International J. Seed Spices 10(1), January 2020:11-15

Performance of fenugreek (*Trigonella foenum-graecum* L.) genotypes for yield and yield contributing traits

P.N. Shakthi, K.C. Meena, I.S. Naruka*, A. Haldar and N. Soni

Department of Plantation, Spices, Medicinal and Aromatic Crops,
College of Horticulture, Mandsaur, RVSKVV, Gwalior - 458001 (Madhya Pradesh)

Abstract

CuminThis investigation was carried out with twenty cultivars includes seven local collected genotypes and thirteen released cultivars. The research experiment was laid out in simple Randomized Block Design with three replications during the year 2019. At 30, 60, 90 DAS and at the time of harvesting, cultivar AFg-2 was recorded highest plant height (12.78, 47.00, 86.45, and 91.30 cm respectively) and dry weight (0.34, 5.70, 17.53 and 25.63 g plant^{-1} respectively). However, number of leaves (22.21, 51.21, 121.18 and 57.39 plant^{-1}), primary branches (2.63, 4.90, 8.33 and 9.34 plant^{-1}), secondary branches (3.61, 7.27, 12.70 and 14.07 plant^{-1}) in the genotype PEB at 30, 60, 90 DAS and at harvest, respectively. Under yield and yield attributing traits, the cultivar AFg-2 was recorded highest number of seeds (15.83 pod^{-1}), pod length (12.40 cm), seed yield (8.77g plant^{-1}), shelling percentage (71.20 %), harvest index (36.11 %) and seed yield (29.22 q hac^{-1}). Maximum (100.17 plant^{-1}) number of pods was recorded in cultivar PEB while highest (19.55 g) 1000 seed weight was recorded in Jaora Local-4.

Key words : Fenugreek, genotype, seed spices, traits, yield

Introduction

Fenugreek (*Trigonella foenum-graecum* L.) is self-pollinated and destogamous annual diploid species, popularly grown by its vernacular name “Methi”, belongs to the family “Fabaceae”. It is native to the Mediterranean Region, extending to Central Asia. Fenugreek is an annual herb, 30 to 90 cm tall having light green leaves which are pinnately trifoliate. The flowers are papilionaceous and white or yellow coloure. The plant produces slender curved pods, which contain 10 to 20 small, yellowish brown seeds, which are smooth and oblong, about 3 mm long, bitter in taste and having distinct flavor (Farooqui *et al*., 2004). Fenugreek is used as whole seed and in powdered form and often roasted to reduce its bitterness and enhances the flavor. Bitter taste of seeds due to presence of an alkaloid “Trigonelline”. The importance of fenugreek has been increased due to presence of asteroid called “*Diosgenin”* and it is used in the synthesis of sex hormones and contraceptives (Meena *et al.,* 2017). Fenugreek leaves and seeds are generally consumed as a spice in food preparation because of its strong flavor and aroma and also used as an ingredient in traditional medicine. The extracts of spices including fenugreek are promising sources of alternative medicine with high free radical scavenging ability and can also be used for therapeutic purposes (Choudhary *et al*., 2017). It is rich source of calcium, iron, alpha-carotene and other vitamins (Chouhan *et al.,* 2017; Nayma *et al*., 2019).

India occupies a topmost position among the fenugreek growing countries in the world. It is growing in Argentina, Southern France, Spain, Morocco, Egypt, North Western India, Turkey, Pakistan, China and Lebanon are the leading countries for fenugreek production. Though, in India fenugreek is mainly grown in Rajasthan, Madhya Pradesh, Andhra Pradesh, Uttar Pradesh, Gujarat and Punjab. Rajasthan state accounting highest production and contributed about 80% of total production in the country (Kumar *et al.,* 2018). Fenugreek is the third major seed spices in India after cumin and coriander. In India total area under fenugreek is 1.50 lakh hectare with the annual production of about 2.13 lakh tons (Spice Board India, 2017-18). Among different states of India, Rajasthan is leading state followed by Madhya Pradesh accounting for 25 thousand tons of production which contributing 10.13 % share (National Horticulture Board, 2017).

