

PERFORMANCE STUDY ON YIELD AND YIELD ATTRIBUTES OF FIFTY GENOTYPES OF FENNEL (*FOENICULUM VULGARE* MILL.)

RAVI KUMAR TELUGU*¹, TEHLAN S.K.¹ AND KOWSALYA N.¹

Department of Horticulture¹, CCS Haryana Agricultural University, Hisar 124 004 (Haryana)

(Received 31 May, 2021; Accepted 14 August, 2021)

Key words: Fennel, Range, Variability, Yield and yield attributing traits.

Abstract—On pooled data (Rabi seasons of 2015-16 and 2016-17), fifty Fennel (*Foeniculum vulgare* Mill.) genotypes collected from different agro-climatic zones (Haryana, Rajasthan, Gujarat, Uttar Pradesh, and Bihar) for their yield and yield attributing traits recorded a wide range of variability for the traits under study. In HF-173 (184.90 cm), the maximum plant height was recorded, while in JF-406 the minimum plant height was recorded (118.07 cm). HF-167 (12.70) and HF-168 (24.60) had the maximum number of primary and secondary branches per plant, respectively. In HF-179, early days to 50% flowering were documented (110.03). In genotype HF-169, the maximum umbels per plant (71.40) and biological yield per plant (311.95 g) were recorded. In addition, the highest number of umbellates per umbel (33.37), seeds per umbellate (25.66), seeds per umbel (851.83), seed yield per plant (73.17 g), seed yield per ha (65.85 Q), harvest index (25.17%) and test weight (9.51 g) were recorded.

INTRODUCTION

Fennel commonly known as 'saunf', an open pollinated spice crop of temperate and subtropical regions belongs to the family Umbelliferae (Apiaceae), has originated from Mediterranean region, where its high degree of genetic variability persists (Miranldi, 1999). It is a diploid species with chromosome number $2n = 22$. Fennel seed contains 6.3 percent moisture, 9.5 percent protein, 10 percent fat, 13.4 percent minerals, 18.5 percent fibre, and 42.3 percent carbohydrates, as well as vitamins such as vitamin C, thiamin, riboflavin, and niacin, as well as minerals such as calcium, phosphorus, iron, sodium and potassium (Bhunja *et al.*, 2005). Fennel seeds are fragrant, stimulating and carminative, and are used to treat cholera, bile irregularities, mental disorders, constipation and dysentery, as well as ailments of the lungs, chest, spleen and kidney stones, as well as menopausal difficulties (Mohamed and Abdu, 2004).

The availability of genetic variability in the population is very important for crop improvement programmes because it allows researchers to select genotypes with desirable traits for improvement and provides a wide range of alternatives for improving the trait of interest. As a result, genotype

evaluation is important for future crop development programmes.

MATERIALS AND METHODS

The study was conducted at Research Farm of the Department of Vegetable Science, CCCSHAU, Hisar (Haryana) during the *Rabi* seasons of 2015-16 and 2016-17. The experimental material consisted of fifty genotypes of fennel in randomized block design with three replications. Each genotype is planted at a spacing of 50 cm x 20 cm (single row of 3.0 m length for each genotype). The pooled data on thirteen morphological and yield attributing traits was taken in five plants which were tagged at random in all three replications to record the pooled data and analyzed by the standard statistical methods.

RESULTS AND DISCUSSION

The results of the present investigation are presented in Table 1. The plant height ranged from 118.07 to 184.90 cm with an overall mean of 149.28 cm. The maximum plant height was recorded in the genotypes HF-173 (184.90 cm) followed by HF-171 (183.04 cm), HF-169 (177.02 cm), NDF-42 (169.77

Mean values of different characters of 50 fennel genotypes- pooled means of two years

