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Variability studies in Fenugreek (*Trigonella foenum-graecum* L.) under mid-hill conditions of Bharsar, Uttarakhand

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Twenty genotypes consisting local collections and varieties of fenugreek were evaluated in (RBD) randomized block design for the assessment of genetic variability parameters. Genotypes under observation showed a significant variation (P=0.05) for characters under study. The phenotypic and genotypic coefficient of variability was recorded high for number of branches plant^{-1}, number of pods plant^{-1}, number of seeds pod^{-1}, test weight and seed yield indicating wide range of variations among genotypes and offered opportunities for crop improvement. High to moderate heritability for all the characters under study with two genotypes having high genetic advance and rest of all having low genetic advance was observed among genotypes. The phenotypic and genotypic correlation among characters showed positive association of yield with days to fifty percent flowering, plant height, pod length, number of seeds pod-1, harvest index and test weight. The path coefficient study revealed that among all characters studied number of pods, harvest index, dry matter, number of seeds pod-1 and plant height had direct positive effect on seed yield indicating importance of characters for the selection of high yielding genotypes.

Key words: Variability, Heritability, Correlation, Path coefficient, Trigonella foenum-graecum

Fenugreek (*Trigonella foenum-graecum* L.), is an annual herb indigenous to Mediterranean region widely distributed throughout the world. It belongs to the family Fabaceae, having somatic chromosome number 2n=2x=16. It is widely cultivated as a leafy vegetable, condiment and seed spice. The seeds are used as spices worldwide, whereas the leaves are used as green leafy vegetable. It is principle constituents of curry powder used in India. Moreover, also possesses medicinal properties. Its seeds had been used in local health tradition for treatment of ailments such as, dysentery, enlargement of lever span, gout, baldness, leucorrhoea, mouth ulcer, abdominal pain, kidney problem, diabetes, dropsy, spleen, obesity, etc. (Jain *et al.,* 2013). It is an erect hairy annual growing upto 30-60 cm. It has long slender stems bear tripartite leaves, light green ovate leaves toothed on margins. The flowers are white or pale yellow in colour. The plant bears thin, sword-shaped pods with a curved tip, carrying 10-20 small hard, yellowish-brown seeds (Helambe and Dande, 2012).

MATERIALS AND METHODS

The experiment was carried out at College of Horticulture, VCSG Uttarakhand University of Horticulture and Forestry, Bharsar. The altitude of the experimental site is about 1900 m asl at a longitude of 78.990 E and latitude of 30.0560 N. (Anon., 2012). The estimate of PCV (phenotypic coefficients of variation) and GCV (genotypic coefficients of variation) were worked out as method given by Burton (1953) and heritability, genetic advance genetic variability and character association were determined by following the methodology of Johnson *et al.,* (1955). Phenotypic and genotypic correlation coefficients for seed yield were estimated by following Al- Jibouri *et al.*, (1958) methodology while path coefficient analysis was determined by Dewey & Lu (1959) method.

RESULTS AND DISCUSSION

Perusal of the data presented in table 1&2 indicates wide range of variation **a**mong the treatments for range of characters under observation. Days to fifty percent germination, days to fifty percent flowering and days to harvest maturity are traits indicating earliness in the genotype, only one genotype show the early germination and flowering but, mature late than check. Two genotypes show early maturity than check among all the cultivar. So, these cultivars can be used in crop augmentation program for the developing early varieties. In the same way, vigorous branching, pods plant^{-1}, seeds pod^{-1}, pod length, and seed yield, are the major yield traits influencing yield directly or indirectly. Genotypes showing superiority over check for yield and yield attributing traits might be used to develop high yielding varieties. Four genotypes were observed superior over check for various yield and yield attributing characters. Whereas, only two genotypes exhibits superiority over check for dry matter content. Likewise, thirteen genotypes exhibited superiority over check for harvest index. Therefore, these genotypes can be utilized for quality improvement of crop. All the character under study shows significant variations among the different genotypes. The results observed are in accordance with (Sharma and Shastry *et al.,* 2008, Prajapati *et al*., 2014 and Giridhar *et al.,* 2015).