Yield is a major parameter, which is influenced by several yield and yield attributing characters controlled by polygenes and also influenced by environment (Hosamath *et al.,* 2017). The existence of adequate level of genetic variability is a pre-requisite for the successful breeding program. Similarly, knowledge of the extent and pattern of the existing variability in a population is essential for the further crop improvement (Fufa, 2017; Bepari, *et al*.,

*Corresponding author email: drisnaruka@yajoo.com

2018). Farmers of Madhya Pradesh are still growing local cultivars of fenugreek which are low yielding and low marketable quality. Even though huge numbers of fenugreek varieties are released by various research institutes with high yield potential and marketable quality. These varieties are more popular in their geographical location. These varieties are needed to be popularize among the farmers of Madhya Pradesh.

Materials and methods

The field experiment was carried out at the "Horticulture Research Farm" College of Horticulture, Mandsaur, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior (Madhya Pradesh) during *rabi* season of 2018-19. The experiment was laid out in Randomized Block Design with three replications. The centre is located at Malwa plateau in Western part of Madhya Pradesh at 23.45^0 to 24.13^0 North latitude, 74.44^0 to 75.18^0 East longitudes. This region falls under agro climatic zone no.10 of the state and belongs to sub-tropical and semi-arid climatic conditions having a mean maximum temperature of 44^0C and mean minimum temperature of 5^0C in summer and winter respectively. It receives an annual average rainfall of 544.05 mm.

This investigation was carried out with twenty genotypes includes seven local collected genotypes from the Mandsaur, Jaora and Tikamgarh district of Madhya Pradesh and thirteen released varieties obtained from different centres. The five plants were collected from each plot at 30, 60, 90 DAS and at harvest to recorded all the parameters and later on their mean was calculated. The experimental data were subjected to statistical analysis using analysis of variance technique suggested by Panse and Sukhatme (1985). Where the "F" test was found significant at 5% level of significance, the critical differences for the treatment's comparison were worked out.

Results and discussion

The data presented in the Table 1 and 2 revealed that all the parameters were significantly differed among genotyped in relation to morphological, yield and yield attributing parameters during investigation at all the growth intervals and all the attributes. The variety AFg-2 recorded maximum plant height (12.78, 47.00, 86.45, and 91.30 cm plant^{-1}) during all the growth stages. It may be due to genetic makeup of the variety, adoptability to the specific climate and crop management and also endogenous growth regulators. Similar results were reported by Dhakad *et al.* (2017) in coriander, Latye *et al.* (2016) and Kurubetta *et al.* (2018) in fenugreek. The investigation reveals that, maximum number of leaves (22.21, 51.21, 121.18 and 57.39 plant^{-1}) and number of primary branches (2.63, 4.90, 8.33 and 9.34 plant^{-1}) were found in genotypes PEB during all the plant life span (Table 1). The number of leaves plant^{-1} has been primarily found to be linking with endogenous hormones in a leaves and also apical dominance these finding was agreement with the findings of Patil *et al.* (2016) in fenugreek and Dhakad *et al.* (2017) in coriander. Also, it may be differed due to their genetic makeup which is indirectly govern by morphology of the plant and also endogenous hormones level and apical dominance. The similar results also reported by Datta and Chtterjee (2004), Latye *et al.* (2016) and Sharanya *et al.* (2018) in fenugreek. Genotype AFg-2 was registered the maximum dry weight (0.34, 5.70, 17.53 and 25.63 g plant^{-1}) at all the growth phases at 30, 60, 90 DAS and at harvest respectively (Table 1). Genotypes grown under ideal agronomic and climatic condition the variation was observed in overall growth of varieties, it may be due to genetic makeup and also photo synthetically active leaf area results in more absorption and utilization of radiant energy which ultimately leads to maximum dry matter accumulation. These results are in agreement with the findings of Gurjar *et al.* (2016), Patil *et al.* (2016) and Meena *et al.* (2019a) in fenugreek.

