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Growth and yield of fenugreek (*Trigonella foenum-graecum* L.) as influenced by planting method and irrigation

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Abstract

A field experiment entitled “Effect of different planting methods & irrigation levels on the growth and yield of fenugreek (*Trigonella foenum-graecum* L.)” was conducted during *rabi* season of 2017-18 at experimental field, Guru Kashi University, Talwandi Sabo (Punjab). The experiment was laid out in split plot design with four planting methods (Ridge planting, bed planting (67 cm), bed planting (90 cm) and flat planting) in main plots and two irrigation levels (2 irrigations at 45 and 90 days after sowing (DAS) and 4 irrigations at 30, 60, 90 and 120 DAS) in sub plots replicated thrice. The results indicated that bed planting (67 cm) and 4 irrigations at 30, 60, 90 and 120 DAS proved to be significant over other treatments as it registered maximum growth as well as yield characters. Highest plant height, number of branches, number of pods per plant, number of seeds per pod, pod length, seed yield, straw yield, biological yield and harvest index were found in bed planting (67 cm) and 4 irrigations at 30, 60, 90 and 120 DAS. Thus, it can be concluded that sowing of fenugreek on bed planting (67 cm) and 4 irrigations at 30, 60, 90 and 120 DAS were found more effective than rest of the treatments.

Keywords: Bed planting, fenugreek, flat bed, irrigation, ridge, yield

Introduction

Fenugreek (*Trigonella foenum-graecum* L.) popularly known by its vernacular name “*methi*” has been in culinary and medicinal uses due to its restorative and nutraceutical properties for more than 2500 years. Fenugreek seed helps not only in reducing blood sugar levels due to its high phytochemicals concentration, but it also reduce low density cholesterols and triacylglycerols. Fenugreek leaves and seed have been used extensively to prepare extracts and powders for medicinal uses (Basch *et al.*, 2003) [1]. The seed of fenugreek have been used all through the ages and were held in high repute among the Egyptians, Greeks and Romans. India is one of the major producer and exporter of fenugreek. Fenugreek is mainly grown in arid and semi arid regions of India. It is grown on 94 thousand ha area with production of 1.16 lakh tones and productivity is 1200 kg/ha. In India, the major fenugreek growing states are Rajasthan, Gujrat, Madhya Pradesh, Tamil Nadu, Uttar Pradesh and Punjab. More than 80 per cent area and production of the country is contributed by Rajasthan alone. Punjab produces 2.36 thousand tonnes of fenugreek having 0.95% share in total production.

Fenugreek is generally exposed to moisture stress at later crop growth stages which adversely affect formation of reproductive organs and consequently the productivity decline. Therefore, matching irrigation schedule with crop water demand at different growth stages in a manner (for instance at appropriate intervals) that not only achieves maximum water use efficiency but also optimizes crop productivity on sustainable basis, is essential. Studies on irrigation scheduling based on different irrigations may provide a viable and economically feasible option for irrigation of fenugreek crop in Rajasthan. Datta and Chatterjee (2006) [3] reported that irrigation at IW-CPE ratio of 1.0 at Nadia in West Bengal resulted in highest fenugreek seed yield.

Fenugreek is a close growing crop, thus to get maximum production of fenugreek, it is most important and essential to enhance the growth of crop and increases seed yield and this could be achieved largely by providing the most optimum plant population per unit area and balanced nutrient under field conditions, which could be provided by optimizing the spacing and fertilizer levels. The plants grown in the wider spacing exhibit more horizontal and continuous vegetative growth due to less population pressure per unit area therefore, they give less yield per unit area (Kumar, 2004) [5]. Therefore, keeping all above facts in mind, the present investigation entitled “Effect of different planting methods & irrigation levels on the growth and yield of fenugreek” was conducted.

