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Evaluation of the Relations between Yield and Yield Components of Fenugreek (*Trigonella foenum-graecum* L.) by Correlation and Path Analysis

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ABSTRACT: The present experiment conducted during *Rabi* season of the year 2019-2020 at Main Experiment Station of Department of Vegetable Science Acharya Narendra Deva University of Agriculture and Technology, Narendra Nagar (Kumarganj), Faizabad (Ayodhya) Uttar Pradesh, India. Observation was recorded for growth and yield attributes traits and found that highly significant and positive correlation with length of pod was showed by seed yield plant^{-1} whereas days to maturity, 1000-seed weight, and days to 50% flowering showed highly significant and negatively correlation with seed yield per plant. Whereas direct and indirect effect at both phenotypic and genotypic level elucidated that days to 50% flowering have substantial positive direct effect on seed yield plant^{-1} while negative direct effect was exhibited by days to maturity followed by 1000 seed weight and seeds pod^{-1}. Regarding indirect contribution days to maturity via days to 50% flowering and secondary branches plant^{-1} via days to maturity inhibited substances position and negative effects respectively thus, selection of length of pod and days to 50% flowering should take into consideration during selection in yield input. Major objective of this study was to evolve new varieties with higher yield and its attributing traits. Improvement made in crop varieties is mainly concentrated on increasing yield and yield attributing characters.

Keywords: Correlation, Coefficient, Effect Fenugreek, Path.

INTRODUCTION

Fenugreek scientifically known as *Trigonella foenum-graecum* L. is an herbaceous, diploid (consisting 2n=16) species, in India usually grown widely with its localism name "Methi". Fenugreek originated from West Asia and South-Eastern Europe belongs to the family "fabaceae". There are 50 species mostly of Mediterranean and oriental origin comprises in the genus *Trigonella*. Fenugreek have bisexual flower and self-pollinated in pollination behavior.

Fenugreek grown for both purpose seed as well as leaves, is one of the most important spices and condiment crop. In North India and other subcontinent it is grown widely for its seeds and green leaves. In the genus *Trigonella* there are two species which have economic importance *viz*., *T. foenum graecum* L., the common methi and *T. corniculata*, the kasthuri methi. These both species are pay a major contribution in our national economy. It is widely cultivated in India, Bangladesh, Turkey, Morocco, China, Egypt, France, Spain, Nepal, North Africa, Pakistan, East Africa, Russia and Argentina. India is the major exporter and producer of this seed spices crops. India is the major fenugreek growing states are Rajasthan, Gujarat, Tamil Nadu, Madhya Pradesh, Haryana, Uttar Pradesh Punjab and Maharashtra. In India fenugreek is cultivated on the total area of 120 (000) ha. with 188 (000) metric tonnes annual production (Anonymous, 2019-20).

Improvement in the quantitative desired traits in crop bringing by followed simply selection and hybridization methods approaches. End product of various character is yield, influence directly or indirectly the plant growth. Study of the correlation coefficient provide us knowledge about different association present among yield and attributing traits. But it is elucidate only about the magnitude and direction of relationship among traits whereas to partitioning the association into direct and indirect effect we need help of path coefficient analysis for various component of yield. Path analysis is simply standardized partial regression coefficient, which splits the correlation coefficient into the measure of direct and indirect effects of a set of independent variables on the dependent variables. It carried out using the estimates of correlation coefficients.