The yield of the crop depends on the vigor nature of the plant and plant vigor is showed by morphological parameters. The significant variations were observed in yield and yield attributing parameters *viz.,* number of pods (plant^{-1}), number of seeds (pod^{-1}), pod length (cm pod^{-1}), seed yield (g plant^{-1}), test weight (g), shelling percentage (%), seed yield (q ha^{-1}) and harvest index (%). The seed yield was depending on the number of pods plant^{-1}, pod length, number of seeds pod^{-1} and also harvest index and response of fenugreek varieties to favorable agro-climatic conditions, different vegetative character of the cultivar. The data presenred in the Table 2 revealed that, maximum number of pods (100.17 plant^{-1}) was recorded in genotype PEB, number of seeds (15.83 pod^{-1}), pod length (12.40 cm), seed yield (29.22 q ha^{-1}), harvest index (36.11 %) and shelling percent (71.20%) in genotype AFg-2, while genotype Jaora Local-4 was recorded maximum (19.55 g) test weight. The variation is due to congenial climate, optimum photoperiod for luxuriant growth and more number of primary branches causes' greater assimilation of photosynthate which ultimately result in higher yield. Similar results were found by fennel genotypes (Meena *et al.* (2019b) and fenugreek (Thakral *et al.*, 2006, Chauhan *et al.*, 2017, Jyothi and Hedge, 2018). Variation in the seed yield may be due to filling percentage of the pod.

Table 1. Performance of fenugreek genotypes for morphological parameters.

Genotypes	Plant height (cm plant^{-1})				No. of leaves (plant^{-1})				No. of primary branches (plant^{-1})				Dry weight (g plant^{-1})			
	30 DAS	60 DAS	90 DAS	At harvest	30 DAS	60 DAS	90 DAS	At harvest	30 DAS	60 DAS	90 DAS	At harvest	30 DAS	60 DAS	90 DAS	At harvest
Lam Selection- 1	10.27	36.69	64.63	75.83	15.44	44.55	69.85	38.94	1.97	4.03	5.22	660	0.15	2.78	13.57	20.90
Lam Methi- 2	11.28	32.66	77.99	81.97	13.73	34.72	73.92	38.58	2.30	4.50	5.33	680	0.14	2.73	9.43	17.26
Lam Methi- 3	11.60	39.47	78.51	88.79	15.89	40.72	67.96	35.13	2.03	4.30	5.45	660	0.17	2.77	11.93	19.46
AFg- 1	10.50	41.35	75.02	79.99	13.33	42.96	87.75	42.14	2.23	4.43	5.22	660	0.17	3.33	12.37	19.60
AFg- 2	12.78	47.00	86.45	91.30	21.57	49.55	114.81	47.57	2.60	4.87	5.72	720	0.34	5.70	17.53	25.63
AFg- 3	12.24	43.50	63.84	84.25	20.33	46.44	74.47	36.31	2.03	4.50	4.83	627	0.20	4.20	14.00	20.64
AFg- 4	10.57	46.47	78.04	84.44	18.55	45.52	82.42	43.84	2.23	4.30	5.33	633	0.18	3.40	12.95	21.74
AFg- 5	10.86	36.50	71.38	78.32	17.80	40.60	69.95	36.02	2.10	4.43	5.16	640	0.23	3.30	10.95	22.68
-HM- 57	12.28	39.17	83.49	90.49	21.10	49.45	92.43	44.89	2.50	4.77	5.61	713	0.23	4.63	14.47	24.28
PEB	9.06	27.96	45.27	53.21	22.21	51.21	121.18	57.39	2.63	4.90	8.33	934	0.15	3.97	10.33	23.74
GM- I	11.50	40.81	78.94	89.28	20.49	46.73	69.68	37.18	2.43	4.63	5.50	600	0.19	4.33	14.30	22.59
GM- 2	12.39	46.87	83.76	90.78	20.70	47.63	92.81	44.17	2.47	4.70	5.67	713	0.24	4.63	15.10	24.56
DFC- 21	10.52	39.57	75.85	81.31	19.70	45.23	79.40	41.20	2.50	4.60	5.11	640	0.19	4.00	12.23	17.94
MDS Local- 1	9.65	34.59	70.44	86.63	14.38	35.34	75.88	41.75	2.30	3.97	4.94	687	0.14	3.33	13.12	16.48
MDS Local- 2	10.17	33.80	73.62	87.98	15.33	38.67	80.81	44.16	2.37	4.17	5.00	647	0.33	3.40	11.90	17.87
Jaora Local- 1	10.54	35.67	77.75	81.65	13.73	40.68	71.56	42.71	2.41	4.30	5.49	700	0.12	3.03	13.73	20.40
Jaora Local- 2	11.33	39.56	75.57	84.96	17.78	45.72	70.72	41.37	2.17	4.03	5.17	647	0.16	4.27	10.60	23.12
Jaora Local- 3	9.73	41.95	71.88	80.21	14.23	32.84	57.90	40.83	1.90	2.77	4.84	713	0.15	2.22	8.62	17.52
Jaora Local- 4	9.37	40.62	57.96	70.60	13.53	32.00	52.69	34.20	1.83	2.77	4.83	520	0.18	1.99	8.53	14.75
TKG Local	9.88	33.96	72.83	81.66	17.09	43.50	90.58	43.37	2.30	4.17	5.07	667	0.22	4.13	13.13	19.47
SEm ±	**0.37**	**0.77**	**2.50**	**2.37**	**0.51**	**1.29**	**2.33**	**1.41**	**0.09**	**0.12**	**0.07**	**020**	**0.01**	**0.11**	**0.16**	**065**
CD @ 5 %	**1.05**	**2.20**	**7.15**	**6.79**	**1.46**	**3.69**	**6.66**	**4.03**	**0.25**	**0.34**	**0.20**	**057**	**0.03**	**0.31**	**0.45**	**1 86**

