

Variability, correlation and path analysis in fennel (*Foeniculum vulgare* Mill.)

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Abstract

Forty eight collections of fennel (*Foeniculum vulgare*) showed significant variability for days to flowering, plant height, branches per plant, umbels per plant, umbellets per umbel, grains per umbel, 1000 seed weight, yield per plant and yield per plot at Jobner, India. The broad sense heritability was high for 1000 seed weight, umbels per plant and grain yield per plant while genetic advance was high for umbels per plant, yield per plant and yield per plot. Grain yield per plot was significant and positively associated with yield per plant, grains per umbel and umbels per plant. Branches per plant showed a high positive, direct effect on yield per plot followed by grains per umbel and plant height.

Key words: correlation, fennel, *Foeniculum vulgare*, variability.

In India, fennel (*Foeniculum vulgare* Mill.) is mainly cultivated in the states of Rajasthan, Gujarat and Uttar Pradesh in an area of about 17,400 ha with a annual production of about 18,100 tonnes. Work on crop improvement of fennel in India is scanty. The present note reports the results of a study on variability, correlation and path coefficient analysis in 48 germplasm collections of fennel maintained at S K N College of Agriculture, Jobner (Rajasthan, India). The collections were evaluated in a Randomised Block Design with three replications. Each col-

lection was grown in plot of 4.0 m x 2.4 m size accomodating six rows, spaced 40 cm apart. Observations were recorded on five randomly selected plants from each plot for plant height, branches per plant, umbels per plant, umbellets per umbel and yield per plant; days to flowering, 1000 seed weight and yield per plot was recorded on whole plot basis.

Analysis of variance indicated significant differences for all the characters studied indicating existence of variability in the germplasm (Table 1). These

Table 1. MSS, range, mean, variance, coefficient of variation, heritability and genetic advance for yield and other characters in fennel

Character	MSS (47 df)	Range	Mean \pm S E	Variance		Coefficient of variance		Heritability (Broad sense)	Genetic advance (%)
				Geno- typic	Pheno- typic	Geno- typic	Pheno- typic		
Days to flowering	15.54**	117.33-127.00	120.97 \pm 1.35	3.34	8.84	1.51	2.46	37.87	1.91
Plant height (cm)	145.09**	32.06-94.86	76.02 \pm 4.99	23.37	98.34	6.36	13.04	23.76	6.38
Branches per plant	0.80**	4.46-6.83	5.64 \pm 0.03	0.13	0.52	6.60	12.88	26.26	6.96
Umbels per plant	32.55**	7.93-21.20	13.39 \pm 0.94	8.96	12.62	23.60	26.56	78.91	43.11
Umbellets per umbel	6.81**	11.06-18.00	14.42 \pm 0.81	1.60	3.58	8.79	13.13	44.83	12.12
Grains per umbel	2109.79**	110.60-205.53	152.95 \pm 15.85	451.88	1206.01	13.85	22.77	37.96	17.52
Test weight	0.44**	4.63-6.80	5.44 \pm 0.03	0.14	0.15	7.02	7.13	97.14	14.25
Yield per plot	11698.60**	47.55-298.83	186.38 \pm 20.49	3479.64	4740.31	31.63	36.93	73.40	55.85
Grain yield per plant	4.62**	2.54-7.20	4.61 \pm 0.45	1.33	1.94	25.05	30.18	68.90	42.84

** Significant at 1 per cent level

Table 2. Direct and indirect effects of different characters on grain yield in fennel

Character	Days to flower- ing	Plant height	Branches per plant	Umbels per plant	Umbellets per umbel	Grains per umbel	Test weight	Yield per plant	Genotypic correlation with yield per plot
Days to flowering	-1.9255	0.4501	0.1858	0.8255	-0.5073	0.4992	0.4034	0.0240	-0.4047
Plant height (cm)	-0.6506	1.3320	-0.6748	0.3668	-0.6110	0.2221	0.2998	0.0128	0.0272
Branches per plant	-0.1827	-0.4590	1.9584	-0.5689	0.0225	-0.1720	-0.3265	-0.0024	0.2692
Umbels per plant	1.1806	-0.3529	0.8276	-1.3464	0.5119	-0.4054	0.0894	0.0110	0.4836
Umbellets per umbel	-0.6825	0.5687	-0.0309	0.4815	-1.4313	1.3620	0.1383	0.0147	0.1439
Grains per umbel	-0.5489	0.1689	-0.1924	0.3117	-1.1131	1.7514	0.0270	0.0060	0.4105
Test weight	-0.1060	0.0512	-0.0818	-0.1539	0.2533	0.0604	0.7819	-0.0032	0.0648
Yield per plant	0.5816	-0.2142	0.0585	-0.1869	0.2644	-0.1318	0.0318	-0.0794	0.3239

