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Assessment of the Genetic Variability, Heritability, and Genetic Advance for Seed Yield and its Related Traits in Fennel (*Foeniculum vulgare* Mill.)

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ABSTRACT

The experiment was conducted during the *rabi* season of 2020–2021 at NDUAT, Kumarganj, Ayodhya (U.P.), to assess genetic variability, heritability and genetic advance for seed yield and its related traits in fennel. A total of 78 genotypes, along with three checks, were studied for 12 quantitative characters. Analysis of variance revealed that the variances due to checks were highly significant for all characters except internodal length and nodes plant^{-1}. Similarly, the variance due to blocks was highly significant for traits such as number of umbels plant^{-1}, number of umbellate umbel^{-1}, number of seeds umbellate^{-1}, umbel diameter, plant height, seed yield plant^{-1}, suggesting considerable environmental influence on these traits. The highest phenotypic and genotypic coefficients of variation were recorded for number of umbels plant^{-1} (22.25%, 22.10%), respectively. High estimates of broad-sense heritability were observed for days to 50% flowering (99.64%), number of umbels plant^{-1} (98.66%), number of umbellate umbel^{-1} (97.46), umbel diameter (97.22), number of branches plant^{-1} (96.45%), nodes plant^{-1} (96.22%), 1000-seed weight (92.45) and inter nodal length (83.26%). The highest genetic advance was observed for the number of umbels plant^{-1} (26.86), which also showed the highest genetic advance as % of mean (45.28%), followed by umbel diameter (33.50%).The results indicated that selection based on these traits would be effective for improving seed yield in fennel.

KEYWORDS: Fennel, genetic variability, broad sense heritability, genetic advance

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1. INTRODUCTION

Fennel (*Foeniculum vulgare* Mill., also known as *Anethum foeniculum*) is a versatile aromatic and medicinal herb valued for its essential oils used in pharmaceutical and industrial applications, widely cultivated across tropical and temperate regions of the world due to its adaptability to diverse climatic conditions (Refika et al., 2025). Fennel was renowned by the ancient Egyptians, Romans, Indians, and Chinese. In early Sanskrit writings, fennel was known as madhurika and its cultivation in India dates back to at least 2000 BC. To the ancient Greeks, fennel represented success and was called marathon because the battle of Marathon (490 BC) was fought in a fennel field (Badgujar et al., 2014). It is an important spice crop with significant economic value, primarily attributed to its pharmaceutical properties and its extensive use in culinary applications (Magon et al., 2025). Fennel belongs to the family Apiaceae and is considered one of the most important aromatic spice crops. Cytologically, it is a diploid species with a chromosome number 2n=2x=22 and exhibits allogamous nature, with a high degree of cross-pollination ranging from 82.2 to 95.40% (Ramanujam et al., 1964). The crop requires a relatively long duration of about 170–175 days to reach maturity and thrives best under cool and dry climatic conditions, although it can be grown in a wide range of soil types. Different part of the fennel plant, including seeds, leaves, and roots, possess medicinal and nutritional importance. Different parts of the plant are employed to treat many digestive ailments (Kooti et al. 2015). It also is very useful in the treatment of diabetes, bronchitis, chronic cough, and kidney stones (Rather et al. 2014). Due to its diuretic effect, fennel is also used to treat kidney and bladder diseases, and to relieve nausea. Further, it is applied to improve eye illnesses such as cataracts and conjunctivitis (Kooti et al., 2015). The dried seeds or fruits have a characteristic pleasant aroma and sweet taste similar to anise (*Pimpinella anisum),* which makes them highly desirable for culinary uses.

Botanically, fennel produces terminal inflorescences in the form of compound umbels, consisting of small, yellow-colored, bisexual, actinomorphic, and pentamerous flowers. The fruits are typically light green to dark brown in color (Noreen et al., 2023). The essential oil of fennel seeds is rich in biotic compounds such as tras-anethole about 70%, which imparts sweetness, and fenchone, which contributes to bitterness, along with other components like limonene. In India, fennel seeds are commonly used for mastication, either alone or in combination with betel leaves, and are also used in the preparation of flavored products and scented items. Additionally, fennel is widely used in traditional medicine systems, where seeds and stems are consumed as herbal teas for the treatment of ailments such as digestive disorders and kidney stones. The plant is known to possess diuretic, stomachic, and galactagogue properties, which enhance its medicinal significance (Khammassi et al., 2023). Based on its usage and morphology, fennel is generally classified into three main types: bitter fennel (*Foeniculum vulgare* Mill. Subsp.*vulgare* var. *vulgare*), sweet fennel (*Foeniculum vulgare* subsp. *vulgare* var. *dulce*), and fennel bulb (*Foeniculum vulgare* subsp. *vulgare* var. *azoricum*).

