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CONTENTS

Variability studies in fenugreek [*Trigonella foenum-graecum* L.]

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ABSTRACT: Eighteen genotypes of fenugreek were evaluated for growth and yield contributing traits at the Vegetable Research Center, G.B.P.U.A. &T., Pantnagar during the year 2018-19. Analysis of variance revealed that differences among genotypes were highly significant for the characters namely, test weight, number of seeds per pod, days to 50% flowering, days to maturity and seed yield. Minimum days of 50% flowering was found in genotypes FGK131 (46 days) followed by FGK128 (47 days). Plant height ranged from 80.33cm to 111.07cm. Highest number of pods per plant were observed in genotypes FGK132 (105.63) followed by FGK134 (97.80). The highest value for seed yield were observed in genotype FGK124 (1.39 kg per plot) followed by Pant Ragini (1.36 kg per plot). Highest PCV and GCV value revealed greater phenotypic and genotypic variability among the genotypes. For the character test weight, high heritability and high genetic advance were observed.

Key words: Fenugreek, genetic advance, genotypes, heritability, variability

Indian subcontinent has always been recognised as "Land of spices**".** India is the largest producer, consumer and exporter of spices in the world, where 63 kinds of spices are grown (Pruthi, 1998). Fenugreek is the third largest seed spice in India. This is one of the oldest cultivated plants. It was a part of Indian diet even 3000 years ago. Genus Trigonella have two species of economic importance, viz., *Trigonella foenum-graecum*L.or commonly known as "methi" and *Trigonella corniculata* L. or commonly known as "kasurimethi". It is a diploid plant of chromosome number 2n=16. It is also a dicotyledonous plant of 30-90 cm height with erect, branched and grooved stem with little pubescence. The leaves are pinnately trifoliate in nature and plant bears papilionaceous white or yellow flowers grow from the leaf axils. The fruits are pod or legumes having 10-20 small hard yellowish brown seeds. Fenugreek is well known for its distinctive, pungent aromatic compounds in the seed that impart aroma, colour and flavour to the food, making it highly desirable supplement for use in culinary application (Max, 1992). Fenugreek is a typically self pollinated and cleistogamous plant. Pollen fertility ranges from 95-98% in the unopened flower bud and 67-80% in open flowers. In terms of fenugreek production Asia positioned in 1st place among continents and acreage with India leading in fenugreek seed production by producing about 90% of the world grown (Acharya *et al.,* 2008). In India it is mainly cultivated in Rajasthan, Madhya Pradesh, Gujarat, Punjab and Uttar Pradesh. More than 80% area and production of the country is contributed by Rajasthan alone. Variation in genetic resources is the basis of crop improvement programme of any crop. Diversity in plant genetic resources provides an opportunity for plant breeders to develop a new cultivar. *Per se* performance determines the potentiality of parents for utilizing them in an efficient breeding programme. Knowledge of the nature and magnitude of variability is of great importance for identification of superior parents in any crop improvement programme. Therefore, the present investigation was undertaken to find out the suitable cultivar for the improvement of fenugreek crop.

MATERIALS AND METHODS

To study the performance of different genotypes of fenugreek, an experiment was laid out with 18 genotypes/varieties at Vegetable Research Centre, G. B. Pant University of Agriculture and Technology, Pantnagarrabi season during the 2018-19. The 18 genotypes were replicated thrice in randomized block design. The net plot size was 3.0x2.4 m. Sowing of seed was done in the first week of

November at 30x10 cm spacing in flat beds. Recommended agronomical practices and plant protection measures were followed. Observations were recorded in respect of days to 50% flowering, plant height (cm), number of pods per plant, number of branches per plant, pod length (cm), number of seeds per pod, test weight (g), days to maturity and seed yield per plot. The data were analysed statistically according to the method outlined by Panse and Sukhatme (1985). Heritability in broad sense was calculated as per formula given by Burton and De Vane (1953) and genetic advance as per centage of mean were worked out using the formula suggested by Allard (1960).

RESULTS AND DISCUSSION

ANOVA for nine characters is presented in Table 1.Analysis of variance revealed that difference among fenugreek genotypes was highly significant for the five characters viz., test weight, number of seeds per pod, days to 50% flowering, days to maturity, and seed yield. Whereas, significant behaviour was found in four characters namely pod length, plant height, number of branches per plant and number of pods per plant.