The assessment of PCV and GCV shows variations present in on hand germplasm. For the characters studied, higher magnitude of PCV than GCV was obtained, though the difference was very less in a good number of the traits. This indicates that these traits are minimally influenced by environmental factors. Generally, coefficients of variation were of higher to lower magnitude suggesting that genetic diversity was present in the germplasm. The findings are in conformity with (Banerjee and Kole, 2004, Sharma and Sastry, 2008; Prajapati *et al.,* 2010, Pushpa *et al.,* 2012 and Jain *et al.,* 2013). The PCV was estimated high for days to fifty percent germination, plant length, branches number, pods number, seeds pod^{-1}, test weight and yield which were in concord with (Banerjee and Kole, 2004, Sarada *et al.,* 2008, Prajapati *et al.,* 2010, Dashora *et al.,* 2011, Dashora *et al.,* 2012, Singh *et al.,* 2012 and Jain *et al.,* 2013). GCV was observed high for branches number, pod number, seeds pod^{-1}, test weight, and yield moderate for plant height and low for days to fifty percent flowering which was in harmony with (Banerjee and Kole, 2004, Sarada 2008, Prajapati *et al.,* 2010,

Singh *et al.,* 2012 and Jain *et al.,* 2013). The concept of heritability has a production value in governing a character, generally expressed in per cent. It is a good index for estimating transmission of a trait to offspring from parent (Falconer, 1989). The estimate of heritability is useful for plant breeders in order to select elite genotypes from genetically diverse populations. It estimates the amount of genetic variance to total phenotypic variance. In the present study, heritability ranges from 35.99 to 97.00%. High heritability was observed for days to fifty percent germination, days to fifty percent flowering, plant height, branches number, pod number, pod length, days to maturity, test weight and yield (Chandra *et al.,* 2000, Banerjee and Kole, 2004, Sharma and Sastry, 2008, Prajapati *et al.,* 2010, Jain *et al.,* 2013 and Singh *et al.,* 2012), and for harvest index by (Dashora *et al.,* 2011 and Dashora *et al.,* 2012). High heritability was observed for number of seed pod^{-1} by (Sarada *et al.,* 2008). Genetic gain under assortment of per cent of the population mean was low to high for various characters studied. The range was from 9.50% to 93.54%. It was found high for the characters *viz.* number of pods, seed yield and test weight which were in close agreement with (Chandra *et al.,*2000, Banerjee and Kole, 2004, Sarada *et al.,* 2008 and Prajapati *et al.,* 2010). High heritability is accompanied by high genetic gain for yield, test weight and seeds pod^{-1} indicating more scope of selection on the basis of these traits. Which is similar to the findings of (Chandra *et al.,* 2000, Banerjee and Kole, 2004 and Sarada *et al.,* 2008) shown in table 3.

Correlation analysis provides information for the recognition of important characters to be considered during crop improvement program. Direct selection for complex traits such as yield is not notably efficient as they are polygenic traits and their expression depends on the performance of a range of component traits. So, for developing high yielding genotypes, assortment should be intended through contributing traits which necessitate the comprehension of their extent of association with yield. The genotypic correlation coefficients were higher in magnitude than phenotypic correlation coefficients presented in table 4. The information on nature and enormity of correlation coefficients helps in determining selection criteria for noteworthy progress characters along with economic yield. The genotypic correlation coefficient for seed yield had a significant positive association with days to fifty percent flowering, plant height, pod length, seeds pod^{-1}, harvest index and test weight. Similarly, seed pod^{-1} has significant positive correlation with days to fifty percent flowering, plant height and pod length. Pod plant^{-1} has significant correlation with days to fifty percent germination and branches plant^{-1}. Pod length had significantly positive correlation with days to fifty percent flowering and plant height which was also observed by (Chandra *et al.,* 2000), Banerjee and Kole, 2004, Dashora *et al.,* 2011 and Jain *et al.,* 2013). Although, correlation studies provide useful information in estimating the yield components but it does not provide information about the nature and degree of contributions made by number of independent traits.

