

Research Article

Evaluation of Fenugreek (*Trigonella foenum-graecum* L.) Genotypes for Horticultural Traits

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Abstract

The experimental material consisted of 20 accessions which were, evaluated in a Randomized Block Design during Rabi 2016-17. The observations were recorded on days to 50 per cent flowering. Plant height, number of primary branches per plant, pods per plant, and seeds per pod, pod length, 1000-seed weight (g) and seed yield per plant (g). On the basis of estimates the accessions with higher mean values for various components were identified. Accession UM-410 had lowest mean for day to 50 per cent flowering. Accession UM-401 had highest mean values for plant height, UM-401 for number of primary branches per plant, UM-410 for number of pods per plant, UM-410 for seeds per pod, UM-391 for pod length, UM-410 for 1000-seed weight. Hence, it is suggested that these accessions be tested in multiplication trial to confirm their superiority and may also be used as parents in hybridization programme to develop high yielding varieties.

Keywords: Fenugreek, genotypes/lines, seed weight, morphological and seed yield per plant (g)

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Introduction

India is known as the “Land of Spices” as foreign invaders invaded India for spices in ancient times. India is the largest producer, consumer and exporter of spices and spice products. Fenugreek (*Trigonella foenum-graecum* L.) is an annual diploid species, popularly grown by its vernacular name “methi”, belonging to the sub-family “*papilionaceae*” of the family “*fabaceae*”. It is native to the countries bordering the Eastern shores of the Mediterranean region, extending to Central Asia. It is a self-pollinated crop with chromosome no. $2n=16$ [1]. The genus *Trigonella* is one of the largest genera of the tribe Trifoliati in the family *Fabaceae* and sub-family *Papilionaceae*. Among *Trigonella* species, *Trigonella foenum-graecum* (commonly known as fenugreek) is an annual species. It is indigenous to countries on the Eastern shores of the Mediterranean, but widely cultivated in India, Egypt, Ethiopia, Morocco and occasionally in England [2].

Fenugreek occupies a prime position among various seed spices grown in India. It is an annual herb belonging to sub-family *papilionaceae* of the family *leguminaceae*. Fenugreek has three culinary uses; as an herb (dried or fresh leaves), as a spice (seeds) and as a vegetable (fresh leaves and sprouts). It is mainly a condiment, but its seeds are also used as carminative and are an ingredient of several *Ayurvedic* medicines, mainly those prescribed for promoting appetite, correcting digestive disorder and for relieving the pain of joints particularly in old age of life. It is grown both for seed as well as for fodder purpose. Its green fodder compares very well with Lucerne and barseem. It is one of such crops in which every part is consumed in one or other form. Its tender leaves are consumed as leafy vegetables; chopped leaves are mixed in flour to prepare ‘*Parantha*’. Seed has carminative property and is also an important ingredient in concentrate feed for animals. It also serves as a soil renovating crop. Being a legume crop, its root nodules containing bacteria ‘*Rhizobium*’ improve the soil fertility by fixing atmospheric nitrogen. Medicinal properties of fenugreek are due to the presence of antioxidant and anti-inflammatory compounds such as genistein, kaempferol, quercetin, rutin, apigenin, selenium and superoxide dismutase. Fenugreek is advised for breast-feeding mothers for increasing breast milk production. Fenugreek paste is used as a shampoo for preventing hair fall. Environmentally, fenugreek could help in preserving the integrity of agricultural land by reducing soil erosion. Compared to continuous corn, hay crops can reduce soil loss by about 90%. Reduction of soil erosion is a key component of soil conservation and improved water quality as large amounts of phosphorus can be transported off the farm through soil loss. In addition, the roots of legumes help break up compacted soil layers and are effective soil builders. The ability of fenugreek to fix its own nitrogen lowers its fertility requirement during its production and in the following year’s crop. The leaves and shoots are quite rich in protein, minerals and vitamins A and C. [3] reported