Genotypes	PH (cm)	PBP	SBP	DFP	UPP	UTPU	SPUT	SPU	SYPP (g)	SYPH (Q)	BYPP (g)	HI (%)	TW (g)
HF-162	143.64	7.95	15.44	112.66	43.44	23.12	17.87	415.20	34.03	30.63	236.72	14.44	5.19
HF-163	141.27	7.67	15.93	114.47	36.47	24.83	18.20	452.62	38.84	34.95	254.09	15.30	5.38
HF-164	151.27	7.52	17.40	113.63	41.07	24.97	17.53	437.94	42.73	40.73	250.67	17.23	6.31
HF-165	137.62	9.57	16.97	115.97	45.50	24.45	18.78	460.47	40.80	36.72	265.93	15.35	5.55
HF-166	150.70	9.10	16.23	115.77	44.37	23.07	18.70	431.36	42.67	38.40	263.58	16.20	5.68
HF-167	163.23	12.70	21.23	111.40	69.10	29.39	23.67	694.97	63.40	53.45	283.92	22.38	7.43
HF-168	164.71	12.55	24.60	110.10	66.67	32.55	24.17	788.37	67.67	61.83	293.18	23.13	8.53
HF-169	177.02	12.10	22.07	110.20	71.40	32.95	22.78	825.43	70.10	62.76	311.95	22.51	9.27
HF-170	158.01	9.25	18.70	110.37	47.70	23.80	18.33	436.80	43.40	39.72	256.70	16.99	6.01
HF-171	183.04	12.08	20.90	111.27	69.93	33.37	25.60	851.83	73.17	65.85	290.65	25.17	9.51
HF-172	151.37	9.10	18.93	115.87	42.87	23.75	18.80	445.90	40.73	39.15	252.76	16.19	5.79
HF-173	184.90	11.77	20.27	111.90	62.63	31.92	22.65	725.13	66.17	59.55	277.11	23.84	8.22
HF-174	161.21	11.20	17.90	114.90	43.83	25.13	17.93	450.10	47.14	38.35	241.66	19.56	6.41
HF-175	164.35	10.15	16.97	113.67	46.60	24.97	17.77	442.16	41.73	37.56	250.88	16.74	6.51
HF-176	148.50	9.95	17.87	124.70	46.92	25.95	18.59	480.52	38.97	42.82	255.24	15.37	6.55
HF-177	158.05	9.30	16.77	114.03	41.57	25.27	18.65	471.53	39.85	35.88	264.97	15.04	5.84
HF-178	158.11	10.20	16.57	107.17	44.84	24.64	17.90	442.23	44.37	41.31	253.04	17.59	6.03
HF-179	160.30	10.40	17.30	107.03	43.40	25.83	18.18	470.22	39.43	35.49	252.94	15.65	6.01
HF-180	162.51	10.47	17.93	112.43	56.17	28.03	22.57	632.93	51.57	46.41	272.46	20.77	7.16
HF-182	169.22	10.38	17.83	111.50	53.87	27.72	21.59	599.94	51.49	46.34	273.67	20.35	7.08
NDF-28	166.94	9.97	18.24	112.77	47.83	28.57	22.73	651.61	51.81	46.63	260.04	19.93	7.25
NDF-38	149.90	11.05	18.84	119.03	53.64	25.92	21.35	555.62	55.77	50.19	259.36	21.66	7.37
NDF-39	149.90	10.67	15.63	113.07	53.03	27.15	19.13	521.89	47.53	38.28	246.36	19.37	5.98
NDF-41	148.33	8.25	16.57	116.73	44.23	26.65	20.33	545.20	46.00	44.68	239.56	19.20	6.23
NDF-42	169.77	10.80	17.40	119.77	44.84	25.13	21.30	533.55	42.80	47.76	236.79	18.18	6.76
NDF-43	158.39	8.67	16.57	119.20	41.23	26.37	20.80	550.50	44.53	41.76	249.34	18.06	6.40
NDF-44	146.04	9.59	16.97	116.13	45.27	26.05	20.08	524.41	43.20	40.38	242.49	17.86	6.19
JF-12	120.96	5.08	10.74	112.97	23.67	17.93	14.93	268.90	19.04	17.13	210.71	9.06	3.47
JF-382-2	120.13	5.77	12.27	118.27	33.80	22.50	17.40	393.47	28.87	27.06	231.54	12.48	4.55
JF-406	118.07	6.88	13.78	119.10	27.43	19.58	16.27	319.00	21.90	20.52	224.81	9.75	3.69
JF-421	131.10	6.52	14.37	120.40	33.80	22.47	18.20	407.82	27.97	25.17	241.67	11.72	4.42
JF-494	124.83	9.18	16.10	119.73	29.90	20.15	16.47	333.19	23.67	21.30	240.04	9.87	3.84
JF-533-2	130.54	6.84	14.63	119.80	35.20	23.08	17.27	400.16	26.43	23.79	235.85	11.21	4.23
JF-582	130.91	8.49	16.77	115.50	41.10	23.40	18.20	427.32	32.33	28.18	246.02	13.13	5.17
JK-/RM/AF-7	146.39	7.33	15.93	118.90	45.37	27.59	21.37	591.91	49.90	44.91	271.11	19.99	6.46
JK-/RM/AF-9	149.87	8.65	15.60	119.40	47.19	26.72	20.82	557.68	50.80	45.72	275.05	19.88	6.56
JK-/RM/AF-13	157.52	8.97	17.33	120.00	47.67	26.73	20.43	544.63	47.02	42.31	258.96	18.19	6.44
JK-/RM/AF-19	153.17	8.99	15.37	116.77	42.57	23.83	21.52	513.21	42.40	40.17	261.71	16.25	6.03
JK-/RM/AF-24	147.13	8.07	16.00	121.00	41.73	25.07	18.33	461.52	37.40	30.63	258.57	14.57	5.88
RF-21	127.07	8.55	16.53	124.17	31.70	20.93	18.90	397.64	29.74	26.76	249.72	11.93	4.82
RF-38	122.87	8.02	16.13	125.80	34.30	22.30	18.34	410.10	28.37	25.53	253.43	11.22	4.42
RF-54	149.95	8.02	16.37	118.23	37.30	20.63	17.74	366.13	35.77	35.28	246.04	14.61	5.45
RF-57	150.63	8.38	16.47	119.80	27.50	20.13	16.87	340.42	25.10	22.59	253.11	9.92	4.23
GF-11	146.67	7.32	15.40	113.37	39.07	24.38	20.97	513.02	39.27	35.34	266.32	14.77	5.47
GF-12	141.41	7.85	17.27	115.87	44.97	26.22	19.00	501.16	43.13	40.26	275.13	15.68	6.09
HF-33	136.23	8.33	17.87	113.70	47.97	26.73	19.10	513.73	46.47	44.73	257.22	18.09	6.26
HF-39	140.05	8.69	16.97	115.03	48.53	24.83	20.67	514.98	44.60	40.14	250.78	17.83	6.10
PF-35	144.72	9.82	16.37	118.27	44.20	25.13	20.27	511.88	44.00	40.89	252.58	17.43	6.34
GF-2	142.57	7.90	15.80	115.57	39.50	24.97	18.42	461.15	41.10	36.99	265.99	15.54	5.71
R.sourbha	153.13	9.53	16.00	116.70	44.34	26.33	18.63	492.68	43.40	40.56	242.89	17.87	6.26
Overall mean	149.28	9.11	17.00	115.88	44.74	25.26	19.52	501.60	42.77	39.07	256.11	16.70	6.05
SE(m)	3.84	0.24	0.61	1.08	1.24	0.90	0.71	10.60	2.12	1.22	6.26	0.81	0.13
C.D 5%	10.79	0.68	1.21	3.05	3.48	2.54	1.99	29.81	5.96	3.42	17.61	2.27	0.37
CV (%)	4.45	4.62	4.38	1.62	4.79	6.18	6.28	3.66	8.59	5.40	4.24	8.39	3.80