Path coefficient estimates provides basis for allocation of appropriate weightage to various attributes while designing a program for the improvement of crop yields represented in table 5. In order to recognize factors contributing significantly towards seed yield, the estimates of direct and indirect effects were also computed through path coefficient analysis depicted in table 3. The path coefficient analysis revealed that out of all characters studied number of pods had maximum and direct positive effect on seed yield followed by harvest index, percent dry matter, number of seeds per pod and plant height whereas, number of branches had maximum direct negative effect on seed yield followed by days to fifty percent germination, days to harvest maturity, days to fifty percent flowering, pod length and test weight. Further, Test weigh had maximum indirect positive effect on seed yield followed by pod length, harvest index, number of seed per pod, plant height, days to fifty percent flowering, days to fifty percent germination, number of branches and number of pods whereas, days to harvest maturity had indirect negative effect on seed yield previously done experiment by (Banerjee and Kole, 2004, Sharma and Shastry, 2008, Kole and Saha, 2013) also reported similar effect of yield attributing characters on seed yield.

Table 1: Performance of genotype for morphological and yield traits.

Name of Genotype	Days to 50% germination ± SE(m)	Days to 50% flowering ± SE(m)	Days to harvest maturity ± SE(m)	Plant height ± SE(m)	Number of branches per plant ± SE(m)	Number of pods per plant ± SE(m)
Belwari Local	7.00 ± (0.577)	51.67 ± (2.028)	100.67 ± (1.453)	27.59 ± (2.009)	2.47 ± (0.521)	6.27 ± (0.982)
Rudhauli Local	7.67 ± (0.882)	51.67 ± (1.764)	95.33 ± (1.453)	20.27 ± (2.146)	2.13 ± (0.353)	3.67 ± (0.333)
Kammarpur Local	9.00 ± (0.577)	60.67 ± (1.202)	107.33 ± (1.202)	22.82 ± (1.384)	3.27 ± (0.593)	7.40 ± (2.139)
Ramnagar Local-1	7.33 ± (0.667)	55.67 ± (1.764)	96.00 ± (2.082)	30.18 ± (0.451)	3.80 ± (0.306)	6.60 ± (0.115)
Motigarpur Local	9.00 ± (0.577)	49.67 ± (1.333)	104.33 ± (2.603)	22.15 ± (0.536)	2.40 ± (0.115)	3.93 ± (0.533)
Misipur Local	10.00 ± (0.577)	45.33 ± (1.453)	118.67 ± (1.202)	24.17 ± (2.148)	4.13 ± (0.291)	10.33 ± (0.851)
Kanpur Local	7.33 ± (0.333)	58.67 ± (2.028)	90.00 ± (1.000)	26.27 ± (0.871)	2.93 ± (0.467)	5.53 ± (0.481)
Jaunpur Local	9.33 ± (1.453)	54.33 ± (1.764)	117.33 ± (2.028)	23.19 ± (1.581)	2.60 ± (0.115)	6.27 ± (1.881)
Samodhpur Local	9.33 ± (0.882)	63.67 ± (1.453)	96.33 ± (1.453)	29.99 ± (2.282)	3.33 ± (0.406)	6.80 ± (0.611)
Ramnagar Local-2	10.67 ± (0.882)	65.67 ± (2.028)	121.67 ± (1.202)	36.36 ± (1.674)	3.33 ± (0.521)	7.67 ± (1.852)
PEB	10.33 ± (0.882)	54.00 ± (2.082)	91.67 ± (0.334)	32.80 ± (0.490)	3.73 ± (0.353)	7.80 ± (0.808)
Kasuri	10.33 ± (1.453)	53.33 ± (1.856)	125.67 ± (2.028)	18.00 ± (0.070)	5.07 ± (0.437)	19.12 ± (0.924)
Hanumangarh Local	9.00 ± (0.667)	65.67 ± (1.453)	114.67 ± (1.764)	32.13 ± (3.865)	3.27 ± (0.570)	10.69 ± (4.284)
Kotdwara Local	11.67 ± (0.333)	55.00 ± (1.528)	119.33 ± (0.882)	28.95 ± (3.167)	3.13 ± (0.333)	7.60 ± (0.577)
Sankarpur Local	8.33 ± (0.882)	55.33 ± (1.856)	121.33 ± (1.202)	32.29 ± (3.022)	3.73 ± (0.240)	8.53 ± (1.551)
Nainidanda Local	10.67 ± (1.202)	51.00 ± (1.732)	121.67 ± (1.764)	29.55 ± (4.202)	2.40 ± (0.400)	6.13 ± (1.568)
Dugada Local	6.00 ± (0.577)	59.33 ± (1.202)	123.00 ± (1.155)	32.20 ± (1.501)	3.73 ± (0.521)	8.87 ± (1.328)
Adwari Local	9.00 ± (1.155)	64.67 ± (1.453)	97.00 ± (0.577)	28.75 ± (5.032)	3.60 ± (0.115)	7.27 ± (2.146)
Satpuli Local	9.67 ± (1.202)	60.67 ± (1.856)	108.67 ± (1.202)	26.05 ± (2.277)	2.67 ± (0.733)	4.93 ± (1.122)
Pant Ragani*	6.33 ± (0.333)	62.00 ± (1.528)	94.33 ± (1.453)	29.67 ± (7.034)	3.07 ± (0.667)	6.27 ± (3.269)
SE(d)	1.254	2.425	2.123	3.939	0.597	2.427
C.D.(0.05)	2.548	4.928	4.315	8.005	1.212	4.933

