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ESTIMATE OF CORRELATION AND PATH COEFFICIENT ANALYSIS FOR ECONOMIC TRAITS IN FENUGREEK (*TRIGONELLA FOENUM - GRAECUM* L.)

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ABSTRACT

The experiment was conducted to estimate the correlation and path coefficient analysis for economic traits in twenty genotypes of fenugreek with three replications in Randomized Block Design (RBD) with during *Rabi* season in 2021-22 at Vegetable Research Farm at College of Horticulture, Banda University of Agriculture and Technology, Banda-210001, Uttar Pradesh. The data were recorded on twelve characters for different economic traits in fenugreek. Analysis for inter-relationship between different characters show that days to 50% flowering showed positive and significant correlation with days to maturity whereas negative and significant correlation with plant height, test weight and seed yield per plot (g). Number of branches per plant exhibited positive and significant correlation with pod length (0.501), seeds per with seed yield per plot (0.603). Number of seeds per pod showed significant and positive correlation with seed yield per plot (0.239) at 5% level of significance while it showed highly significant and positive correlation with pod length (0.933) and highly significant and negative correlation with test weight (-0.562). Pod length showed significant and positive correlation with seed yield per plot (0.385) and it showed significant and negative correlation with test weight (-0.380) at both level of significance. Days to maturity showed highly significant and positive correlation with days to 50% flowering (1.253) and it showed highly significant and negative correlation with plant height (-0.751), seed yield per plot (0.330). Test weight showed highly significant and negative correlation with no of seeds per pod (-0.562), days to 50% flowering (-0.512) and pod length (-0.380) and it showed highly significant and positive correlation with seed yield per plot (0.430). The most important character seed yield per plot showed highly significant but negative correlation with days to 50% flowering (-0.330), and it showed highly significant and positive correlation with plant height (0.490), no of pods per plant (0.603), pod length (0.385) and test weight (0.590). Seeds per pod showed highly significant and positive correlation with pod length (0.933) and it showed highly significant and negative correlation with test weight (0.933). Higher magnitude of positive direct effect on seed yield per plot was found in test weight (1.336), plant height (1.012), no. of branches per plant (0.678), no of seeds per pod (0.651) and protein content (0.401). Positive direct effect of remaining traits was found low. In contrast, negative pod (0.478) and it was found significantly but negatively correlated with test weight (-305) and total protein content (-601). Number of pods per plant showed positive and significant correlation direct effect on seed yield per plot was found for pods per plant (-1.056), pod length (-0.731). Regarding indirect effects days to 50% flowering (0.472) via days to maturity, plant height (0.570) via test weight showed indirect effect on seed yield.

Key words : Correlation, Path, Coefficient, RBD.

Introduction

Fenugreek (*Trigonella foenum-graecum* L.), is self-pollinated, annual and one of the oldest medicinal spices belong to the family Leguminaceae with diploid chromosome number (2n=2x=16) and originated in Mediterranean region, Southern Europe and Western Asia. Its vernacular names called Methi (Hindi). The *Trigonella*, derived from *Latin* language that means ‘‘little triangle” due to its yellowish-white triangular flowers (Flammang *et al*., 2004). It is commercially cultivated in India, Pakistan, Afghanistan, Iran, Nepal, Egypt, France,

Spain, Turkey, Morocco, North Africa, Middle East and Argentina. Fenugreek seed, leaves renowned for their distinct aroma that slightly bitter in taste. The genus *Trigonella* have 50 species & only two are cultivated species, that is *Trigonella foenum- graecum* L commonly called "Methi" and *Trigonella corniculata* L. called "Kasuri Methi". Fenugreek seeds and leaves are widely used in cooking, particularly in Indian, Middle Eastern, and North African cuisines. Many health benefits, including better digestion, decreased inflammation, increased milk supply in nursing mothers, and blood sugar regulation, are thought to be associated with it. Many health benefits, many health benefits, including better digestion, decreased inflammation, increased milk supply in nursing mothers, and blood sugar regulation, are thought to be associated with it. Many health benefits, including better digestion, decreased inflammation, increased milk supply in nursing mothers, and blood sugar regulation, are thought to be associated with it.

It is commercially cultivated in India, Pakistan, Afghanistan, Iran, Nepal, Egypt, France, Spain, Turkey, Morocco, North Africa, Middle East and Argentina. India leads the world in both area and production. According to NHB estimates, fenugreek has an area of 122000 ha and a production of 189000 MT in 2018–2019.