MATERIAL AND METHODS

The present study was conducted in *Rabi* season of 2019-20 at Main Experiment Station (Vegetable Research Farm), Narendra Nagar (Kumarganj), Ayodhya (U.P.) India. Humid sub-tropical climate is found in Narendra Nagar and geographically located in between 24.47° and 26.56° N latitude and 82.12° and 83.98° E longitude at an altitude of 113 m above from sea level in the Gangetic Alluvial plains of eastern Uttar Pradesh. The present investigation was carried out in Augmented Block Design with 3 check variety where plot size is 2m × 0.90m. Spacing maintain between row to row 30 cm and plant to plant is 10 cm. Genetic material use in the research consisting 75 selected germplasm including 3 checks of fenugreek. The check varieties were Hisar Sonali (C.C.S.H.A.U., Hisar, and Haryana), Pusa Early Bunching (IARI, New Delhi) and NDM-1 (A.N.D.U.A.T., Kumarganj, Ayodhya, and Uttar Pradesh). To raise healthy crops all recommended agronomic practices for the region were adopted. Five plants were randomly selected and tagged before flowering from each plot to investigate on different characters under study. For the data observation 11 characters were considered *viz.*, Days to 50% flowering, Plant height (cm), Primary branches per plant, Secondary branches per plant, Days to maturity, Pods per plant, Length of pod (cm), Seeds per pod, 1000-seed weight (g), Seed yield per plant (g), Seed yield (q/ha).

The overall mean values of different characters were subjected to statistical analysis. The statistical analysis was done by using the techniques of analysis of "Augmented Block Design". These designs were developed by Federer (1956). The basic concept of correlation was developed by Galton (1889) which was later elaborated and discussed by Searle (1964). The estimates of direct and indirect effects were calculated by the path coefficient analysis as suggested by Wright (1921) and elaborated by Dewey and Lu (1959).

RESULTS AND DISCUSSION

A. Correlation coefficient

The correlation coefficients among various traits were examined out in all feasible growth and yield characters with seed yield plant^{-1} (g). Association between various morphological traits with seed yield plant^{-1} (g) are given in Table 1. The most important traits seed yield plant^{-1} exhibited positive and highly significant association with length of pod (0.408) while negatively and highly significant correlation with days to maturity (-0.653) followed by 1000-seed weight (-0.645), days to 50% flowering (-0.629) and plant height (-0.210). 1000-seed weight showed significant and positively relationship with plant height (0.435) followed by secondary branches per plant (0.281), length of pod (0.248), days to maturity (0.245), days to 50% flowering and pods per plant (0.224). Seeds per pod showed highly significant and positive correlation with secondary branches per plant (0.630) followed by pods per plant (0.592), primary branches per plant (0.353), length of pod (0.298), while highly significant and negatively correlation with plant height (-0.263). Length of pod showed highly significant and positive correlation with pods per plant (0.332) while highly significant and negatively correlation with days to 50% flowering (-0.484) followed by days to maturity (-0.371). Pods per plant showed highly significant and positive correlation with secondary branches per plant (0.619) followed by days to maturity (0.350) and primary branches per plant (0.243) while significant and negative correlation with plant height (-0.241). Days to maturity showed highly significant and positive correlation with days to 50% flowering (0.946) followed by secondary branches per plant (0.538), primary branches per plant (0.372). Secondary branches per plant showed highly significant and positive correlation with primary branches per plant (0.481) followed by days to 50% flowering (0.447). Primary branches per plant showed highly significant and positively correlation with days to 50% flowering (0.503) followed by plant height (0.442). Plant height showed highly significant and positive correlation with days to 50% flowering (0.368). Similar findings have been also reported by Kole *et al.* (2013); Lodhi *et al.* (2015); Fikreselassie *et al.* (2012).

Table 1: Estimates of correlation coefficient between nine characters in fenugreek genotypes.

Traits	Days to 50% flowering	Plant height (cm)	Primary branches/plant	Secondary branches/plant	Days to maturity	Pods per plant	Length of pods (cm)	Seeds/pod	1000 seed weight	Seed yield per plant (g)
Days to 50% flowering	**1.000**	0.368*	0.503**	0.447**	0.946**	0.160	-0.484**	0.011	0.228*	**-0.629****
Plant height (cm)		**1.000**	0.442**	-0.147	0.161	-0.241*	0.077	-0.263**	0.435**	**-0.210****
Primary branches/plant			**1.000**	0.481**	0.372**	0.243*	-0.118	0.353**	-0.090	**0.182**
Secondary branches/plant				**1.000**	0.538**	0.619**	0.134	0.630**	0.281*	**-0.157**
Days to maturity					**1.000**	0.350**	-0.371**	0.079	0.245*	**-0.653****
Pods per plant						**1.000**	0.332**	0.592**	0.224*	**0.064**
Length of Pods (cm)							**1.000**	0.298*	0.248*	**0.408****
Seeds/pod								**1.000**	0.056	**0.172**
1000 seed weight									**1.000**	**-0.645****