Materials and methods

The present investigation “Effect of different planting methods & irrigation levels on the growth and yield of fenugreek (*Trigonella foenum-graecum* L.)” was conducted at experimental farm of University College of Agriculture, Guru Kashi University Talwandi Sabo, Bathinda during rabi season 2017-18. Talwandi Sabo is located at 29°57' N latitude and 75°7' E longitudes and altitude (213 m above sea levels). The tract is characterized by semi humid climate. Maximum temperature is about 45-47°C is not uncommon during summer, while freezing temperature accompanied by frost occurrence may be witnessed in the month of December and January. The mean annual rainfall fluctuates around 150 mm, major part of which is during the month of July to November with a few shower of cyclonic rains during winter and spring month. A composite soil sample (0-15 cm) was collected from experimental field before planting of crop. The soil sample was air dried, grinded, and sieved to study the physico-chemical properties of experimental field. The soil of experimental field was sandy loam in texture. The soil was alkaline (pH 8.2) and with normal electrical conductivity (0.34 dSm⁻¹). The soil was low in organic carbon (0.32%) and available nitrogen (125 kg/ha), medium in available phosphorus (13.9 kg/ha) and available potassium (245.6 kg/ha). The experiment was laid out in split plot design with four planting methods (Ridge planting, bed planting (67 cm), bed planting (90 cm) and flat planting) in main plots and two irrigation levels (2 irrigations at 45 and 90 days after sowing (DAS) and 4 irrigations at 30, 60, 90 and 120 DAS) in sub plots, replicated thrice. All the observations on yield and yield components of fenugreek were recorded after harvesting of the crop.

The collected data were statistically analyzed by using Fisher's ANOVA technique and least significant difference (LSD) test at 5% probability level was used to compare differences among treatment means.

Results and Discussion

Growth attributes

Bed planting (67 cm) significantly recorded higher plant height and number of branches per plant over ridge planting, bed planting (90 cm) and flat planting, however, lowest plant height and number of branches per plant was observed in ridge planting (Table 1). The observed increase in plant height due to bed planting (67 cm) was 23.2, 3.8 and 12.1% at harvest over ridge planting, bed planting (90 cm) and flat planting, respectively. The observed increase in number of branches due to bed planting (67 cm) was of the order 22.5, 7.4 and 14.2% over ridge planting, bed planting (90 cm) and flat planting. Similar results were also reported by Kumar *et al.* (2015) [6] and Mehta *et al.*, (2012) [8] in fenugreek.

Table 1: Effect of different planting methods and irrigation levels on growth parameters of fenugreek

Treatment	Plant height (cm)	Number of branches/plant
Planting method		
Ridge planting	62.2	4.53
Bed planting (67 cm)	76.6	5.55
Bed planting (90 cm)	73.8	5.17
Flat planting	68.4	4.86
LSD (P=0.05)	2.1	0.20
Irrigation level (No.)		
2	80.5	4.88
4	85.4	5.18
LSD (P=0.05)	1.5	0.14

Among the irrigation levels, 4 irrigations at 30, 60, 90 and 120 days after sowing (DAS) recorded significantly higher plant height and number of branches per plant at harvest over 2 irrigations at 45 and 90 DAS treatment. The increase in plant height and number of branches per plant due to 4 irrigations at 30, 60, 90 and 120 DAS over 2 irrigations at 45 and 90 DAS at harvest was 4.2 percent and 6.1 percent, respectively. These results are in conformity with the findings of Lakpale *et al.* (2007) and Chovatia *et al.* (2009) [7, 2] in fenugreek.

Yield attributes

Number of pods per plant, pod length and number of seeds/pod of fenugreek were significantly influenced by varying planting methods (Table 2). Bed planting (67 cm) significantly increased the pods/plant (47.4) over ridge planting (42.4), bed planting (90 cm) (44.5) and flat planting (42.7). Bed planting (67 cm) significantly increased the pod length (15.3 cm) over ridge planting (12.8), bed planting (90 cm) (14.5) and flat planting (13.6). Bed planting (67 cm) significantly increased the seeds per pod (17.8) over ridge planting (14.8), bed planting (90 cm), (16.9) and flat planting (15.8). These results are in conformity with those of Dewangan *et al.* (2012) [4] in fennel. The results corroborate with finding of Dutta and Chatarjee (2006) [3].

Table 2: Effect of different planting methods and irrigation levels on yield attributes of fenugreek

Treatment	Number of pods/plant	Pod length (cm)	Number of seeds/pod
Planting method			
Ridge planting	42.4	12.8	14.8
Bed planting (67 cm)	47.4	15.3	17.8
Bed planting (90 cm)	44.5	14.5	16.9
Flat planting	42.7	13.6	15.8
LSD (P=0.05)	2.3	0.47	0.50
Irrigation level (no.)			
2	43.1	13.7	15.9
4	45.4	14.4	16.7
LSD (P=0.05)	1.6	0.33	0.35

The data showed that 4 irrigations at 30, 60, 90 and 120 DAS recorded significantly higher number of pods per plant, pod length and seeds per pod over 2 irrigations at 45 and 90 DAS. The increase in number of pods per plant, pod length and number of seeds per pod due to 4 irrigations at 30, 60, 90 and 120 DAS over 2 irrigations at 45 and 90 DAS was 5.3 percent, 5.4 percent and 5.1 percent, respectively. These results are in conformity with the findings reported by Kumar (2004) [5] in fenugreek and Sharma *et al.* (2017) [9].