The correlation coefficient provides knowledge about the different relationships existing between yield and yield components. It only discloses the direct and magnitude of associations existing between any two characters but the path coefficient analysis helps in dividing the correlation into direct and indirect effects of various components on yield. Path coefficient analysis describes cause and effect relationship between the variables which is unique in splitting the relationship into direct and indirect effects through other variables. Path analysis provides the information of great value to the breeder which helps in identifying the component traits of seed yield per plot.

Materials and Methods

There is total 20 genotypes of fenugreek collected from locally adapted and different research Institutes & SAU. Number of replications is three & Experiment done in Randomized Block Design. The detailed description of the parental lines is given in layout. The experiment was conducted in semi-arid or semi tropics climate of Bundelkhand region at Vegetable Research Farm at College of Horticulture, Banda University of Agriculture and Technology, Banda, Uttar Pradesh during *Rabi* season 2021-22. The distance between row to row and plant to plant is 30m and 10m, respectively. Five plants were randomly selected from each plot of experimental trial and tagged before flowering to investigate on different characters under study. Parameter recorded during the experiment is Days to 50 per cent flowering, Plant height (cm), Number of shoots per plant, Days to maturity, Number of pods per plant, Length of pod (cm), Number of seeds per pod, 1000 seed weight (g), Seed yield per plant (g), Total sugar content (%), Total protein content (%), Total tannin content(mg/100g).

Results and Discussion

In present investigation, genotypic correlation and phenotypic correlation, genotypic correlation is more reliable. Days to 50 % flowering showed positive and significant correlation with days to maturity whereas negative and significant correlation with plant height, test weight and seed yield per plot (g). Number of branches per plant exhibited positive and significant correlation with pod length (0.501), seeds per pod (0.478) and it was found significantly but negatively correlated with test weight (-305) and total protein content (-601). Number of pods per plant showed positive and significant correlation with seed yield per plot (0.603). Number of seeds per pod showed significant and positive correlation with seed yield per plot (0.239) at 5% level of significance. While it showed highly significant and positive correlation with pod length (0.933) and highly significant and negative correlation with test weight (-0.562). Pod length showed significant and positive correlation with seed yield per plot (0.385) and it showed significant and negative correlation with test weight (-0.380) at both level of significance. Days to maturity showed highly significant and positive correlation with days to 50% flowering (1.253) and it showed highly significant and negative correlation with plant height (-0.751), seed yield per plot (0.330). Test weight showed highly significant and negative correlation with no of seeds per pod (-0.562), days to 50% flowering (-0.512) and pod length (-0.380) and it showed highly significant and positive correlation with seed yield per plot (0.430). The most important character seed yield per plot showed highly significant but negative correlation with days to 50% flowering (-0.330), and it showed highly significant and positive correlation with plant height (0.490), no of pods per plant (0.603), pod length (0.385) and test weight (0.590). Seeds per pod showed highly significant and positive correlation with pod length (0.933) and it showed highly significant and negative correlation with test weight (0.933). Days to 50% flowering showed highly significant and positive correlation with days to maturity (Mamatha *et al*., 2017). It had negative correlation with seed yield per plot. Similar results were reported by Wojo *et al*. (2016). Plant height

Table 1 : Estimates of Genotypic correlation coefficient between twelve characters.

Traits	Days taken to 50 % flowering	Plant height (cm)	Number of branches per plant	Number of pods per plant	Number of seeds per pod	Pod length (cm)	Test weight (g)	Days taken to maturity	Total sugar content in seed %	Protein content in seed %	Tannin content in seed mg/100g	Seed yield per plot (g)
Days taken to 50% flowering	**1.000**	-0.867**	-0.012	0.206	0.173	-0.107	-0.512**	1.253**	-0.128	-0.290*	-0.266*	-0.330**
Plant height (cm)		**1.000**	0.265*	-0.029	0.191	0.504**	0.426**	-0.751**	-0.337**	0.244	0.122	0.490**
Number of branches per plant			**1.000**	0.116	0.478**	0.501**	-0.305*	0.066	-0.092	-0.601**	0.034	0.206
Number of pods per plant				**1.000**	0.274*	-0.095	0.261*	0.308*	-0.186	0.048	0.064	0.603**
Number of seeds per pod					**1.000**	0.933**	-0.562**	0.089	-0.380**	-0.069	-0.095	0.239*
Pod length (cm)						**1.000**	-0.380**	-0.085	-0.309*	-0.005	0.090	0.385**
Test weight (g)							**1.000**	-0.650**	0.190	0.186	0.275*	0.590**
Days taken to maturity								**1.000**	-0.275*	-0.333**	-0.058**	-0.190
Total sugar content in seed%									**1.000**	0.010	-0.043	-0.097
Protein content in seed %										**1.000**	0.000	0.147
Tannin content in seed mg/100g											**1.000**	0.249