Table 2: Performance of genotype for yield traits

Name of Genotype	Pod length ± SE(m)	Number of seeds per pods ± SE(m)	Dry matter content (%) ± SE(m)	Harvest index (%) ± SE(m)	Test weight ± SE(m)	Yield/Plot ± SE(m)
Belwari Local	7.63 ± (0.290)	10.53 ± (0.851)	55.19 ± (6.154)	35.29 ± (0.958)	13.79 ± (0.552)	66.13 ± (5.867)
Rudhauli Local	8.59 ± (0.395)	12.07 ± (0.677)	67.46 ± (6.460)	56.52 ± (5.457)	10.44 ± (0.280)	82.93 ± (10.657)
Kammarpur Local	8.49 ± (0.862)	14.13 ± (1.525)	63.40 ± (3.369)	58.73 ± (4.567)	12.94 ± (0.433)	103.20 ± (9.272)
Ramnagar Local-1	9.22 ± (0.907)	13.27 ± (0.406)	68.70 ± (1.145)	52.99 ± (2.731)	16.73 ± (0.490)	110.40 ± (2.771)
Motigarpur Local	7.22 ± (0.283)	12.73 ± (0.874)	68.63 ± (1.375)	40.94 ± (10.543)	14.07 ± (0.976)	97.60 ± (3.331)
Misipur Local	8.66 ± (0.718)	14.00 ± (0.503)	67.02 ± (1.368)	63.81 ± (7.854)	18.70 ± (0.700)	115.20 ± (15.123)
Kanpur Local	9.71 ± (0.725)	12.93 ± (0.897)	61.62 ± (0.651)	42.11 ± (3.605)	14.32 ± (0.892)	79.20 ± (4.866)
Jaunpur Local	9.04 ± (0.493)	13.80 ± (1.400)	63.82 ± (5.677)	39.11 ± (6.526)	20.86 ± (0.678)	76.00 ± (6.214)
Samodhpur Local	9.47 ± (1.170)	15.13 ± (0.751)	70.27 ± (4.503)	59.54 ± (6.061)	18.74 ± (0.504)	125.07 ± (4.438)
Ramnagar Local-2	8.16 ± (0.347)	12.93 ± (0.677)	71.74 ± (2.860)	64.66 ± (1.383)	31.06 ± (0.650)	139.20 ± (25.716)
PEB	9.78 ± (0.940)	14.07 ± (0.581)	65.59 ± (2.012)	69.27 ± (4.089)	30.34 ± (0.979)	261.87 ± (18.015)
Kasuri	2.26 ± (0.288)	7.55 ± (0.454)	50.34 ± (5.067)	57.67 ± (7.405)	9.79 ± (0.460)	63.73 ± (1.867)
Hanumangarh Local	10.61 ± (1.454)	12.73 ± (0.240)	65.44 ± (9.545)	66.24 ± (0.448)	25.97 ± (1.282)	224.00 ± (14.518)
Kotdwara Local	9.93 ± (1.283)	13.07 ± (0.593)	71.76 ± (2.049)	41.02 ± (9.852)	15.87 ± (0.925)	102.93 ± (21.651)
Sankarpur Local	7.69 ± (0.157)	12.67 ± (1.213)	58.18 ± (4.369)	54.02 ± (2.051)	21.85 ± (1.011)	84.27 ± (9.253)
Nainidanda Local	8.17 ± (1.617)	14.47 ± (0.546)	74.45 ± (0.137)	42.31 ± (4.712)	21.74 ± (1.030)	84.27 ± (9.253)
Dugada Local	9.87 ± (0.822)	14.07 ± (0.291)	68.13 ± (3.914)	59.95 ± (5.420)	19.70 ± (0.881)	136.00 ± (25.399)
Adwari Local	10.34 ± (1.032)	14.47 ±(0.437)	80.75 ± (3.618)	52.06 ± (4.720)	17.83 ± (0.605)	122.67 ± (36.536)
Satpuli Local	9.42 ± (1.162)	12.20 ±(1.361)	63.45 ± (3.777)	61.09 ± (1.598)	13.06 ± (0.583)	97.33 ± (5.353)
Pant Ragani*	7.65 ± (1.150)	13.27 ± (0.742)	73.60 ± (2.403)	42.78 ± (3.887)	19.57 ± (0.910)	117.60 ± (13.910)
SE(d)	1.113	1.152	5.886	7.864	1.132	22.001
C.D.(0.05)	2.261	2.341	11.961	15.981	2.300	44.711

