

Genetic variability on yield and its yield attributing characters in fennel (*Foeniculum vulgare* Mill.)

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Abstract

Genetic variability, heritability, and correlation were analysed among fifty genotypes for eight characters in fennel (*Foeniculum vulgare* Mill.) in an Augmented Block Design at National Research Centre on Seed Spices, Ajmer for yield and its yield attributing characters in 2013-14. The analysis of variance revealed significant differences among the germplasms for seed yield (8559.019*) and plant height (618.655**). The phenotypic coefficient of variance (PCV) was higher than corresponding genotypic coefficient of variance (GCV) for most of the characters. The heritability estimates were high for seed yield, plant height, umbellate per umbel, secondary branches per plant, 1000-seed weight, umbel per plant, primary branches per plant and seeds per umbellate. High genetic advance as percent of mean was recorded for seed yield, plant height, umbellate per umbel, secondary branches per plant, umbel per plant, 1000-seed weight, primary branches per plant and seeds per umbellate. The primary branches per plant (0.359**), secondary branches per plant (0.352*) and umbel per plant (0.306*), exhibited positive and significant correlated with the seed yield. Therefore, greater emphasis should be given on these characters while selecting for higher yield and related characters.

Key words: Correlation, fennel, genetic advance, heritability, variability

Introduction

Fennel (*Foeniculum vulgare* Mill) 2n=22 an important seed spice crop, mainly grown for its seeds in the states of Rajasthan and Gujarat and some extent in other states. In India fennel is cultivated covering a total area of about 99723 ha with annual production of 142995 tonnes, while in the Rajasthan 26973 ha. Area was under cultivation of fennel with 26157 tonnes production during 2013-2014 (Anon, 1). Since most of the yield attributing characters are quantitatively inherited and highly affected by environment, it is difficult to judge whether the observed variability is heritable or not. The primary parameters are given viz., genotypic and phenotypic variances, genetic advance, genetic gain and heritability are useful in understanding the nature of inheritance of different characters. Therefore, the present study was undertaken to know the nature and magnitude of variability present in fennel for yield and its attributes.

Material and methods

Fifty genotypes of fennel (*Foeniculum vulgare* Mill) were evaluated in Augmented Block Design at National Research Centre on Seed Spices, Ajmer (Rajasthan) during *Rabi* season 2013-2014. Each entry was grown in a single row and row to row distance was 60 cm. and plant to plant distance was 30 cm. The observation were recorded on five randomly selected plants for eight

characters viz., primary branches per plant, secondary branches per plant, umbel per plant, umbellate per umbel, seeds per umbellate, plant height, 1000-seed weight and seed yield.

The estimate the variation among the germplasms and checks, analysis of variance was carried out as per the procedure suggested by Federer, 4. Heritability in broad sense was calculated by the formula given by Hanson *et al.*, 5 and the genetic advance (GA) was calculated by the following formula as suggested by Johnson *et al.*, 7.

Result and discussion

The analysis of variance revealed found significant among germplasm for these characters are given viz., seed yield (8559.019*) and plant height (618.655**) (Table 1) which is earlier reported by Singh, 9, Dashora, 3, Meena, 8. The observed general mean for plant height was (153.95) and plant height ranged from (90-120 cm.). Mean seed yield was recorded (104.26) and the ranged from (9.4-44.6). The observed general mean for number of umbel per plant was (41.38) and ranged from (8-123.2). The observed general mean for seeds per umbellate was (28.82) and ranged from (19.42-5). The observed general mean for umbellates per umbel was (26.83) and ranged from (18-46). The general mean for secondary branches per plant was (11.93) and ranged from (5.8-24). The mean for primary branches per plant was (6.64) while ranged from (4.2-10). The observed

mean for test weight was (7.10) while mean ranged from (3.8-9.4) (Table 2).

The estimates of phenotypic coefficient of variation (PCV) was higher than genotypic coefficient of variation (GCV) for all the characters. Which is an indicator of additive effect of the environment on the expression of the characters and selection must be done these characters for improvement. The estimate of PCV and GCV indicated the existence of fairly high degree of variability for seed yield (80.548% and 60.14%). High magnitude of PCV and GCV was also reported for seed yield by Singh and mittal 9, Dashora, 3 and moderate for secondary branches per plant (29.36 % and 14.13 %), primary branches per plant (20.99 % and 8.21 %), umbellate per umbel (20.75 % and 12.64 %) and 1000-seed weight (20.07 % and 8.05 %). The low variance was for seeds per umbellate (17.28 % and 7.20 %) and

plant height (14.42 % and 12.66 %). suggesting that these characters were least affected by environment selection should be done these characters. This observation draws Support from the high value of heritability recorded for these characters.