Table 2. Performance of fenugreek cultivars for yield and yield attributing traits.

Varieties	No. of pod (Plant^{-1})	No. of seeds (Pod^{-1})	Pod length (cm)	Seed yield (g plant^{-1})	test weight (g)	Shelling %	Seed yield (q/ha)	Harvest index (%)
Lam Selection- 1	54.40	14.87	11.14	6.29	12.56	54.49	20.96	30.08
Lam Methi- 2	66.13	15.39	10.93	5.19	12.67	54.71	17.31	30.09
Lam Methi- 3	57.73	15.45	11.44	7.01	13.55	60.64	23.37	36.03
AFg- 1	53.33	14.24	11.37	5.88	14.15	58.56	19.60	30.00
AFg- 2	84.40	15.83	12.40	8.77	15.97	71.20	29.22	36.11
AFg- 3	62.33	15.31	11.37	6.73	14.85	59.13	22.42	32.59
AFg- 4	57.00	15.08	10.80	6.50	15.40	57.15	21.67	29.89
AFg- 5	62.27	15.32	11.68	6.69	15.56	53.72	22.31	29.51
HM- 57	82.73	15.60	11.40	7.80	13.75	61.96	26.00	32.86
PEB	100.17	13.08	10.60	5.99	11.62	59.55	19.97	23.37
GM- 1	69.93	15.48	11.46	7.03	14.78	57.71	23.44	31.13
GM- 2	82.33	15.67	11.71	8.38	15.71	62.26	27.94	34.13
DFC- 21	57.60	14.64	10.93	5.58	13.19	57.75	18.61	31.12
MDS Local- 1	60.33	15.21	10.81	5.77	12.19	60.59	19.23	31.23
MDS Local- 2	59.73	15.08	11.18	5.15	12.06	56.09	17.17	28.79
Jaora Local- 1	55.40	14.89	11.41	6.09	11.08	54.67	20.31	29.87
Jaora Local- 2	35.93	14.28	11.36	5.35	18.29	54.16	17.84	23.28
Jaora Local- 3	38.67	12.00	10.67	4.12	14.47	53.72	13.72	23.50
Jaora Local- 4	30.73	11.85	10.67	4.02	19.55	39.27	13.41	27.28
TKG Local	56.40	14.68	10.93	6.33	14.77	60.97	21.09	33.66
SEm ±	**1.82**	**0.46**	**0.26**	**0.34**	**0.41**	**1.69**	**1.13**	**1.19**
CD @ 5 %	**5.20**	**1.32**	**0.75**	**0.97**	**1.19**	**4.83**	**3.22**	**3.40**