showed positive and significant correlation with pod length, test weight and seed yield per plot. Similar results were reported by Singh *et al.* (2013), this indicates that plant height is an important trait and it can be directly improved by selecting these characters. No of branches per plant showed positive and significant correlation with seeds per pod (Wojo *et al*., 2016). So, it indicates that no of branches per plant is an important character for seed yield, can be improved by selecting the associated characters. No. of pods per plant showed positive and significant correlation with seed yield per plot. This indicate that no of pods per plant is an important yield contributing character and yield will ultimately increase if breeder selects the genotype having maximum no of plants. Similar results are reported by Prajapati *et al. (*2010), No of seeds per pod showed positive andsignificant correlation with seed yield per plot (Prajapati *et al*., 2012), pod length and significant negative correlation with test weight. Test weight was positively and significantly correlated with seed yield per plot (Mamatha *et al*., 2017). This indicates that selection for this trait would directly improve the seed yield. Rest of the traits low effects on main characters. The most important character seed yield per plot showed positive correlation with plant height, no of pods per plant, no of seeds per pod, pod length and test weight. These results are in accordance with Mamatha *et al.* (2017). Thus it can be concluded that selection of these traits will positively influence the seed yield.

Path coefficient

The path coefficient analysis was derived through genotypic correlation coefficient and

Table 2 : Estimates of phenotypic correlation coefficient for twelve characters in fenugreek.

Traits	Days taken to 50 % flowering	Plant height (cm)	Number of branches per plant	Number of pods per plant	Number of seeds per pod	Pod length (cm)	Test weight (g)	Days taken to maturity	Total sugar content in seed %	Protein content in seed %	Tannin content in seed mg/100g	Seed yield per plot (g)
Days taken to 50% flowering	**1.000**	-0.650**	0.024	0.024	0.124	-0.004	-0.458**	0.588**	-0.121	-0.280*	-0.258*	-0.315*
Plant height (cm)		**1.000**	0.124	0.041	0.036	0.127	0.342**	-0.420**	-0.238	0.118	0.087	0.327*
Number of branches per plant			**1.000**	-0.010	0.433**	0.507**	-0.251	0.094	-0.085	-0.514**	0.030	0.139
Number of pods per plant				**1.000**	-0.097	-0.173	0.025	0.027	-0.027	-0.003	0.037	0.417**
Number of seeds per pod					**1.000**	0.592**	-0.432**	0.309*	-0.311*	-0.041	-0.081	0.193
Pod length (cm)						**1.000**	-0.223	0.124	-0.224	0.033	0.070	0.221
Test weight (g)							**1.000**	-0.241	0.163	0.155	0.250	0.472**
Days taken to maturity								**1.000**	-0.167	-0.148	-0.312*	-0.059
Total sugar content in seed%									**1.000**	-0.001	-0.041	-0.074
Protein content in seed %										**1.000**	0.002	0.125
Tannin content in seed mg/100g											**1.000**	0.232

Table 3 : Phenotypic Path coefficient analysis for twelve characters in fenugreek.

Traits	**Days taken to 50 % flowering**	**Plant height (cm)**	**Number of branches per plant**	**Number of pods per plant**	**Number of seeds per pod**	**Pod length (cm)**	**Test weight (g)**	**Days taken to maturity**	**Total sugar content in seed %**	**Protein content in seed %**	**Tannin content in seed mg/100g**	**Seed yield per plot (g)**
Days taken to 50% flowering	**0.558**	-0.881	-0.003	-0.174	0.101	0.049	-0.674	0.472	-0.041	-0.143	0.114	-0.621**
Plant height (cm)	-0.486	**1.012**	0.212	0.030	0.103	-0.280	0.570	-0.415	-0.110	0.227	-0.053	0.811**
Number of branches per plant	-0.002	0.317	**0.678**	-0.193	0.237	-0.281	-0.535	-0.113	-0.061	0.055	-0.077	0.025
Number of pods per plant	0.092	-0.029	0.124	**-1.056**	-0.175	0.161	0.348	0.273	-0.061	0.037	-0.028	-0.313*
Number of seeds per pod	0.087	0.160	0.247	0.284	**0.651**	-0.582	-0.717	-0.032	-0.118	-0.006	0.041	0.014
Pod length (cm)	-0.037	0.388	0.260	0.233	0.518	**-0.731**	-0.427	0.125	-0.091	-0.002	-0.035	0.202
Test weight (g)	-0.282	0.432	-0.271	-0.275	-0.350	0.233	**1.336**	-0.297	0.062	-0.040	-0.119	0.430**
Days taken to maturity	0.310	-0.493	-0.090	-0.339	-0.024	-0.108	-0.465	**0.851**	-0.064	-0.051	-0.019	-0.492**
Total sugar content in seed%	-0.070	-0.341	-0.128	0.197	-0.236	0.204	0.253	-0.166	**0.326**	-0.177	0.018	-0.120
Protein content in seed %	-0.208	0.599	0.096	-0.103	-0.011	0.003	-0.141	-0.112	-0.151	**0.383**	0.044	0.401**
Tannin content in seed mg/100g	-0.147	0.123	0.121	-0.068	-0.061	-0.059	0.367	0.038	-0.014	-0.039	**-0.432**	-0.171