Table 3. Estimates of the phenotypic and genotypic coefficient of variability, heritability, genetic advance and genetic gain for different traits

Character	Range	Mean ± S.E(m)	COV (%)		Heritability (%)	Genetic Advance (%)	Genetic Gain (%)
			Phenotypic	Genotypic			
Days to 50 per cent germination.	5.67	8.87 ±1.25	21.03	18.00	73.29	2.85	31.75
Days to 50 per cent flowering.	20.33	56.90 ±2.42	11.01	9.70	77.54	10.01	17.589
Plant height (cm).	18.36	27.67 ±3.94	20.03	18.66	86.86	9.78	35.832
Number of branch per plant.	2.93	3.24 ±0.60	24.44	21.28	75.80	1.26	38.165
Number of pods per plant	15.45	7.58 ±2.43	47.28	46.34	96.06	6.71	93.549
Number of seed per pod.	7.58	13 ±1.15	24.28	23.20	91.28	3.88	45.659
Pods length (cm).	8.35	8.60 ±1.11	15.27	11.96	61.34	2.50	19.298
Dry matter (%)	30.41	66.48 ±5.89	12.82	7.69	35.99	6.35	9.503
Harvest index	33.98	53.01 ±7.86	17.76	16.30	84.16	16.39	30.795
Day to harvesting maturity	35.67	108.25 ±2.12	11.52	11.27	95.65	24.57	22.696
Test weight (g)	21.27	18.37 ±1.13	32.65	32.16	97.00	12.00	65.237
Seed yield per plot (g)	7.93	4.59 ±0.63	45.02	43.51	93.42	3.97	86.628

Table 4. Phenotypic and Genotypic coefficients of correlation among different traits in Fenugreek

Characters		DG	DF	PH	NOB	NOP	PL	NOS	PDM	HI	DHM	TW	YPP
DG	P	1.000	-0.136	0.032	0.296*	0.464**	-0.119	-0.146	-0.060	0.300*	0.392**	0.148	0.104
	G	1.000	-0.200	0.090	0.417**	0.532**	-0.134	-0.127	-0.059	0.416**	0.460**	0.196	0.114
DF	P			0.206	0.022	-0.128	0.260*	0.185	0.194	0.224	-0.145	0.286*	0.335**
	G			0.265*	0.014	-0.118	0.329*	0.259*	0.406**	0.285*	-0.140	0.345**	0.369**
PH	P				0.059	-0.073	0.376**	0.383**	0.261*	0.064	0.187	0.649**	0.360**
	G				0.056	-0.093	0.415**	0.467**	0.371**	0.062	0.212	0.712**	0.386**
NOB	P					0.734**	-0.269*	-0.160	-0.156	0.496**	0.350**	0.007	0.092
	G					0.812**	-0.368**	-0.191	-0.367**	0.590**	0.401**	0.027	0.091
NOP	P						-0.477**	-0.446**	-0.381**	0.414**	0.536**	-0.057	0.010
	G						-0.521**	-0.572**	-0.680**	0.476**	0.553**	-0.057	0.012
PL	P							0.547**	0.359**	0.077	-0.309*	0.378**	0.531**
	G							0.689**	0.465**	0.069	-0.335**	0.409**	0.562**
NOS	P								0.559**	-0.207	-0.203	0.416**	0.316*
	G								0.969**	-0.216	-0.216	0.548**	0.413**
PDM	P									-0.168	-0.134	0.223	0.174
	G									-0.238	-0.262*	0.452**	0.303*
HI	P										0.327*	0.230	0.487**
	G										0.340**	0.249	0.508**
DHM	P											0.154	-0.145
	G											0.158	-0.165
TW	P												0.712**
	G												0.745**
YPP	P												1.000
	G												1.000