Thereafter, most of the yield-contributed characters are assessably inherited and highly affected by the environment, this make difficult to judge whether the observed characters are heritable or not. The genetic parameters genotypic and phenotypic variances, genetic advance, genetic gain, and heritability are useful to study the nature of inheritance of different traits. Therefore, a study was undertaken to elicit information on the nature and magnitude of variability present in the released varieties of fennel for yield and its attributes (Meena et al., 2010)

2. MATERIALS AND METHODS

The experiment was conducted during the Rabi season of 2020–2021 at NDUAT, Kumarganj, Ayodhya (U.P.). A total of seventy-eight genotypes along with three checks were evaluated in an Augmented Block Design. The experimental site is located between 24.47°–26.56° N latitude and 83.98° E longitudes at an altitude of 113 m above the mean sea level in the Gangatic Alluvial Plains of Eastern Uttar Pradesh of Ayodhya district. After two months of seed sowing, the seed should be ready for transplanting. During transplanting distance between rows and plants was 40 to 60 cm, for maintaining optimum plant population. Recommended practices would follow to raise good crops. Observations were recorded on five randomly selected plants from each genotype for twelve quantitative traits including plant height (cm), Number of primary branches plant^{-1}, Nodes plant^{-1}, Days to maturity, Inter nodal length (cm), Days to 50% flowering, Number of umbels plant^{-1} Number of umbellate umbel^{-1}, Number of seed umbellate^{-1}, Umbel diameter (cm) 1000-seed weight (g), Seed yield plant^{-1} (g). Statistical analysis was carried out using analysis of variance foraugmented design as suggested by Federer (1956). Genotypic and phenotypic coefficient of variance was calculated following Burton and De Vane (1953). Heritability and genetic advance were estimated according to Hanson et al. (1956), Johnson et al. (1955), respectively.

3. RESULTS AND DISCUSSION

The analysis of variance for twelve quantitative characters (Table 1) revealed significant differences among the genotypes, indicating the presence of substantial genetic variability. Similar finding of significant variability in fennel genotypes have also been reported in recent studies (Yaldiz

Table 1: Analysis of variance for twelve characters in fennel genotypes

Characters	Source of variation		
	Blocks	Checks	Error
	(b-1)	(c-1)	(b-1) (c-1)
Df	4	2	8
Days to 50% flowering	0.23^{*}	54.87^{**}	0.28
No. of branches plant^{-1}	0.26^{*}	17.30^{**}	0.06
Inter nodal length	0.93^{*}	0.57^{*}	0.85
No. of umbels plant^{-1}	15.33^{**}	22.13^{**}	2.34
No. of umbellate umbel^{-1}	10.40^{**}	11.21^{**}	27.49
No. of seeds umbellate^{-1}	18.42^{**}	73.61^{**}	16.11
Umbel diameter	3.38^{**}	4.90^{**}	5.28
Plant height	13.35^{**}	76.19^{**}	18.79
Nodes plant^{-1}	0.26^{*}	0.22^{*}	2.16
Days to maturity	0.21^{*}	53.14^{**}	0.21
1000-seed weight	1.15^{*}	2.18^{**}	1.12
Seed yield plant^{-1}	9.55^{**}	24.64^{**}	11.88

et al., 2025). The variances due to checks were highly significant for all characters except inter nodal length and nodes plant^{-1}. Similarly, the variance due to blocks was highly significant for traits such as number of umbels plant^{-1}, number of umbellate umbel^{-1}, number of seeds umbellate^{-1}, umbel diameter, plant height, seed yield plant^{-1}, suggesting considerable environmental influence on these traits. The mean performance of genotypes for different characters (Table 2) showed wide variation. Days to 50% flowering ranged from 81.93 to 117.27 days with a mean of 100 days. The number of branches plant^{-1} varied from 5.16 to 12.46, with a mean of 9.01. Inter nodal length ranged from 8.68 cm to 21.12 cm, the number of umbels per plant varied widely from 33.43 to 90.57, indicating significant variability among genotypes. Similarly, seed yield plant^{-1} ranged from 31.95 g to 52.15 g, reflecting the potential for selection of superior genotypes. Such wide variability for yield and its components has also been observed in fennel breeding population (Azam et al., 2024).

