

Correlation and Path coefficient Analysis in Fennel (*Foeniculum vulgare* Mill.)

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ABSTRACT: The present investigation was conducted to study the correlation coefficient and path coefficient analysis for 12 characters in Augmented Block Design of seventy five genotypes with three checks in fennel (*Foeniculum vulgare* Mill.) and it was carried out in Rabi season, 2020-21 at ANDUA&T, Kumarganj, Ayodhya. Correlation studies revealed that the most important trait seed yield/plant had revealed highly significant and positively correlated with plant height (0.338) followed by seed weight/umbel (0.294). Whereas, internodal length (0.166), days to maturity (0.164), days to 50 % flowering (0.157), number. of umbels/plant (0.127) and number of seeds/umbellet (0.010) exhibited positive correlation with seed yield / plant. Higher magnitude of positive direct effect on seed yield/plant was exerted by seed weight / umbel (1.851) followed by number of umbels/plant (1.7311), plant height (0.126), number of seeds/umbellet (0.112) and days to 50% flowering (0.115). While, negative direct effect on seed yield / plant was exerted by number of nodes / plant (-0.128) followed by test weight (-0.09), days to maturity (-0.079) and internodal length (-0.065). This indicates the attributing characters among the genotypes evaluated and will be improved by selection and breeding programme for yield and attributing characters.

Keywords: Fennel, Augmented Block Design, correlation coefficient and path coefficient analysis.

INTRODUCTION

Fennel (*Foeniculum vulgare* Mill. with chromosome number $2n=2x=22$) is one of the most essential seasonal spices and medicinal plants which belong to family Apiaceae. It is originated from Southern Europe and Mediterranean area. Fennel is mostly cultivated in temperate and subtropical regions such as Romania, Russia, Germany, France, Italy, India, Argentina, and U.S.A. In India, the major fennel producing states are Gujarat, Rajasthan and U.P. Annual production of fennel is 137 million tonnes in 83 thousand hectare area (NHB, 2020).

It is an annual or biennial aromatic, stout glabrous herb. It is allogamous plant due to protandrous in which cross pollination up to 82.20 to 91.40% (Ramanujanm *et al.*, 1964). The seed of fennel contains approximately carbohydrates (42.3%), crude fibre (18.5%), minerals (13.4%), fat (10%) and protein (9.5%). The seed contains 0.7% to 6.0% volatile oil depends on the varieties (Kumawat *et al.* 2020). Anethole (70%) and fenchone (12-15%) are main constituents of the fennel seeds which are responsible for sweetness and bitterness respectively. It is extensively used to season and flavour for the various food preparations and in the medication, pharmaceuticals, perfumery, cosmetics

and several industries. Fennel seed, leaf and root have medicinal properties. It is cure the headache, dysentery, appetite loss, gassy colic in children, throat pain, eye strain, stomach pain and improve eyesight. Seeds are used for flavouring soups and liquors, pickles, meat dishes, sauce, bread rolls, pastries and confectionery. In India, there are used as masticatory or for chewing alone or with betel.

Correlation studies combined with path coefficient analysis are a strong tool for studying character associations and their final influence on yield, allowing for appropriate selection techniques. Yield is the end product of various characteristics that have an influence on plant growth either directly or indirectly. The correlation coefficient describes the numerous correlations that exist between the yield and yield component. It simply shows the direction and amount of affiliation between any two characteristics, but path coefficient analysis provides for the correlation to be partitioned into direct and indirect effects of various yields and yield attributes.