Where,

*(Significant at 5% level of significance), ** (Significant at 1% level of significance)

DG (Days to fifty percent germination), DF (Days to fifty percent flowering), PH (Plant Height), NOB (Number of Branches per plant) NOP (Number of Pod per plant), PL (Pod Length) NOS (No. of seed per pod), PDM (Percentage dry matter), HI (Harvest index), DHM (Days to harvest maturity), TW (Test weight), YPP (Yield per plot)

Table 5. Genotypic path estimates of direct and indirect effects of different traits on seed yield per plot in fenugreek

Characters	DG	DF	PH	NOB	NOP	PL	NOS	PDM	HI	DHM	TW	YPP
DG	**-0.998**	0.164	0.050	-0.937	1.725	0.029	-0.102	-0.077	0.736	-0.443	-0.032	0.114
DF	0.199	**-0.820**	0.147	-0.031	-0.381	-0.070	0.210	0.532	0.504	0.135	-0.056	0.369**
PH	-0.090	-0.217	**0.555**	-0.126	-0.302	-0.089	0.377	0.486	0.110	-0.204	-0.115	0.386**
NOB	-0.417	-0.011	0.031	**-2.245**	2.636	0.079	-0.154	-0.481	1.045	-0.387	-0.004	0.091
NOP	-0.531	0.096	-0.052	-1.824	**3.245**	0.111	-0.462	-0.891	0.843	-0.533	0.009	0.012
PL	0.134	-0.270	0.231	0.826	-1.690	**-0.214**	0.556	0.609	0.122	0.323	-0.066	0.562**
NOS	0.127	-0.213	0.259	0.428	-1.856	-0.147	**0.808**	1.269	-0.382	0.208	-0.089	0.413**
PDM	0.059	-0.333	0.206	0.825	-2.205	-0.099	0.782	**1.310**	-0.421	0.252	-0.073	0.303*
HI	-0.415	-0.234	0.034	-1.326	1.546	-0.015	-0.174	-0.311	**1.770**	-0.327	-0.040	0.508**
DHM	-0.459	0.115	0.118	-0.901	1.796	0.072	-0.174	-0.343	0.602	**-0.963**	-0.026	-0.165
TW	-0.195	-0.283	0.396	-0.061	-0.186	-0.087	0.443	0.592	0.441	-0.152	**-0.162**	0.745**

Residual effect = 0.182

DG (Days to fifty percent germination), DF (Days to fifty percent flowering), PH (Plant Height), NOB (Number of Branches per plant) NOP (Number of Pod per plant), PL (Pod Length) NOS (No. of seed per pod), PDM (Percentage dry matter), HI (Harvest index), DHM (Days to harvest maturity), TW (Test weight), YPP (Yield per plot)

CONCLUSION

On the basis of average performance of genotype, it

can be predicted that Kammarpur Local Dugada Local Adwari Local Hanumangarh Local, PEB, Ramnagar Local-2 Sankarpur Local, Nainidanda Local, Ramnagar Local-2 Jaunpur Local, were superior over other entries and over standard checks for yield, quality and other important horticultural traits. All the genotypes was found superior for most of the character under study such as plant height, number of branches, number of pod, pod length, number of seed per pod, days to harvest maturity, test weight, seed yield. Therefore, they can be further evaluated for stability analysis. Further, all these genotypes can also be utilized in future breeding programs for their superior characters. High heritability coupled with high genetic advance as per cent of mean and GCV were observed for number of pods, seed yield and test weight indicating the presence of additive gene effects suggesting more scope of selection for these traits. The path coefficient analysis revealed that out of all characters studied number of pods, harvest index, percent dry matter, number of seeds per pod and plant height had maximum direct positive effect on seed yield whereas, number of branches, days to fifty percent germination, days to harvest maturity, days to fifty percent flowering, pod length had maximum direct negative effect on seed yield. These results showed that selection should be made on the basis of these characters for yield improvement in fenugreek.