The estimates of phenotypic coefficients of variation (PCV) were slightly higher than genotypic coefficients of variation (GCV) for all the traits (Table 3), indicating the influence

Table 2 : Mean performance of seventy-five genotypes for twelve characters in fennel

Genotypes	DF	NBP	INL	NUP	NUU	NSU	UD	PH	NP	DM	SW	SYP
NDF-203	98.93	8.62	16.12	56.83	25.95	22.69	14.81	110.48	6.62	158.93	4.92	41.19
NDF-2	87.93	8.58	17.72	57.83	39.55	35.15	14.31	133.08	7.22	147.93	5.22	39.34
NDF-3	86.93	7.96	16.62	58.03	35.15	27.18	17.21	131.08	8.82	146.93	6.64	33.19
NDF-4	85.93	8.78	16.22	48.63	33.19	32.95	13.91	114.48	8.54	145.93	7.52	37.09
NDF-5	87.93	8.46	19.52	39.23	28.11	21.75	17.81	115.08	7.22	147.93	7.22	45.89
NDF-6	101.93	9.36	21.12	49.43	34.55	30.15	15.93	124.88	7.56	161.93	6.92	43.29
NDF-7	108.93	7.66	15.62	39.43	41.09	32.67	16.91	117.08	7.63	168.93	6.32	42.79
NDF-8	109.93	10.46	16.72	39.83	35.35	34.55	16.01	138.48	7.02	169.93	7.32	35.89
NDF-9	99.93	10.06	17.92	52.03	24.55	27.75	16.05	115.68	8.58	159.93	6.02	34.99
NDF-10	96.93	7.64	18.22	50.23	31.95	21.03	13.61	100.48	8.82	156.93	7.72	38.79
NDF-11	95.93	7.76	16.12	33.43	28.55	27.35	15.41	105.88	7.66	155.93	5.52	36.29
NDF-12	110.93	7.70	18.32	34.23	43.95	23.15	14.45	115.68	7.62	170.93	6.92	42.89
NDF-13	84.93	10.76	14.84	39.63	32.07	39.15	12.01	133.28	8.62	144.93	6.02	34.79
NDF-14	81.93	8.58	15.32	52.83	33.13	32.77	13.81	105.88	6.60	141.93	4.32	36.09
NDF-15	111.93	9.26	16.00	75.83	32.55	28.75	17.21	115.38	7.55	171.93	7.12	42.89
NDF-16	102.93	11.56	17.38	76.83	24.11	38.63	13.94	111.16	7.25	162.93	7.21	40.95
NDF-17	102.93	10.96	18.78	62.23	29.03	29.57	13.74	111.36	9.17	162.93	6.29	32.55
NDF -18	115.93	9.46	17.98	52.63	29.11	28.37	17.94	109.16	7.85	175.93	6.89	33.25
NDF-19	87.93	11.16	16.78	63.95	25.91	22.37	11.60	100.56	8.16	147.93	7.19	38.75
NDF-20	87.93	7.08	13.38	45.83	32.15	33.17	13.54	91.96	6.55	147.93	5.79	39.85
NDF-21	106.93	9.46	13.68	64.03	24.17	31.57	18.14	124.96	8.55	166.93	6.13	41.75

Table 2: Continue...