The ANOVA revealed that estimated mean sum of squares for the character viz., test weight, number of seeds per pod, days to 50% flowering, days to maturity and seed yield were significant at 1% level indicating the large variation among the genotypes (Table 1). Similar finding was also reported by Singh and Kaur (2007), Verma and Ali (2012) and Mamatha *et al.* (2017).Range and mean performance of genotypes for growth and yield characters are given in Table 2 and 3.

Days to 50% flowering varied from 46(FGK131) to 56 days (FGK137) with the average of 49 days and coefficient of variation was observed 4.22%. Plant height ranged from 80.33 cm (Pant Ragini) to 111.07cm (FGK129) with general mean value 94.56 cm and coefficient of variation observed as 11.67%. Branches per plant ranged from 2.40 (FGK134) to 3.87(Pant Ragini) with an overall mean of 2.88 and coefficient of variation observed 13.23%. A range from 51.33(FGK130) to 105.63(FGK132) was found for number of pods per plant with an overall mean 79.43with coefficient of variation 25.58%. The pod length varied from 8.53cm (FGK130) to 11.07cm (FGK133) with an overall mean 9.80 and coefficient of variation observed was 8.04%. On the basis of mean performance of genotypes, seeds per pod ranged from 10.67 (FGK129) to 17.33 (FGK138) with an overall mean 14.44 and coefficient of variation observed was 12.02%. A ranged for test weight (g) valued from 8.92(Pant Ragini) to 16.03 (FGK133) with an overall mean 12.42 and coefficient of variation observed was 6.44%. Days to maturity ranged from 146 days (FGK134) to 156 days (FGK124) with an average of 152 days and coefficient of variation was 1.30%.Seed yield per plot varied from 0.86 kg per plot (FGK133) to 1.39 kg per plot (FGK124) with an overall mean 1.20 and coefficient of variation 8.86.

Table 1: Analysis of variance (ANOVA) of growth and yield characters in fenugreek (2018-19)

S. No.	Characters	Source of variation		
		Replication	Treatment	Error
	d.f.	2	17	34
1.	Days to 50% flowering	4.389	21.069**	4.310
2.	Plant height (cm)	1257.614	234.258*	132.680
3.	Branches per plant	0.162	0.309*	0.145
4.	No. of pods per plant	835.235	800.448*	413.141
5.	Pod length (cm)	1.286	1.217*	0.622
6.	Seeds per pod	26.389	8.000**	3.016
7.	Test weight (g)	1.471	8.492**	0.641
8.	Days to maturity	21.240	15.159**	3.907
9.	Seed yield per plot	0.004	0.058**	0.011

** Significant at 0.01% level of significance, *Significant at 0.05% level of significance

Table 2: Mean value and Coefficient of variation for ten characters in fenugreek cultivars

S. No.	Genotypes	Days to 50% flowering	Plant height (cm)	Branches per plant	No. of pods per plant	Pod length (cm)	Seeds per pod	Test weight (g)	Days to maturity (days)	Seed yield (kg per plot)	Seed yield (quintal per hectare)
1.	FGK122	53	82.83	2.80	90.47	9.57	13.67	10.92	153	1.19	16.57
2.	FGK123	50	87.53	3.07	72.27	9.36	16.67	11.83	154	1.21	16.85
3.	FGK124	49	99.60	3.07	94.03	10.85	15.33	14.08	156	1.39	19.31
4.	FGK125	48	99.20	2.67	77.87	10.09	15.00	13.08	152	1.13	15.69
5.	FGK126	49	92.13	3.13	80.67	9.30	15.67	10.73	153	1.18	16.34
6.	FGK127	54	93.20	2.67	56.00	9.40	13.67	11.51	151	1.26	17.57
7.	FGK128	47	110.07	2.73	67.93	10.13	14.67	12.39	153	1.17	16.30
8.	FGK129	49	111.07	2.73	97.60	9.77	10.67	14.48	150	1.19	16.48
9.	FGK130	48	91.60	2.87	51.33	8.53	14.00	13.18	152	1.29	17.92
10.	FGK131	46	107.27	2.80	93.60	9.83	14.33	11.61	150	0.96	13.29
11.	FGK132	49	91.87	3.07	105.63	9.50	15.00	12.75	153	1.30	18.01
12.	FGK133	47	87.00	2.60	63.87	11.07	14.00	16.03	152	0.86	11.90
13.	FGK134	48	95.13	2.40	97.80	10.33	13.67	13.58	146	1.23	17.04
14.	FGK135	49	98.07	3.13	92.80	9.33	11.33	14.21	151	1.10	15.32
15.	FGK136	48	99.40	2.80	85.53	10.00	15.00	11.71	153	1.35	18.75
16.	FGK137	56	85.60	2.80	77.93	9.47	14.00	11.04	150	1.35	18.70
17.	FGK138	47	90.13	2.60	56.40	10.63	17.33	11.56	152	1.12	15.51
18.	Pant Ragini	49	80.33	3.87	68.07	9.27	16.00	8.92	148	1.36	18.84
	General mean	49.2	94.56	2.88	79.43	9.80	14.44	12.42	152	1.20	
	S.Em. ±	1.20	6.38	0.22	11.74	0.46	1.00	0.46	1.14	0.06	
	C.D. at 5%	3.45	18.27	0.63	33.73	1.31	2.88	1.33	3.28	0.18	
	C.V.	4.22	11.677	13.23	25.58	8.049	12.02	6.44	1.303	8.86	