MATERIALS AND METHODS

An experiment was conducted at Main Experimental Station, Department of Vegetable Science, Acharya

Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya Uttar Pradesh, during Rabi season 2020-21. Narendra Nagar falls under humid sub-tropical region, receiving an annual mean rainfall about 1200 mm. Geographically Narendra Nagar is located in between 26.556 latitude and 81.841 longitudes at altitude of 98 m above the mean sea level in the Gangetic Alluvial Plains of Eastern Uttar Pradesh of Ayodhya district. Seventy five diverse genotypes consisted as experimental material of fennel (*Foeniculum vulgare* Mill.) with 3 checks viz. NDF-1, RF- 101 and RF-205 within 5 blocks. The experiment was laid out in Augmented Block Design. The seedlings were transplanted at a spacing of 60 × 40 cm suggested agronomical practices and plant protections measure was followed to maintain optimum plant stand. The observations were recorded on 5 randomly selected competency plants from each plot for the characters viz. days to 50 % flowering, plant height (cm), number of branches /plant, number of nodes/plant, internodal length (cm), number of umbels/plant, number of umbellets/umbel, number of seeds/umbellet, days to maturity, seed weight / umbel (g), test weight (g) and seed yield/plant (g). The data were statistically analysed for estimation of correlation coefficient was using formula by Searle (1961) and analysis of path coefficients was done using Dewey and Lu (1959).

RESULTS AND DISCUSSION

Perusal of Table 1 the most important trait seed yield /plant had exhibited highly significant and positive

associated with plant height (0.338) and seed weight/umbel (0.294). Whereas, days to maturity (0.164), days to 50 % flowering (0.157) and internodal length (0.166) had exhibited positive correlation with seed yield / plant. While, number of branches/plant (-0.085), test weight (-0.067) and number of nodes / plant (-0.065) exhibited negatively association with seed yield/plant. Days to 50% flowering revealed highly significant and positively correlated with days to maturity (0.966) and significant and positive correlation with seed weight/umbel (0.226). Days to maturity had significant positive association with seed weight/umbel (0.254) but were negatively correlated with number of umbels / plant (-0.199), test weight (-0.105) and internodal length (-0.077). Plant height showed highly significant and positive association with internodal length (0.343). However, seed weight/umbel (-0.061) was negatively correlated with plant height. Number of umbels/plant was highly significant and negatively correlated with seed weight/umbel (-0.886). Number of umbellets/umbel had significant and positive correlation with number of seeds/umbel (0.257) followed by test weight (0.253). Number of nodes/plant had highly significant and negative correlation with internodal length (-0.860) and negatively correlated with test weight (-0.033). Number of seeds/umbellet presented highly significant and positively correlated with test weight (0.317) while, negatively correlated with seed weight/umbel (-0.146) (Table 1). Similar results were also reported by Yadav *et al.* (2013); Mohan *et al.* (2017); Singh *et al.* (2020).

Table 1: Estimates of correlation coefficient among twelve characters in fennel genotypes.

Character s	Days to maturity	Plant height	Number of branches per plant	Number of umbels per plant	Number of umbellets per umbel	Number of node per plant	Internodal length	Number of seeds per umbellet	Seed weight per umbel	Test weight	Seed yield per plant
Days to 50% flowering	0.966**	0.041	0.133	-0.178	0.066	0.056	-0.049	-0.050	0.226*	-0.095	0.157
Days to maturity		0.068	0.111	-0.199	0.044	0.102	-0.077	-0.060	0.254*	-0.105	0.164
Plant height			0.081	0.206	0.034	0.109	0.343**	0.055	-0.061	0.041	0.338**
Number of branches per plant				-0.038	0.142	0.130	-0.063	0.189	-0.027	0.040	-0.085
Number of umbels per plant					-0.095	-0.087	0.161	0.107	-0.886**	0.077	0.127
Number of umbellets per umbel						0.109	-0.094	0.257*	0.036	0.253*	-0.029
Number of nodes per plant							-0.860	0.122	0.066	-0.033	-0.065
Internodal length								-0.081	-0.098	0.055	0.166
Number of seed per umbellet									-0.146	0.317**	0.010
Seed weight per umbel										0.055	0.294**
Test weight											-0.067

*Significant at 5 percent probability level; **Significant at 1 percent probability level