Genotypes	DF	NBP	INL	NUP	NUU	NSU	UD	PH	NP	DM	SW	SYP
NDF-22	105.93	10.56	14.98	75.43	24.91	30.17	15.34	115.16	6.25	165.93	5.99	42.55
NDF-23	99.93	11.76	14.78	63.83	26.91	26.77	15.54	116.56	8.25	159.93	6.69	43.45
NDF-24	103.93	12.26	15.98	62.83	27.91	38.57	14.84	138.96	9.35	163.93	7.09	52.15
NDF-25	103.93	12.46	16.31	40.43	29.91	36.57	12.94	117.16	9.05	163.93	7.19	41.15
NDF-26	101.93	10.36	14.38	55.83	19.91	25.37	16.14	98.16	7.65	161.93	6.79	37.45
NDF-27	104.93	9.76	18.38	62.49	28.71	38.77	11.14	124.76	7.75	164.93	6.69	43.75
NDF-28	98.93	12.16	15.78	73.43	28.31	39.17	12.94	123.76	5.65	158.93	7.29	44.25
NDF-29	93.93	12.36	12.68	62.43	31.91	30.77	12.74	102.36	7.55	153.93	5.59	46.05
NDF-30	105.93	8.96	13.98	66.63	30.71	23.18	17.54	132.36	7.85	165.93	5.09	39.35
NDF-31	106.27	9.23	11.48	87.37	26.98	28.15	15.71	132.02	8.55	166.27	6.41	42.95
NDF-32	102.27	12.03	10.38	63.57	28.38	24.95	14.41	108.52	8.75	162.27	5.81	44.85
NDF-33	89.27	9.03	12.48	64.77	34.98	28.75	16.01	123.52	7.45	149.27	7.31	41.15
NDF-34	84.27	9.17	12.28	80.37	31.42	36.15	17.61	112.52	8.15	144.27	5.61	34.25
NDF-35	104.27	9.83	12.88	85.37	28.18	36.95	16.71	118.72	7.23	164.27	7.21	39.55
NDF-36	105.27	7.53	16.08	90.57	23.58	38.25	17.51	123.52	6.55	165.27	6.41	31.95
NDF-37	98.27	8.63	13.38	64.37	30.98	42.75	18.71	93.72	7.35	158.27	4.71	40.45
NDF-38	117.27	7.63	15.28	86.17	27.18	27.75	17.63	103.52	7.55	177.27	7.11	37.35
NDF-39	117.27	8.53	18.28	78.17	27.78	29.75	20.41	119.52	7.25	177.27	6.61	32.95
NDF-40	104.27	8.03	16.08	84.77	36.38	33.35	17.41	143.52	7.19	164.27	5.81	38.85
NDF-41	107.27	8.43	13.48	79.77	29.38	29.95	17.81	131.52	7.85	167.27	6.51	35.15
NDF-42	91.27	10.83	15.28	59.57	27.98	29.15	17.21	128.52	8.55	151.27	6.31	37.35
NDF-43	93.27	7.39	13.78	66.97	19.98	30.15	12.61	83.52	7.38	153.27	6.11	37.95
NDF-44	104.27	9.43	16.18	56.57	41.18	39.55	15.81	129.52	9.75	164.27	7.21	41.25
NDF-45	86.27	8.63	13.38	49.57	27.58	27.15	15.91	99.52	9.35	146.27	6.21	46.05
NDF-46	93.27	7.99	15.25	68.20	26.25	30.52	16.37	115.02	8.79	153.27	8.93	48.35
NDF-47	106.27	9.39	13.65	54.20	34.25	41.12	13.97	132.02	9.19	166.27	8.23	39.15
NDF-48	106.27	7.49	16.17	55.40	29.65	37.92	17.87	141.02	7.49	166.27	8.13	47.25
NDF-49	107.27	11.19	16.65	50.80	30.05	39.12	13.87	132.02	9.39	167.27	6.33	42.05
NDF-50	106.27	8.99	18.25	78.00	40.65	36.32	13.77	147.02	7.99	166.27	7.93	47.25
NDF-51	105.27	8.09	17.45	67.40	36.65	35.32	14.92	104.02	9.99	165.27	8.53	48.65
NDF-52	108.27	6.49	16.35	76.20	32.25	27.12	20.17	135.02	7.39	168.27	7.73	43.55
NDF-53	83.27	7.03	16.25	72.40	26.85	27.32	14.57	134.02	6.25	143.27	8.13	40.85
NDF-54	115.27	6.29	17.19	62.40	31.85	23.92	13.37	106.02	6.39	175.27	6.43	39.15
NDF-55	100.27	10.09	13.85	51.24	26.45	32.92	12.67	133.02	8.39	160.27	6.83	41.75
NDF-183	95.27	8.29	15.25	41.36	33.05	34.92	15.77	95.02	9.59	155.27	7.03	38.25
NDF-184	103.27	6.39	17.35	49.60	23.25	31.72	14.37	115.02	7.25	163.27	6.23	38.25
NDF-185	90.27	9.09	13.45	53.50	28.65	29.32	18.17	135.02	6.19	150.27	6.88	38.25
NDF-186	84.27	10.89	14.65	35.60	17.45	34.32	11.37	130.02	6.79	144.27	5.53	38.25
NDF-187	100.27	8.09	15.55	56.20	24.45	32.32	14.97	121.02	7.44	160.27	7.28	38.25
NDF-188	104.6	8.86	18.78	62.97	36.31	30.62	12.07	129.02	7.79	164.6	5.35	38.25

Table 2: Continue...