that fenugreek seed contain protein (25.5%), fat (7.9%), mucilaginous matter (20%) and saponins (4.8%). The seeds also contain cellulose, hemicelluloses and major nutrients like phosphorus, potassium and mineral nutrients like calcium, iron and sodium, amino acids like leucine, valine, lysine and phenylalanine. Fenugreek is used both as whole seed and in powdered form and often roasted to reduce its bitterness and enhance the flavor. Seeds are bitter in taste due to presence of an alkaloid "*Trigonelline*". The importance of fenugreek has further increased due to presence of a steroid called "*Diosgenin*". *Diosgenin* is used in the synthesis of sex hormones and oral contraceptives. Further the crop attracted the attention of the farmers and agricultural scientist due to high remunerative prices. In India it is mainly cultivated in Rajasthan, Gujarat, Tamil Nadu, Andhra Pradesh, Uttar Pradesh, Himachal Pradesh and Haryana with total area of 13100 ha and production of 138000 MT Anonymous, [4]. The knowledge of genetic variation is important for selection in crop improvement program. [5] found significant variation for flowering time and duration, growth habit and seed yield. Available variability is a prerequisite for planning any breeding programme on scientific line. The evaluation also helps to assess the relative merits of different genotypes with regard to different characters and for selection of appropriate parents for hybridization. The present study was undertaken at BBAU, Lucknow to evaluate the variability present in germplasm of fenugreek and to evaluate the extent of association among yield and yield contributing traits.

Materials and Methods

The experimental material consisted of 20 accessions which were, evaluated in an Randomized Block Design during Rabi 2016-17 the field experiment was conducted at Horticultural Research Farm of the Department of Applied Plant Science (Horticulture), Babasaheb Bhimrao Ambedkar University (A central university), Vidya - Vihar, Rai-bareli Road, Lucknow - 226025 (U.P.), India during Rabi season of 2016-17. A set of 20 germplasm lines of fenugreek were obtained from the "Department of Plant Breeding and Genetics, S.K.N. College Of Agriculture, Jobner-303 329, Sri Karan Narendra Agriculture University Jobner. The experimental material was evaluated in Randomized Block Design (Federer, 1956). In each block, genotypes were sown in a plot size 1.20x1.20 m² consisting of one row. The row to row and plant to plant distance was kept 25 cm and 10 cm, respectively. Recommended cultivation practices were followed to raise a good crop. Five plants were randomly selected and tagged before flowering from each line to record the data on the following attributes. The observations were recorded on days to 50 per cent flowering. Plant height, number of primary branches per plant, pods per plant, and seeds per pod, pod length, 1000-seed weight and seed yield per plant **Figure 1**. The experimental data recorded were subjected to statistical analysis using analysis of variance technique suggested by [6]. The critical differences for the treatments comparison were worked out, wherever the "F" test was found significant at 5 per cent level of significance.



Figure 1 A general view of experimental field of fenugreek at vegetative growth

Result and Discussion

Morphological traits

The results obtained during the investigation in respect to morphological parameters viz., plant height (cm), days to 50 per cent flowering, number of primary branches per plant, pods per plant, and seeds per pod, pod length, 1000-seed weight and seed yield per plant. The analysis of variance revealed that mean squares were highly significant for all the

characters studied indicating sufficient variability in the germplasm **Table 1**. Wide range of variation in mean performance of genotypes was observed for all characters under study. In other words, the performance of the genotypes with respect to these characters were statistically significant, suggesting that there is ample scope for selection in different traits for the improvement of fenugreek. The mean performances of twenty genotypes for ten characters are presented in **Table 2**. The mean value of plant height was 10.74 cm with a range of 9.24 cm (UM-402) to 13.27 cm (UM-410). The tallest accession was UM-410 (13.27) followed by UM-391, UM-392, UM-408, UM-403, UM-405 and UM-396 at 30 DAS. The mean value of plant height was 41.16 cm with a range of 35.91 cm (UM-408) to 44.43 cm (UM-405). The tallest accession was UM-405 (44.43) followed by UM-395, UM-410, UM-406, UM-399, UM-392 and UM-398 at 60 DAS. The mean value of plant height was 73.69 cm with a range of 64.07 cm (UM-406) to 88.16 cm (UM-410). The tallest accession was UM-410 (88.16) followed by UM-397, UM-393, UM-40, UM-392, UM-394 and UM-398 at 90 DAS.

