.41d	15.46c	0.318d	10.64d	456.57d	1.20d	62.22d	24.76d
D ₅	26.12e	8.55e	15.29c	0.287e	10.33e	422.64e	1.11e	60.44e	22.02e
D ₆	23.83f	8.03f	14.67d	0.219f	9.87f	355.83f	0.93f	59.68e	21.15e
SEm (±)	0.387	0.090	0.108	0.001	0.041	0.643	0.002	0.433	0.410
CD (P =0.05)	1.177	0.275	0.329	0.003	0.124	1.879	0.007	1.307	1.235

(D₁– 15th October, D₂– 30th October, D₃– 15th November, D₄– 30th November, D₅– 15th December, D₆– 30th December)

Seeds per pod

The seeds per pod for different sowing dates differed significantly and ranged from 14.67 to 16.38 (Table 2). The sowing date of 15th November (16.38) produced highest number of seeds per pod which was at par with 30th October (16.12). The lowest seed per pod was found in plants sown during 30th December (14.67). Nandre *et al.*, (2011) found that fenugreek plants sown during 1st November produced significantly the maximum seeds per pod. Bhutia and Sharangi (2016) obtained highest seeds per pod with 23rd November sowing. Sultana *et al.*, (2016) also observed that highest seeds per pod were produced when fenugreek seeds were sown in 23rd November. The findings of the present investigation are close to Nandre *et al.*, (2011).

Seed weight per pod

The sowing dates varied significantly in this trait ranging from 0.219 to 0.417 g (Table 2). The maximum seed weight per pod was obtained from 30th October (0.417 g), followed by 15th November (0.386 g) and 15th October (0.366 g). While, the sowing date of 30th December produced significantly minimum (0.219 g) weight of seeds per pod. The present findings are similar with the results recorded by the earlier workers like Lal *et al.*, (2003), Nandre *et al.*, (2011) and Sultana *et al.*, (2016) in fenugreek.

Test weight

Test weight for different sowing dates was significantly found to be different. The test weight ranged from 9.87 to 12.38 g (Table 2). The highest test weight was recorded with 30th October (12.38 g) sowing date followed by 15th November (11.71 g) and 15th October (11.29 g). Sowing of the fenugreek seeds on 30th December (9.87 g) recorded the least test

weight. Higher test weight in 30th October sown plants is due to the fact that crop got sufficient time for its growth under favourable condition. This result is in close conformity to that of Bhutia and Sharangi (2016) and Sultana *et al.*, (2016), who recorded the highest test weight with 2nd November sowing date.

Seed yield per plot

Different date of sowing exhibited a significant variation in respect of seed yield per plot (Table 2). The plot yield ranged from 355.83 to 552.58 g. The sowing date of 30th October gave maximum seed yield per plot (552.58 g). The second maximum seed yield per plot was obtained from 15th November (505.07 g) followed by 15th October (474.79 g). The lowest seed yield per plot was recorded in 30th December sowing date (355.83 g). The cumulative effect of higher values of yield attributes during 30th October sowing date led to production of higher yield. It is an established fact that sinks capacity largely governs crop productivity (Evans, 1975).

Seed yield per hectare

Different sowing dates under investigation showed a wide range of variability on seed yield per hectare (Table 2). It ranged from 0.93 to 1.45 tonnes. The maximum seed yield was obtained from 30th October sowing (1.45 t/ha) followed by 15th November (1.33 t/ha) and 15th October (1.25 t/ha). The lowest seed yield was found with 30th December planting (0.93 t/ha). The possible reason for low yield in delayed sowing might be due to insufficient time for vegetative growth as the plant entered the reproductive phase at a faster rate. According to Nandre *et al.*, (2011), the highest seed yield of fenugreek per hectare was obtained during 1st November sowing. Lal *et al.*, (2003) also found the similar results

in fenugreek. Bhutia and Sharangi (2016) and Sultana *et al.*, (2016) obtained highest seed yield with the 2nd November sown crops. Thus the results of the present study are in accordance with all the records of earlier work done by Lal *et al.*, (2003), Nandre *et al.*, (2011), Bhutia and Sharangi (2016) and Sultana *et al.*, (2016).

Shelling percentage

The maximum shelling percentage was obtained from 30th October (68.16 per cent) followed by 15th October (65.71 per cent) and 15th November (63.55 per cent). The lowest shelling percentage was recorded with 30th December (59.68 per cent), which was at par with 15th December (60.44 per cent). According to Anitha *et al.*, (2016), the highest shelling percentage was recorded on 15th October sowing date, which was at par with the 1st November sown plants.

Harvest index

Different sowing dates showed significant variation in respect of harvest index (Table 2). The harvest index ranged from 21.15 to 31.14 per cent. Sowing date of 30th October gave maximum harvest index (31.14 per cent) followed by 15th October (28.86 per cent) and 15th November (26.36 per cent). Fenugreek plants sown during 30th December gave minimum harvest index (21.15 per cent) which was at par with plants sown during 15th December (22.02 per cent).

This might be due to better vegetative growth in terms of more number of branches per plant and more number of pods per plant due to better photosynthetic efficiency and translocation of photosynthates from source to sink. Moghaddam *et al.*, (2014) reported that sowing of cumin on 5th November resulted in maximum harvest index than that sown on 5th December and 5th March.

The study indicated that the sowing dates had significant influence on the growth, phenology and yield of fenugreek. It was evident from the results obtained that sowing of fenugreek early at 30th October is recommended for getting good growth and higher yield. Reduction in yield has also been observed with the delay in sowing date in respect to different parameters. However, the experiment should be carried out for another 2 to 3 years to confirm the results under the new alluvial zones of West Bengal.

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