Genotypes	DF	NBP	INL	NUP	NUU	NSU	UD	PH	NP	DM	SW	SYP
NDF-189	82.6	8.26	19.18	42.77	38.51	24.42	10.47	137.02	7.49	142.6	5.25	38.25
NDF-190	97.6	9.56	12.78	50.17	32.11	30.32	12.47	140.02	4.59	157.6	4.95	38.25
NDF-191	95.6	8.16	15.98	52.57	36.11	26.32	15.87	134.02	9.19	155.6	6.85	38.25
NDF-192	105.6	11.66	14.18	65.17	40.31	31.62	15.47	131.02	8.19	165.6	6.95	38.25
NDF-193	101.6	11.16	15.58	49.17	27.11	22.62	13.47	116.02	8.49	161.6	6.35	38.25
NDF-194	105.6	10.46	8.68	54.77	35.61	26.82	11.27	115.02	5.59	165.6	6.45	38.25
NDF-195	103.6	9.46	10.68	63.37	32.91	35.82	12.07	129.02	6.59	163.6	6.25	38.25
NDF-196	104.6	7.16	16.68	73.37	29.81	29.82	14.07	124.02	8.59	164.6	5.75	38.25
NDF-197	98.6	6.46	11.98	40.17	33.81	19.82	14.47	127.02	3.79	158.6	6.05	38.25
NDF-198	99.6	5.86	9.18	38.67	23.11	35.82	15.97	117.02	6.09	159.6	5.65	38.25
NDF-199	100.6	5.16	15.68	42.37	31.91	21.42	13.87	105.02	8.79	160.6	7.55	38.25
NDF-200	109.6	9.06	12.38	63.67	37.21	25.62	12.97	132.02	4.39	169.6	2.95	38.25
NDF-201	110.6	7.26	11.18	56.17	37.81	33.22	16.47	117.02	6.79	170.6	6.15	38.25
NDF-202	103.6	7.46	13.18	60.77	29.31	35.82	18.47	126.02	5.09	163.6	4.45	38.25
NDF-1 (Check)	98.4	10.14	14.90	52.12	23.72	27.87	15.62	122.10	7.74	158.4	5.95	38.25
RF-101 (Check)	94.6	8.22	14.36	60.54	33.40	35.54	16.16	125.89	7.66	154.6	5.86	38.25
RF-205 (Check)	91.8	6.42	14.28	71.84	30.82	31.84	17.54	118.08	8.06	151.8	7.05	38.25
Minimum	81.93	5.16	8.68	33.43	17.45	19.82	10.47	83.52	3.79	141.93	2.95	31.95
Maximum	117.27	12.46	21.12	90.57	43.95	42.75	20.41	147.02	9.99	177.27	8.93	52.15
Mean	100	9.01	15.25	59.33	30.60	30.93	15.18	120.10	7.63	160.00	6.47	41.04
CD (p=0.05)	2.00	0.93	3.48	5.76	19.74	15.11	8.65	42.73	5.54	2.00	3.98	12.98
CV (%)	6.86	8.21	6.10	7.58	9.85	10.26	8.74	9.43	9.22	6.15	10.27	8.36

DF: Days to 50% flowering; NBP: Number of branches plant^{-1}; INL: Inter nodal length (cm); NUP: Number of umbels plant^{-1}; NUU: Number of umbellate umbel^{-1}; NSU: Number of seeds umbellate^{-1}; UD: Umbel diameter (cm); PH: Plant height (cm); NP: Nodes plant^{-1}; DM: Days to maturity; SW: 1000-seed weight (g); SYP: Seed yield plant^{-1} (g)

of environmental factors on trait expression.