PH; Plant Height, PBP; Primary Branches per Plant, SBP; Secondary Branches per Plant, DFP; Days to 50 % Flowering, UPP; Umbels per Plant, UTPU; Umbellates per Umbel, SPUT; Seeds per Umbellate SPU; Seeds per Umbel, SYPP; Seed Yield per Plant, SYPH; Seed Yield Per ha, BYPP; Biological Yield per Plant, HI; Harvest Index, TW; Test Weight

cm), HF-168 (169.22 cm) and NDF-28 (166.94 cm) while, the minimum plant height was recorded in the genotype JF-406 (118.07 cm).

Primary branches per plant varied from 5.08 to 12.70 with overall mean 9.11. The genotype HF-167 (12.70) recorded maximum number of primary branches per plant followed by HF-168 (12.55), HF-169 (12.10), HF-171 (12.08), HF-173 (11.77) and HF-174 (11.20). The minimum number of primary branches per plant was recorded in the genotype JF-12 (5.08).

Secondary branches per plant varied from 10.74 to 24.60 with an overall mean 17.00. The maximum number of secondary branches per plant was recorded in the genotypes HF-168 (24.60) followed by HF-169 (22.07), HF-167 (21.23), HF-171 (20.90) and HF-173 (20.27). And minimum number of secondary branches per plant was recorded in the genotype JF-12 (10.74).