Table 1 Analysis of variance for different morphological and yield characters in fenugreek

| Source Of variance | Degree of freedom | Characters | | | | | | | | | |
|--------------------|-------------------|-------------------|---------|----------|-------------------------------|--------------------------------------|--------------------------|-----------------|-------------------------|----------------------|----------------------|
| | | 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10. |
| | | Plant height (cm) | | | Days to 50 per cent flowering | Number of primary branches per plant | Number of pods per plant | Pod length (cm) | Number of seeds per pod | 1000-seed weight (g) | Seed yield per plant |
| Replications | 2 | 1.24 | 3.95 | 2.26 | | | | | | | |
| Treatments | 19 | 3.26** | 17.62** | 117.85** | 74.17** | 1.12** | 86.66** | 0.66** | 3.96** | 4.57** | 10.83** |
| Error | 38 | 1.02 | 1.71 | 1.60 | 9.11 | 0.31 | 2.85 | 0.34 | 0.41 | 0.30 | 0.45 |

Table 2 Mean performance of twenty genotypes of fenugreek for different morphological and yield

| S. No. | Genotypes | Days to 50 per cent flowering | Plant height (cm) | | | Number of primary branches per plant | Number of pods per plant | Pod length (cm) | Seeds per pod | 1000-seed weight (g) | Seed yield per plant (g) |
|--------|-----------------|-------------------------------|-------------------|---------|---------|--------------------------------------|--------------------------|-----------------|---------------|----------------------|--------------------------|
| | | | 30 days | 60 days | 90 days | | | | | | |
| 1 | UM-391 | 64.33 | 12.10 | 42.39 | 72.23 | 5.27 | 35.33 | 11.59 | 13.53 | 11.53 | 5.60 |
| 2 | UM-392 | 62.67 | 11.98 | 42.75 | 76.53 | 4.47 | 38.07 | 10.75 | 12.80 | 12.63 | 9.17 |
| 3 | UM-393 | 64.33 | 11.17 | 41.51 | 79.89 | 5.13 | 35.47 | 10.09 | 12.73 | 13.47 | 6.62 |
| 4 | UM-394 | 62.33 | 9.72 | 41.93 | 75.81 | 4.87 | 42.40 | 9.66 | 13.73 | 9.90 | 5.65 |
| 5 | UM-395 | 73.67 | 10.61 | 44.42 | 73.82 | 4.00 | 34.20 | 9.93 | 12.87 | 12.30 | 8.66 |
| 6 | UM-396 | 72.33 | 11.01 | 40.04 | 75.17 | 3.73 | 38.33 | 10.15 | 13.00 | 10.03 | 5.09 |
| 7 | UM-397 | 73.67 | 10.97 | 37.89 | 85.13 | 3.87 | 30.27 | 9.83 | 12.93 | 10.93 | 4.98 |
| 8 | UM-398 | 66.33 | 10.19 | 42.68 | 75.22 | 3.93 | 27.53 | 9.93 | 12.73 | 10.67 | 7.45 |
| 9 | UM-399 | 74.33 | 10.55 | 43.33 | 74.59 | 4.33 | 34.67 | 10.35 | 13.40 | 9.97 | 5.94 |
| 10 | UM-400 | 75.67 | 9.41 | 38.59 | 68.63 | 4.20 | 30.00 | 10.13 | 12.53 | 10.00 | 5.78 |
| 11 | UM-401 | 77.33 | 10.43 | 40.80 | 66.80 | 3.27 | 36.13 | 9.65 | 12.53 | 10.17 | 4.74 |
| 12 | UM-402 | 72.33 | 9.24 | 40.14 | 74.32 | 3.93 | 34.33 | 10.27 | 14.47 | 10.57 | 6.26 |
| 13 | UM-403 | 72.67 | 11.70 | 41.58 | 71.13 | 3.93 | 35.87 | 10.03 | 15.00 | 13.00 | 6.51 |
| 14 | UM-404 | 63.67 | 10.35 | 39.50 | 68.66 | 5.13 | 34.80 | 10.09 | 11.73 | 10.27 | 5.16 |
| 15 | UM-405 | 72.33 | 11.04 | 44.43 | 67.55 | 3.60 | 32.67 | 10.19 | 14.80 | 12.03 | 6.05 |
| 16 | UM-406 | 71.33 | 9.71 | 43.35 | 64.07 | 3.67 | 40.47 | 10.13 | 14.60 | 10.93 | 6.12 |
| 17 | UM-407 | 72.67 | 10.27 | 40.87 | 65.39 | 4.53 | 32.73 | 10.23 | 14.20 | 12.50 | 5.20 |
| 18 | UM-408 | 69.33 | 11.78 | 35.91 | 71.05 | 3.67 | 43.47 | 10.57 | 14.53 | 11.17 | 9.74 |
| 19 | UM-409 | 71.33 | 9.49 | 37.13 | 79.72 | 3.60 | 38.27 | 9.53 | 12.93 | 10.47 | 7.54 |
| 20 | UM-410 | 61.33 | 13.27 | 44.00 | 88.16 | 5.13 | 51.80 | 10.85 | 16.60 | 13.60 | 12.12 |
| | S.E.m (±) | 1.78 | 0.66 | 0.82 | 0.73 | 0.32 | 2.22 | 0.38 | 0.70 | 0.37 | 0.86 |
| | C.D. 5% | 5.10 | 1.90 | 2.35 | 2.10 | 0.93 | 6.38 | 0.96 | 2.01 | 1.05 | 2.48 |
| | level (P=0.005) | | | | | | | | | | |