These results were agreement with the findings of Chowdhury *et al.* (2014) and Anitha *et al.* (2016) in fenugreek.

Conclusions

Out of twenty genotypes, the highest yield was recorded in genotypes AFg-2 (29.22 q ha^{-1}) followed by GM-2 (27.94 q ha^{-1}) and HM-57 (26.00 q ha^{-1}). Based on results, it can be concluded that the cultivar AFg-2 and GM-2 should be used for further breeding programme of fenugreek.

References

Anitha, B., Reddy, M.L.N., Rao, A.V.D.D., Patro, T. S.K.K.K. and Suneetha, D.R.S. 2016. Effect of sowing date on yield and quality of fenugreek. *Plant Archives,* 16(1): 479-484.

Bepari, A., Naruka, I.S., Meena, K.C., Haldar, A. and Nayma, S. 2018. Effect of sulphur and zinc on growth, yield and quality of coriander (*Coriandrum sativum* L.) cv. RCr-436. *International J. Chemical Studies*, 6(5): 2479-2483.

Chauhan, J., Singhal, R.K., Kakralya, B.L., Kumar, S. and Sodani, R. 2017. Evaluation of yield and yield attributes of fenugreek (*Trigonella foenum-graecum*) genotypes under drought conditions. *International J. Pure & Applied Bioscience,* 5(3): 477-484.

Choudhary, M., Gothwal, D.K., Kumawat, R. and Kumawat, K.R. 2017. Assessment of genetic variability and character association in fenugreek (*Trigonella foenum-graecum* L.) genotypes. *International J. Pure & Applied Bioscience,* 5(5):1485-1492.

Choudhary, S., Pereira, A., Basu, S. and Verma, A.K. 2017. Differential antioxidant composition and potential of some commonly used Indian spices. *J. Agrisearch*, 4(3):160-166.

Chowdhury, M.M.U., Bhowal, S.K., Farhad, I.S.M., Choudhury, A.K. and Khan, A.S.M.M.R. 2014. Productivity of Fenugreek varieties (*Trigonella foenum-graecum* L.), in the coastal saline areas of Noakhali. *The Agriculturists*, 12(2): 18-23.

Datta, S. and Chatterjee, R. 2004. Performance of fenugreek (*Trigonella foenum-graecum* L.) genotypes under new alluvial zone of West Bengal. *J. Spices and Aromatic Crops*, 13(2): 132-134.

Dhakad, R.S., Sengupta, S.K., Lal, N. and Shiurkar, G. 2017. Genetic diversity and heritability analysis in coriander. *The Pharma Innovation Journal,* 6(8): 40-46.

Farooqi, A., Sreeramu, B.S. and Srinivaspa, K.N. 2004. Cultivation of spices crops. Universities press, pp-129-130.

Fufa, M. 2017. Variability in fenugreek (*Trigonella foenum-graecum* L.) accessions grown in Ethiopia. *Advances in Crop Science and Technology*, 5(1): doi: 10.4172/2329-8863.1000258

Gurjar, M., Naruka, I.S. and Shaktawat, R.P.S. 2016. Variability and correlation analysis in fenugreek (*Trigonella foenum-graecum* L.). *Legume Research*, 39(3): 459-465.