Path coefficient analysis exhibited that higher magnitude of positive direct effect on seed yield/plant was exerted by seed weight / umbel, (1.8506), number of umbels / plant (1.7311) and plant height (0.1263) while, negative direct effect on seed yield/ plant were showed by number of nodes / plant (-0.1283), test weight (-0.0904), days to

maturity (-0.0794) and internodal length (-0.0645). In case of indirect positive effect on seed yield / plant indicated that days to maturity (0.4708) and days to 50 % flowering (0.4176) via. seed weight/umbel and plant height (0.3558) and internodal length (0.2786) via. number of umbels/plant. The highest negative indirect

effect on seed yield / plant by number of umbels/plant (-1.6394) *via.* seed weight/umbel followed by seed weight / umbel (-1.5336), days to maturity (-0.3445), days to 50 % flowering (-0.3073), *via.* number of umbels / plant

(Table 2). The same outcomes were also reported by Yadav *et al.* (2013); Kassahun *et al.* (2013); Sefidan *et al.* (2014); Jeeterwal *et al.* (2015; Patel and Patel (2015); Meena and Dhakar (2017); Singh *et al.* (2020).

Table 2: Direct and indirect effects of eleven characters on seed yield per plant in fennel genotypes.

Traits	Days to 50% flowering	Days to maturity	Plant height	Number of branches per plant	Number of umbels per plant	Number of umbellets per umbel	Number of node per plant	Internodal length	Number of seeds per umbellet	Seed weight per umbel	Test weight	Correlation with seed yield per plant
Days to 50% flowering	0.1147	-0.0766	0.0052	0.0003	-0.3073	0.0040	-0.0071	0.0031	-0.0056	0.4176	0.0086	0.157
Days to maturity	0.1107	-0.0794	0.0086	0.0002	-0.3445	0.0027	-0.0131	0.0050	-0.0067	0.4708	0.0095	0.164
Plant height	0.0047	-0.0054	0.1263	0.0002	0.3558	0.0021	-0.0139	-0.0222	0.0062	-0.1123	-0.0037	0.338**
Number of branches per plant	0.0152	-0.0088	0.0102	0.0021	-0.0664	0.0087	-0.0167	0.0040	0.0211	-0.0505	0.0036	-0.085
Number of umbels per plant	-0.0204	0.0158	0.0260	-0.0001	1.7311	-0.0058	0.0111	-0.0104	0.0120	-1.6394	0.0069	0.127
Number of umbellets per umbel	0.0076	-0.0035	0.0043	0.0003	-0.1636	0.0612	-0.0140	0.0061	0.0287	0.0671	0.0228	-0.029
Number of node per plant	0.0064	-0.0081	0.0137	0.0003	-0.1499	0.0067	-0.1283	0.0555	0.0136	0.1220	0.0030	-0.065
Internodal length	-0.0056	0.0061	0.0434	-0.0001	0.2786	-0.0057	0.1103	-0.0645	-0.0090	-0.1822	0.0049	0.166
Number of seeds per umbellet	-0.0058	0.0048	0.0070	0.0004	0.1855	0.0157	-0.0156	0.0052	0.1118	-0.2698	0.0287	0.01
Seed weight per umbel	0.0259	-0.0202	0.0077	-0.0001	-1.5336	0.0022	-0.0085	0.0064	-0.0163	1.8506	0.0050	0.294**
Test weight	-0.0109	0.0084	0.0052	0.0001	-0.1326	0.0155	0.0042	-0.0035	0.0355	0.1017	0.0904	-0.067

*Significant at 5 per cent probability level, **Significant at 1 per cent probability
Residual effect 0.18592

CONCLUSION

It may be concluded that seed yield/plant had exhibited highly significant and positive associated with plant height and seed weight/umbel. Higher magnitude of positive direct effect on seed yield/plant was exerted by seed weight/umbel, number. of umbels/plant and plant height. Hence, these characters could be considered reliable indicators for selection and to fix the criteria for selection to improve the seed yield/ plant in fennel.

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Conflict of Interest. None.

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