The overall mean value of days to 50 per cent flowering was 69.70. The mean values of accessions showed a range of 61.33 (UM-410) to 77.33 days (UM-401). The accession UM-401 was the earliest to days to 50% flower followed by UM-400, UM-399, UM-397, UM-395, UM-403, UM-402, and UM-396. Number of primary branches per plant ranged from 3.26 (UM-401) to 5.26 (UM-391) with mean value of 4.21. The highest primary branch per plant was observed in UM-391 followed by UM-393, UM-410, UM-404, UM-394, UM-407 and UM-392. These findings were in accordance with the result obtained by Meena *et al.* [7] Sade *et al.* [8] Lowanshi *et al.* [9] Chandra *et al.* [10] and Prajapati *et al.* [11] in fenugreek. The high yielding genotype UM-391, UM-393, UM-410 and UM-404 (5.13) also showed high mean performance for highest primary branches per plant. These results suggested that above mentioned high yielding genotypes may be considered in varietal improvement programme of fenugreek for desired characters.

Yield and yield attributing traits

The results obtained during the investigation in respect to biochemical parameters viz. pods per plant, and seeds per pod, pod length, 1000-seed weight and seed yield per plant present in Table 2. The mean value of pods per plant was 36.37. The accessions showed a wide range of pods per plant from 25.80 (UM-398) to 46.73 (UM-410). The highest number of pods per plant was observed in UM-410 followed by UM-408, UM-394, UM-406, UM-409, UM-392, UM-395 and UM-403. The mean value of pods length was 10.19 cm with a wide range of 9.53 cm (UM-109) to 11.58 cm (UM-391). The longest pod length was observed in UM-391 followed by UM-410, UM-392, UM-408, UM-399, UM-407 and UM-402. The number of seeds per pod ranged from 11.73 (UM-404) to 16.60 (UM-410) with a mean value of 13.58. The highest number of seeds per pod was observed in UM-410 followed by UM-403, UM-405, UM-406, UM-408, UM-402, UM-407. The test weight ranged from 9.90 (UM-394) to 13.60 g (UM-410) with corresponding mean value of 11.30 g. The highest test weight was observed in UM-410 followed by UM-393, UM-403, UM-392, UM-407, UM-395 and UM-405. The seed yield per plant ranged from 4.74 (UM-401) to 12.12 g (UM-410) with corresponding mean value of 6.71 g. The highest seed yield per plant was observed in UM-410 followed by UM-408, UM-392, UM-395, UM-409, UM-398 and UM-393. These results get support from the findings of Singh *et al.* [12], Benerjee and Kale *et al.* [13] Naik *et al.* [14] and Jain *et al.* [15] in fenugreek. On the basis of estimates the accessions with higher mean values for various components were identified. Accession UM-410 had lowest mean for day to 50 per cent flowering. Accession UM-401 had highest mean values for plant height, UM-401 for number of primary branches per plant, UM-410 for number of pods per plant, UM-410 for seeds per pod, UM-391 for pod length, UM-410 for 1000-seed weight.

Conclusion

Fenugreek occupies a prime position among various seed spices grown in India with many medicinal properties. Yield is a complex character governed by several other yield attributing characters. Since, most of the yield attributing characters are quantitatively inherited and highly affected by environment, it is difficult to judge whether the observed variability is heritable or not. On the basis of overall findings of the present research study it was concluded that there is wide range of variation in fenugreek strain for all the characters studied. UM-401 for number of primary branches per plant, UM-410 for number of pods per plant, UM-410 for seeds per pod, UM-391 for pod length, UM-410 for 1000-seed weight in fenugreek. However, since this is based on experiment, further trials may be needed to substantiate the results in fenugreek.

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