Diagonal figures are direct effects and non-diagonal figures are indirect effects

Table 3. Phenotypic (rp), genotypic (rg) and environmental (re) coefficients among different characters in fennel

Character		Plant height	Branches per plant	Umbels per plant	Umbellets per umbel	Grains per umbel	Test weight per plant	Yield per plant	Yield per plot
Days to flowering	rp	-0.1537	-0.0778	-0.3217**	-0.0027	-0.0605	0.0281	-0.0765	-0.2720*
	rg	0.3379	0.0949	-0.6131	0.3544	0.2851	0.0555	-0.3028	-0.4047
	re	-0.3706**	-0.1592	0.0375	-0.2540	-0.2675	-0.0416	-0.2884**	-0.1604
Plant height	rp		0.2278	-0.0381	0.4831**	0.3345**	0.0129	0.0926	0.0320
	rg		-0.3446	-0.2725	0.4269	0.1268	0.0383	-0.1608	0.0272
	re		0.4184**	0.1995	0.5301**	0.4284**	-0.0368	0.3548**	0.0430
Branches per plant	rp			0.3703**	0.2347*	0.2395*	-0.2305*	0.1002	0.1379
	rg			0.4225	-0.0158	-0.0982	-0.4170	0.0299	0.2692
	rg			0.4519	0.3764**	0.3961	-0.1351	0.1965	0.0490
Umbels per plant	rp				-0.1579	-0.0684	0.0999	0.1247	0.4207**
	rg				-0.3576	-0.2315	0.1143	0.1389	0.4836
	re				0.1613	0.1557	-0.0018	0.0802	0.2500
Umbellets per plant	rp					0.6554**	-0.1122	-0.0269	0.1589
	rg					0.7777	-0.1770	-0.1847	0.1439
	re					0.5745**	0.0358	0.2064	0.1844
Grains per umbel	rp						0.0228	0.0800	0.2713**
	rg						0.0345	-0.0752	0.4105
	re						0.1560	0.2911*	0.1447
Test weight	rp							0.0283	0.0823
	rg							0.0406	0.0648
	re							-0.0685	0.3087
Yield per plant	rp								0.3390**
	rg								0.3239
	re								0.3494**

*Significant at 5% level; **Significant at 1% level

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results are in confirmity with the observations of Ramanujan & Joshi (1996). The genotypic coefficient of variation ranged from 1.51% (days to flowering) to 31.63% (yield per plot). Besides for yield per plot, it was also high for grain yield per plant, umbels per plant and grains per umbel indicating that sufficient variability for these characters existed in the germplasm.

The broad sense heritability was also high for 100 seed weight, umbels per plant, yield per plant and grain yield per plot. In corollary to high heritability estimates, high estimates of genetic advance was also observed for umbels per plant, yield per plant and yield per plot indicating a good scope for improvement of these characters through selection.

The correlation coefficients were calculated at phenotypic, genotypic and environment levels following Singh & Choudhary (1976) to asses the specific role of each character in determining yield. Path coefficient analysis based on genotypic correlation coefficient was also carried out and following Dewey & Lu (1959). The results indicated that plant height, branches per plant, grains per umbel and test weight had high direct positive effect on grain yield, whereas, the direct effect of days to

flowering, umbels per plant and umbellets per plant was negative. A comparison of direct effect values with the correlation coefficient revealed that the indirect effect of these characters through other characters drastically changed the correlation of these characters with grain yield per plot (Tables 2& 3).

It may be concluded that selection in favour of plant height, branches per plant, grains per umbel, 1000 seed weight and against days to flowering, umbels per plant and umbellets per umbel may help in improvement in grain yield in fennel.

References

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