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CONFLICTS OF INTEREST

Conducted research as a part of Master's research and there are no competing interests.

REFERENCES

Al-Jibouri, H.W., Miller, P.A. and Robinson, H.F. (1958). Genotypic and environmental variances and co-variances in an upland cotton cross of inter-specific origin. *Agronomy Journal* 50: 633-636.

Anonymous. (2012). Indian Metrological Department. Metrological Data Base. pp.10.

Banerjee A and Kole P C. (2004). Genetic variability, correlation and path analysis in fenugreek (*Trigonella foenum-graecum* L.). *Journal of Spices and Aromatic Crops* 13(1): 44-48.

Burton G W and De Vane E W. 1953. Estimating heritability in tall fescue (*Festuca arundiancea*) from replicated clonal material. *Proejtunniens* 9(22): 12-15.

Chandra, K., Sastry, E.V.D and Singh, D. (2000). Genetic variation and character association of grain yield and its component characters in fenugreek. *Agricultural Science Digest* 20: 93-95.

Dashora, A., Maloo, S. R. and Dashora, L. K. (2011). Variability, correlation and path coefficient analysis in fenugreek (*Trigonella foenum-graecum.* L.) under water limited conditions. *Journal of Spices and Aromatic Crops* 20(1): 38–42.

Dashora, A., Maloo, S.R. and Verma, P. (2012). Assesment of genetic variability in fenugreek (*Trigonella foenum-graecum* L.) *International Journal of Seed Spices* 2(1): 63-65.

Dewey J R and Lu K H. (1959). Correlation and path analysis of components of crested wheat grass seed production. *Agronomy Journal* 51: 515-518.

Giridhar, K., Kumari, S.S., Rajani, A., Sarada, C. and Naidu, N.L. (2015). Identification of potential genotypes of fenugreek in rainfed vertisols for yield and diosgenin content. *Indian Journal of Agricultural Research* 13(2): 2-7.

Helambe and Dande. (2012). Fenugreek (*Trigonella foenum-graecum* L.): An Overview. *International Journal of Current Pharmaceutical Review and Research* 2(4): 169-187.

Jain, A., Singh, B., Solanki, R.K., Saxena, S.N. and Kakani, R.K. (2013). Genetic variability and character association in fenugreek (*Trigonella foenum-graecum* L.). *International Journal Seed Spices* 3(2): 22-28.

Jain, A., Singh, B., Solanki, R.K., Saxena, S.N. and

Kakani, R.K. (2013). Genetic variability and character association in fenugreek (*Trigonella foenum-graecum* L.). *International Journal Seed Spices* 3(2): 22-28.

Johanson, H. W., Robinson, H. F. and Comstock, R.E. (1955). Estimates of genetic and environmental variability in soybean. *Agronomy Journal* 47: 314-318.

Kole P C and Saha A. (2013). Correlation co-efficient of component characters with seed yield and their direct effects in path analysis in fenugreek. *Journal of Horticulture and Forestry* 5(1): 17-20.

Prajapati, D.B., Ravindrababu, Y. and Prajapati, B.H. (2010). Genetic variability and character association in fenugreek (*Trigonella foenum-graecum* L.). *Journal of Spices and Aromatic Crop* 19 (1 & 2): 61–64.

Pushpa, T.N., Chandregowda, M., Srikantaprasad, D. and Gowda, A.P.M. (2012). Evaluation of fenugreek (*Trigonella foenum-graecum* L.) genotypes for growth and seed yield. *Crop Research* 43 **(1, 2 & 3)**: 238-244.

Sarada, C., Giridhar, K. and Rao, H. N. (2008). Studies on genetic variability, heritability and genetic advance in fenugreek (*Trigonella foenum-graecum* L.). *Journal of Spices and Aromatic Crops* 17(2): 163-166.

Sharma, K.C. and Sastry, E.V.D. (2008). Path analysis for seed yield and its component characters in fenugreek (*Trigonella foenum-graecum* L.). *Journal of Spices and Aromatic Crops* 17(2): 69-74.

Singh, K.P., Jain, P.K., Sengupta, S.K., Mehta, A.K. and Nair, B. (2012). Variability, heritability and genetic advance in fenugreek (*Trigonella foenum-graecum* L.) germplasms. *Jawaharlal Nehru Krishi Vishwa Vidyalaya Research Journal* 46(3): 328-332.