Table 4 : Genotypic Path coefficient analysis for twelve characters in fenugreek.

Traits	Days taken to 50 % flowering	Plant height (cm)	Number of branches per plant	Number of pods per plant	Number of seeds per pod	Pod length (cm)	Test weight (g)	Days taken to maturity	Total sugar content in seed %	Protein content in seed %	Tannin content in seed mg/100g	Seed yield per plot (g)
Days taken to 50% flowering	**-0.234**	0.041	-0.001	-0.006	-0.009	-0.027	-0.209	-0.108	0.005	-0.100	0.083	-0.565**
Plant height (cm)	0.152	**-0.063**	0.007	-0.004	-0.005	0.097	0.152	0.065	0.010	0.113	-0.028	0.497**
Number of branches per plant	0.004	-0.012	**0.039**	-0.011	-0.014	0.095	-0.094	0.027	0.007	0.030	-0.036	0.036
Number of pods per plant	-0.015	-0.003	0.005	**-0.089**	0.006	-0.026	0.011	-0.036	0.001	0.012	-0.012	-0.145
Number of seeds per pod	-0.033	-0.004	0.008	0.009	**-0.066**	0.296	-0.205	0.008	0.014	-0.003	0.026	0.049
Pod length (cm)	0.016	-0.015	0.009	0.006	-0.049	**0.399**	-0.133	-0.028	0.011	0.001	-0.025	0.191
Test weight (g)	0.110	-0.021	-0.008	-0.002	0.030	-0.119	**0.444**	0.064	-0.007	-0.028	-0.080	0.383**
Days taken to maturity	-0.126	0.020	-0.005	-0.016	0.003	0.056	-0.141	**-0.201**	0.008	-0.036	-0.014	0.452**
Total sugar content in seed%	0.028	0.015	-0.007	0.002	0.022	-0.103	0.073	0.039	**-0.043**	-0.123	0.013	-0.083
Protein content in seed %	0.086	-0.026	0.004	-0.004	0.001	0.001	-0.045	0.027	0.019	**0.272**	0.032	0.367**
Tannin content in seed mg/100g	0.061	-0.005	0.004	-0.003	0.005	0.032	0.111	-0.009	0.002	-0.027	**-0.320**	-0.150

phenotypic correlation coefficients to determine how all the parameters affect directly or indirectly seed yield per plant. Genotypic path coefficient was found greater than phenotypic path coefficient for all the traits and more reliance is placed over genotypic path coefficient analysis. Higher magnitude of positive direct effect on seed yield per plot was found in test weight (1.336), plant height (1.012), No. of branches per plant (0.678), no of seeds per pod (0.651) and protein content (0.401). Positive direct effect of remaining traits was found low. In contrast, negative direct effect on seed yield per plot was found for pods per plant (-1.056), pod length (-0.731). Regarding indirect effects days to 50% flowering (0.472) via days to maturity, plant height (0.570) via test weight showed indirect effect on seed yield. Effect of rest of the traits is low. Path analysis technique was developed by Wright (1921) and demonstrated by Dewey and Lu (1959). Path coefficient splits the correlation coefficient into direct and indirect effects of different traits on yield. Plant height, no of branches per plant, no of seeds per pod, protein content, test weight and days taken to maturity has positive and direct effect on seed yield per plot at both genotypic and phenotypic levels (Fikreselassie *et al*., 2012) in fenugreek. This result indicates that by selecting these traits direct improvement in seed yield of fenugreek is possible. Regarding indirect effect days to 50% flowering, plant height and days to maturity contributed to seed yield.

Conclusion

The most important character seed yield per plot exhibited significant and positive correlation with plant height, no of pods per plant, no of seeds per pod and test weight. Estimates of Path coefficient analysis at genotypic and phenotypic level indicated that test weight and plant height had maximum significant direct positive effect on seed yield per plot.

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