The highest PCV and GCV were observed for number of umbels per plant (22.25%, 22.10%, respectively), suggesting a high degree of variability and scope for selection. High magnitude of PCV and GCV was also reported by Meena et al., 2017. Moderate PCV and GCV values (10–20%) were observed for number of seeds umbellate^{-1}, nodes plant^{-1}, inter nodal length, umbel diameter, number of umbellate umbel^{-1}, and number of branches plant^{-1}, indicating moderate variability. In contrast, low PCV and GCV (<10%) were recorded for days to 50% flowering, days to maturity, 1000-seed weight, and seed yield plant^{-1}. However, plant height showed moderate PCV (11.38%) but relatively low GCV (6.35%), indicating higher environmental influence on this trait. High heritability estimates were observed for most of the traits, including days to 50% flowering (99.64), days to maturity (99.64), number of umbels plant^{-1} (98.66), number of umbellate umbel^{-1} (97.46), umbel diameter (97.22), number of branches plant^{-1} (96.45), nodes plant^{-1} (96.22), 1000-seed weight (92.45). High heritability suggests that these traits are predominantly governed by genetic factors and selection based phenotypic performance would be reliable. Similar result was found in the findings of Kumar et al., 2017 and Meena et al., 2017. Low heritability was observed for seeds per umbellate 44.61%, seed yield plant^{-1} (39.70%), and plant height (31.08%), indicating a greater influence of environmental factors on these traits.

The highest genetic advance was recorded for number of umbels plant^{-1} (26.86), followed by days to 50% flowering and days to maturity (18.19 each). Similar result was found

Table 3: Estimates of range, grand mean, phenotypic (PCV) and genotypic (GCV) coefficient of variation, heritability in broad sense [h^2 (bs) %], genetic advance in % of mean ($\overline{G}$a%) for twelve characters in fennel genotypes

Characters	Range		Grand mean ($\overline{X}$)	PCV (%)	GCV (%)	Heritability broad sense (h^{2}bs%)	Genetic advance	Genetic advance in % of mean ($\overline{G}$a %)
	Min.	Max.						
Days to 50% flowering	81.93	117.27	100	8.85	8.83	99.64	18.19	18.19
Number of branches plant^{-1}	5.16	12.46	9.01	11.74	11.53	96.45	2.44	29.89
Inter nodal length	8.68	21.12	15.25	14.81	13.51	83.26	3.88	25.43
Number of umbels plant^{-1}	33.43	90.57	59.33	22.25	22.10	98.66	26.86	45.28
Number of umbellate umbel^{-1}	17.45	43.95	30.60	11.77	11.62	97.46	8.11	30.27
Number of seeds umbellate^{-1}	19.82	42.75	30.93	17.44	11.65	44.61	4.96	16.05
Umbel diameter	10.47	20.41	15.18	13.05	12.87	97.22	0.23	30.37
Plant height	83.52	147.02	120.10	11.38	6.35	31.08	8.77	7.30
Nodes plant^{-1}	3.79	9.99	7.63	15.91	14.86	96.22	0.23	32.51
Days to maturity	141.93	177.27	160	5.53	5.52	99.64	18.19	11.37
1000- seed weight	2.95	8.93	6.47	9.97	9.59	92.45	1.57	24.34
Seed yield plant^{-1}	31.95	52.15	41.04	10.82	6.82	39.70	3.64	8.86

only for number of seeds umbel^{-1} in the findings of Meena et al., 2017 and Dashora and Sastry, 2011. Moderate genetic advance observed for plant height and number of umbellate per umbel, while low genetic advance was recorded for traits such as 1000-seed weight, nodes plant^{-1}, and number of branches plant^{-1}.

Genetic advance as percent of mean was highest for number of umbels plant^{-1} (45.28%) followed by umbel diameter (33.50%), nodes plant^{-1} (32.51%), number of umbellate umbel^{-1} (30.27%). High heritability coupled with high genetic advance for these traits indicating the predominance of additive gene action and suggests that selection would be effective in early generation.

Overall, the study revealed significant variability among fennel for yield and its contributing traits, providing ample scope for selection and genetic improvement.

4. CONCLUSION

Considerable genetic diversity among fennel genotypes for yield and its contributing traits. High heritability coupled with high genetic advance was observed for number of umbels per plant and umbel diameter, indicating the predominance of additive gene action and effectiveness of selection in early generations. Traits like days to 50 % flowering and days to maturity also exhibited high heritability. Therefore, selection based on these characters was found useful for improving seed yield in fennel.

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