*; ** significant at 5% and 1% probability levels, respectively

B. Path analysis

The path coefficient analysis evolved by Wright (1920) has been successfully utilize by many workers in different crops for separating the genotypic association and phenotypic correlation coefficient into direct and indirect effects. Table 2 showed the direct and indirect effect of various traits on seed yield per plant. The higher magnitude of positive direct effect on seed yield per plant was exerted by days to 50% flowering (0.942) followed by length of pod (0.460), pods per plant (0.403), primary branches per plant (0.311), secondary branches per plant (0.040). In contrast, days to maturity (-1.454), 1000-seed weight (-0.589), seeds per pod (-0.254), plant height (-0.202) contributed considerable negative direct effect on seed yield per plant. Regarding positive and higher indirect effect on seed yield per plant was exerted by days to maturity (0.891) followed by primary branches per plant (0.437), secondary branches per plant (0.421) and plant height (0.346) via days to 50% flowering . Negative indirect effect on seed yield per plant was exerted by secondary branches per plant (-0.783) followed by primary branches per plant (-0.540), pods per plant (-0.509) and 1000-seed weight (-0.357) via days to maturity. Earlier, positive direct effect on seed yield has been reported Singh *et al*. (2016); Pathak *et al.* (2014); Prakash *et al.* (2021).

Table 2: Direct and indirect effects of different characters on seed yield per plant in fenugreek germplasm.

Traits	Days to 50% flowering	Plant height (cm)	Primary branches/plant	Secondary branches/plant	Days to maturity	Pods per plant	Length of pods (cm)	Seeds/pod	1000 seed weight	Correlation with Seed yield per plant (g)
Days to 50% flowering	**0.942**	-0.074	0.156	0.018	-1.375	0.064	-0.223	-0.003	-0.134	**-0.629****
Plant height (cm)	0.346	**-0.0202**	0.138	-0.006	-0.235	-0.097	0.035	0.067	-0.256	**-0.210****
Primary branches/plant	0.473	-0.0890	**0.311**	0.019	-0.540	0.098	-0.054	-0.089	0.053	**0.182**
Secondary branches/plant	0.421	0.030	0.150	**0.040**	-0.783	0.250	0.062	-0.160	-0.166	**-0.157**
Days to maturity	0.891	-0.033	0.116	0.021	**-1.454**	0.141	-0.171	-0.020	-0.144	**-0.653****
Pods per plant	0.150	0.049	0.076	0.025	-0.509	**0.403**	0.153	-0.150	-0.132	**0.064**
Length of Pods (cm)	-0.456	-0.016	-0.037	0.005	0.540	0.134	**0.460**	-0.076	-0.146	0.408**
Seeds/pod	0.010	0.053	0.110	0.025	-0.115	0.239	0.137	**-0.254**	-0.033	0.172
1000 seed weight	0.215	-0.088	-0.011	0.011	-0.357	0.090	0.114	-0.014	**-0.589**	-0.645**

R Square -0.42109; Residual effect =1.192096

CONCLUSIONS

With the help of finding observation it can be concluded that there exists ample variation within the germplasm of fenugreek**.** Out of seventy five genotypes, entries NDM-97, NDM-116, NDM-1, NDM-37, NDM-137, NDM-20, NDM-57, NDM-76, NDM-14 and NDM-132 were found superior for seed yield per plant and after proper testing through multi-locational yield trials these are may be recommended for cultivation on large scale among the farmers and can be utilize as donors in breeding programme. Crossing between genotypes of cluster VIII and cluster VI may give rise desirable F1/segregates in future.

FUTURE SCOPE

The current experiment would lay the groundwork for future researchers interested in working on the diverse breeding program. The obtained elite varieties could be used as donor parents for economic traits. Crossing between genotypes of cluster VIII and cluster VI which have high inter cluster distance may give rise desirable F1/segregates in future.

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Conflict of Interest. None.

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