Table 3: Over all mean value of genotypes, their range, phenotypic (PCV) and genotypic coefficient variation (GCV), heritability in broad sense and genetic advance as per cent of mean

Characters	Mean	Range	PCV	GCV	Heritability (%)	Genetic Advance as per cent of mean
Plant height (cm)	94.56	80.33-111.07	13.648	6.154	20.330	5.716
No. of branches per plant	2.88	2.40-3.87	15.532	8.136	27.437	8.779
Days to 50% flowering (days)	49.2	46-56	1.825	1.278	48.976	1.842
No. of pods per plant	79.43	51.33-105.63	29.315	14.304	23.809	14.378
Pod length (cm)	9.80	8.53-11.07	9.243	4.543	24.156	4.599
Test weight (g)	12.42	8.92-16.03	14.531	13.023	80.324	24.044
No. of seeds per pod	14.44	10.67-17.33	14.973	8.923	35.515	10.954
Days to maturity (days)	152	146-156	6.398	4.807	56.445	7.440
Seed yield (kg/plot)	1.20	0.86-1.39	13.622	10.340	57.621	16.169

The estimates of phenotypic coefficient of variation (PCV) were higher than genotypic coefficient of variation (GCV) for all the traits studied which is an indicator of additive effect of the environment on the expression of the trait. In present investigation, pods per plant followed by test weight and seed yield per plot showed high values for PCV and GCV. Similar results were also reported by Wojo *et al.* (2016), Mamatha *et al.* (2017) and Shivraj (2018). It indicated that the presence of sufficient amount of genetic variability for these characters can be utilized by selection for improvement. Test weight reported high heritability which shows that selection of this character for genetic improvement would be effective because it is less influenced by environmental factors.Dashora *et al.* (2011), Verma and Ali (2012) and Kole and Saha (2013) also reported similar results. Moderate heritability was reported for days to maturity and seed yield, indicating moderate influence of environment on its phenotypic expression and selection based on performance of characters. These results are in agreement with Verma and Ali (2012) and Kole and Saha (2013). High estimates of genetic advance as

per centage of means observed for test weight indicated that this character is governed by additive gene action and selection will be effective for improvement of test weight. The finding corroborated the earlier reports of Ahari *et al.* (2010), Verma and Ali (2012) and Pushpa (2017). Moderate estimates of genetic advance as per centage of means were found for seed yield per plot, number of seeds per pod and number of pods per plant, which indicates that these characters are governed by non-additive gene action indicating that heterosis breeding will be more effective for improvement of such characters. These results were corroborated by Singh *et al.* (2013).

CONCLUSION

In the present study, high heritability coupled with high genetic advance as per centage of mean was recorded for test weight indicated major role of additive gene action in inheritance of this character. High estimates of heritability along with high genetic advance provides good scope for further improvement in advance generations if the characters are subjected to mass progeny or family selection.On the basis of *per se* performance, the good donor parents for earliness were FGK134 and Pant Ragini. Genotypes namely FGK132, FGK134 and FGK129 were found to be the best donor parents for more number of pods per plant. For more number of seeds per pod, genotypes FGK138, FGK123 and Pant Ragini were good donor parents. Similarly, FGK133 and FGK129 were good donor parents for bold seed.Out of eighteen genotypes, nine genotypes viz., FGK123, FGK124, FGK127, FGK130, FGK132, FGK134, FGK136, FGK137 and Pant Ragini were reported as good donor parents for higher seed yield.

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