Hosamath, J.V., Hegde, R.V., Venugopal, C.K., Vijayakumar, A.G. and Hegde, M.G. 2017. Studies on Genetic Variability, Heritability and Genetic Advance in Fenugreek (*Trigonella foenum-graecum* L.). *International J. Current* Microbiology and *Applied* Sciences, 6(11): 4020-4036.

Jyothi, V.H. and Hegde, R.V. 2018. Performance of Fenugreek (*Trigonella foenum-graecum* L.) genotypes for seed yield. *International J. Current Microbiology and Applied Sciences,* 7(8): 661-666.

Kumar, A., Pandey, V.P., Maurya, V.K., Tiwari, D. and Sriom 2018. Genetic variability, heritability & genetic advance in fenugreek (*Trigonella foenum-graecum* L.). *International J. Chemical Studies*, 6(4): 153-156.

Kurubetta, K.D., Mesta, R.K., Venkatesh, J., Tatagar, M.H., Kareem, M.A. and Sweta, K. 2018. Evaluation of fenugreek genotypes for seed yield in Northern transitional zone of Karnataka. *Research J. Chemical and Environmental Sciences,* 6(1): 51-53.

Latye, P.T., Bharad, S.G., Kale, V.S. Nandeshwar, V.N. and Kholia, A. 2016. Varietal performance of fenugreek under Akola conditions. *International J. Minor Fruits, Medicinal and Aromatic Plants,* 2(1): 32-34.

Meena, M.L. Narolia, S.L. Atal, M.K. and Verma, N. 2017. Evaluation of fenugreek (*Trigonella foenum-graecum* L.) genotypes for horticultural traits. *Chemical Science Review and Letters,* 6(23): 2014-2018.

Meena, R.S., Choudhary, S., Verma, A.K., Meena, N.K. and Mali, S.C. 2019a. Estimates of genetic variability, divergence, correlation and path coefficient for morphological traits in fenugreek (*Trigonella foenum-graecum* L.) genotypes. *Legume Research, doi: 10.18805/LR-4090*

Meena, R.S., Verma, A.K., Meena, N.K., Ahari, A., Balai, S.R. and Mali, S.C. 2019b. Variability and correlation studies for yield and yield contributing traits in fennel (*Foeniculum vulgare* Mill.) germplasm. *International J. Seed Spices,* 9(2): 67-72.

National Horticulture Board 2017. Indian Horticulture Data Base. Ministry of Agriculture, Government of Institutional Area. http://www.nhb.gov.in.

Nayma, S., K.C. Meena, Kiran, M.R. and Kumawat, A. 2019. Effect of sowing time and row spacing on growth, yield and quality of Chandrasur (*Lepidium sativum* L.). *International J. Chemical Studies*, 7(3): 1972-1976.

Panes, V.G. and Sukhatme, P.V. 1985. Statistical method for agriculture workers, Indian Council of Agriculture Research, New Delhi, 155.

Patil, J., Vijayapadma, S.S. and Koppad, S. 2016. Genetic variability studies in fenugreek (*Trigonella foenum-graecum* L.*). Research in Environment and Life Sciences (JournalSeek*), 9(12): 1482-1483.

Sharanya, B.R., Naruka, I.S., Shaktawat, R.P.S., Kushwah, S.S., Singh, O.P. and Singh, D. 2018. Effect of plant geometry on growth, yield and quality of different varieties of fenugreek (*Trigonella foenum-graecum* L.). *Indian J.* Agricultural *Research,* doi: 10.18805/IJARe.A-4977

Spice Board India, 2017-18. Database, http:// indianspices.com

Thakral, K.K., Tehlan S.K. and Partap, P.S. 2006. Varietal evaluation in fenugreek for growth and seed yield. *Haryana J. Horticulture Science,* 35(3 &4): 344-345.

Received : November 2019; Revised : November 2019; Accepted : December 2019.