With the help of PCV and GCV alone, it is not possible to determine the amount of variation which is heritable. The heritability along with genetic advance is more meaningful and help in predicting the resultant effect of selection on phenotypic expression. Analysis of heritability in broad sense was high for plant height (77.09%). Moderate heritability was observed in umbellate per umbel (37.11%), secondary branches per plant (23.18 %) and 1000-seed weight (16.12%). And the Low heritability was observed by umbel per plant (11.89%), seeds per umbellate (45.26%) and primary branch per plant (23.37%). In corollary to high heritability estimates, high estimates of genetic advance as percent of mean was also observed for seed yield (92.505%), indicating predominance of additive gene effect for these characters. This is in accordance with the findings reported by Agnihotri *et al.*, 2 Singh and Mittal 9, Dashora *et al.*,3, Meena *et al.*,8. Yield of a crop is the result of interaction of a number of inter-related characters. Therefore, selection should be based on these component characters after assessing their correlated with yield.

The phenotypic and genotypic correlation among the yield and its yield attributing characters in fennel are given in (Table 3). In the present investigation seed yield was positively correlated with umbel per plant, secondary branches per plant and primary branches per plant (at both the level) and umbellate per umbel and seeds per umbellate (at genotypic level), therefore, these characters should be considered while making selection for yield improvement in fennel. The plant height should positive and significant correlated with seeds per umbellate, umbellate per umbel, umbel per plant, secondary branches per plant and primary branches per plant (at both the level). On other hand seeds per umbellate showed positive and significant correlated with umbellate per umbel (at both the level) and primary branches per plant (at genotypic level). The characters umbellate per umbel showed positive and significant correlated with umbel per plant, secondary branches per plant, primary branches per plant (at both the level). The characters umbel per plant showed positive and significant correlated with secondary branches per plant, primary branches per plant (at both the level). On the other hand secondary branches per plant showed positive and significant correlated with primary branches per plant (at both the level). The observation are in agreement with the findings of Jindla

Table 1: Analysis of variance for different characters in fennel germplasm.

Sources of Variation	Df	Primary branches / plant	Secondary branches / plant	Umbel / plant	Umbellate / Umbel	Seeds / Umbellate	Plant height	Test weight	Seed yield
Block (eliminating check + Var.)	4	3.727	5.028	274.612	25.686	6.878	114.81753	2.396	11199.107*
Entries (ignoring blocks)	53	2.432	18.522	534.384	39.436	22.034	614.283**	2.065	9204.626*
Checks	3	11.933*	54.061**	2061.159**	125.127**	41.309	729.542**	0.140	11291.635*
Varieties	49	1.773	12.501	384.888	34.916	21.272	618.655**	2.092	8559.019*
Checks vs. Varieties	1	6.241	206.937***	3279.325**	3.862	1.555	54.265**	6.489	34578.325**
Error	12	2.368	8.928	326.467	19.585	36.259	113.220	1.667	3204.054

Table 2: Mean, range, genotypic and phenotypic, heritability, genetic advances and genetic advance percent of mean for different characters in fennel.

Character	Mean	Range	Genotypic coefficient of variation (GCV) %	Phenotypic coefficient of variation (PCV)	Heritability in broad sense (%)	Genetic advance	Genetic Advance as % of mean
Primary branches / plant	6.64	4.2-10	8.212	20.996	23.37	0.667	10.107
Secondary branches / plant	11.93	5.8-24	14.131	29.353	23.18	1.627	14.014
Umbel / plant	41.38	8-123.2	16.921	49.08	11.89	4.713	12.017
Umbellate /Umbel	26.83	18-46	12.642	20.753	37.11	4.266	15.864
Seeds / Umbellate	28.82	19-42.5	7.631	17.282	45.26	4.658	16.113
Plant height	153.95	90-210	12.667	14.427	77.09	35.305	22.911
Test weight	7.10	3.8-9.4	8.057	20.07	16.12	0.468	6.662
Seed yield	104.26	9.4-44.6	60.142	80.548	55.75	97.726	92.505

Table 3: Genotypic and phenotypic correlation coefficient for different characters of fennel germplasm.

Primary branches /plant	G	1	0.687**	0.543**	0.737**	0.405**	0.522**	-0.093	0.311*
	P	1	0.776**	0.716**	0.666**	0.251	0.484**	0.165	0.359**
Secondary branches /plant	G		1	0.710**	0.557**	0.248	0.419**	0.139	0.375**
	P		1	0.809**	0.569**	0.168	0.414**	0.144	0.352*
Umbel /plant	G			1	0.366**	-0.080	0.422**	0.215	0.068
	P			1	0.520**	0.028	0.427**	0.185	0.306*
Umbellate /Umbel	G				1	0.634**	0.611**	-0.147	0.341*
	P				1	0.544**	0.599**	0.001	0.243
Seeds / Umbellate	G					1	0.380**	-0.228	0.363**
	P					1	0.341*	-0.164	0.153
Plant height	G						1	-0.143	0.055
	P						1	-0.118	0.065
Test weight	G							1	0.119
	P							1	0.233
Seed yield	G								1
	P								1

**=Significant at (0.01%) and *=Significant at (0.5%) G = Genotypic correlation coefficient and P = Phenotypic correlation coefficient

and Allah (6).

Therefore, these characters should be considered for yield improvement in fennel breeding programme.

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Received : August 2014; Revised : November 2014
Accepted : December 2014