Productivity

The presented data indicated that seed yield, straw yield and biological yield of fenugreek was significantly influenced by varying planting methods (Table 3). Bed planting (67 cm) significantly increased the seed yield (1603 kg/ha) over ridge planting (1169 kg/ha), bed planting (90 cm) (1443 kg/ha) and flat planting (1303 kg/ha). There were 37.1, 11.0 and 23.0% increase in seed yield over ridge planting, bed planting (90 cm) and flat planting, respectively. Bed planting (67 cm) significantly increased the straw yield (3475 kg/ha) over ridge planting (2623 kg/ha), bed planting (90 cm) (3106 kg/ha) and flat planting (2767 kg/ha). The percent increase in straw yield was 32.5, 11.9 and 25.6% over ridge planting, bed planting

(90 cm) and flat planting. Bed planting (67 cm) significantly increased the biological yield (5078 kg/ha) over ridge planting (3792 kg/ha), bed planting (90 cm) (4549 kg/ha) and flat planting (4070 kg/ha). The percent increase in biological yield was 33.9, 11.6 and 24.8% over ridge planting, bed planting at 90 cm and flat planting. Improvement in seed yield as result of remarkable improvement in different growth and yield components due to adoption of different crop geometries was also reported by Dewangan *et al.* (2012) [4].

Among the Irrigation levels 4 irrigations at 30, 60, 90 and 120 DAS recorded significantly higher seed yield, straw yield and biological yield over 2 irrigations at 45 and 90 DAS. There was 10.7 percent increase in seed yield due to 4 irrigations at 30, 60, 90 and 120 DAS over 2 irrigations at 45 and 90 DAS. The increase in yield might be due to favorable moisture status in the root zone of the crop through 4 irrigations at 30, 60, 90 and 120 DAS favored better growth and development of plant and thus increased growth and yield attributes which increased seed yield of fenugreek over 2 irrigations at 45 and 90 DAS. The percent increase in straw yield due to 4 irrigations at 30, 60, 90 and 120 DAS was 8.1% over 2 irrigations at 45 and 90 DAS. Higher straw yield with higher levels of irrigation might be due to its key role in root development by reducing mechanical resistance of soil, higher transpiration, greater nutrient uptake and more photosynthesis due to metabolic activities in the plant. The percent increase in biological yield due to 4 irrigations at 30, 60, 90 and 120 DAS was 8.9 percent over 2 irrigations at 45 and 90 DAS. Since, biological yield is a function of seed and straw yield representing vegetative and reproduction growth of crop. The profound influence of planting methods and irrigation on crop growth led to realization of higher biological yield. Increase in seed yield with higher irrigation level was also reported by Sharma *et al.* (2017) [9].

Table 3: Effect of different planting methods and irrigation levels on yield of fenugreek

Treatment	Seed yield (kg/ha)	Straw yield (kg/ha)	Biological yield (kg/ha)	Harvest index (%)
Planting method				
Ridge planting	1169	2623	3792	30.77
Bed planting (67 cm)	1603	3475	5078	32.05
Bed planting (90 cm)	1443	3106	4549	31.70
Flat planting	1303	2767	4070	31.59
LSD (P=0.05)	106	250	345	NS
Irrigation level (No.)				
2	1310	2877	4187	31.21
4	1449	3109	4558	31.85
LSD (P=0.05)	75	177	244	NS

The different planting methods (bed planting (67 cm), ridge planting, bed planting (90 cm) and flat planting) and irrigation levels (45 and 90 DAS and 30, 60, 90 and 120 DAS) was found non significant on harvest index of fenugreek. Since, harvest index is a function of economic and biological yield representing vegetative and reproduction growth of crop. The results of the present investigation corroborate the findings of Shivran *et al.* (2016) [10].

Conclusion

Bed planting (67 cm) resulted in significantly higher growth and seed yield of fenugreek than other treatments. Irrigations at 30, 60, 90 and 120 DAS treatment recorded significantly higher growth and seed yield of fenugreek than irrigations at

45 and 90 DAS. Sowing of crop on beds of 67 cm size and applied irrigations at 30, 60, 90 and 120 DAS resulted in significantly higher growth and seed yield of fenugreek than other treatment combinations.

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