Days to 50% flowering exhibited in the population and it ranged from 107.03 days (HF-179) to 125.80 days (RF-38) with an overall mean of 115.88 days. The minimum number of days to 50% flowering by genotypes like HF-179, HF-178, HF-168, HF-169, HF-170, HF-171, HF-167, HF-182, HF-173 and HF-180 are considered as early flowering whereas maximum number of days taken to 50% flowering by genotypes like RF-38, HF-176, RF-21, JK/RM/AF-24, JF-406 and JK/RM/AF-13 are considered as late.

Umbels per plant and the means for umbels per plant ranged from 23.67 to 71.40 with an overall mean of 44.74. The maximum numbers of umbels per plant was recorded in genotype HF-169 (71.40) followed by HF-171 (69.93), HF-167 (69.10), HF-168 (66.67) and HF-173 (62.63) and minimum number of umbels per plant was recorded in JF-12 (23.67).

Umbellates per umbel recorded ranged from 17.93 to 33.37 with an average of 25.26. Maximum number of umbellates per umbel was recorded in HF-171 (33.37) followed by HF-169 (32.95), HF-168 (32.55) HF-173 (31.92) and HF-167 (29.39), while, the minimum number of umbellates per umbel was observed in JF-12 (17.93).

Seeds per umbellate ranged from 14.93 to 25.60 with an overall mean of 19.52. The maximum seeds per umbellate was observed in genotype HF-171 (25.60) followed by HF-168 (24.17), HF-167 (23.67), HF-169 (22.78), NDF-28 (22.73), HF-173 (22.65) and HF-180 (22.57), while minimum number of seeds per umbellate was shown by JF-12 (14.93).

The seeds per umbel ranged from 268.90 to 851.83

with an overall mean of 501.60. The maximum number of seeds per umbel was observed in genotype HF-171 (851.83) followed by HF-169 (825.43), HF-168 (788.37), HF-173 (725.13) and HF-167 (694.97). And minimum number of seeds per umbel observed in JF-12 (268.90).

Seed yield per plant ranged from 19.04 g to 73.17 g with an overall mean of 42.77 g. The maximum seed yield per plant was recorded in genotype HF-171 (73.17 g) followed by HF-169 (70.10), HF-168 (67.67), HF-173 (66.17) and HF-167 (63.40), while the minimum seed yield per plant recorded was in JF-12 (19.04g).

Seed yield per ha ranged from 17.13 Q to 65.85 Q with an overall mean of 39.07 Q. The maximum seed yield per ha was recorded in genotype HF-171 (65.85 Q) followed by HF-169 (62.76), HF-168 (61.83), HF-173 (59.55) and HF-167 (53.45). And minimum seed yield per ha was recorded in JF-12 (17.13 Q).

The biological yield per plant ranged from 210.71 g to 311.95 g with an overall mean of 256.11 g. The maximum numbers of biological yield per plant was recorded in genotype HF-169 (311.95 g) followed by HF-168 (293.18), HF-171 (290.65) HF-167 (283.92), HF-173 (277.11), GF-12 (275.13), JK/RM/AF-9 (275.05) and HF-182 (273.67), while the minimum number of biological yield per plant was recorded in JF-12 (210.71 g).

Harvest index ranged from 9.06 % to 24.16 % and the overall mean value was calculated to be 16.70 %. The maximum harvest index was recorded in genotype HF-171 (24.16 %) followed by HF-173 (23.84 %), HF-168 (23.13 %), HF-169 (22.51 %), HF-167 (22.38 %) and NDF-38 (21.66 %). And minimum harvest index was recorded in JF-12 (9.06 %).

Test weight ranged from 3.47 g to 9.51 g and the overall mean was 6.05 g. The maximum test weight was recorded in genotype HF-171 (9.51 g) followed by HF-169 (9.27 g), HF-168 (8.53 g), HF-173 (8.22 g), HF-167 (7.43 g) and NDF-38 (7.37 g) and minimum test weight was recorded in JF-12 (3.47 g). These results are in accordance with the findings of fennel in Singh and Mittal (2002); Singh *et al.* (2004); Patel *et al.* (2008); Yogi *et al.* (2013) and Sengupta *et al.* (2014) and Ghanshyam *et al.* (2015) and Fenugreek in Mamatha *et al.* (2017).

From the study it was evident that the mean performance of all thirteen characters under study revealed a great range of mean values, which concludes that there is a wide genetic variability among the genotypes for the traits like plant height (cm), primary branches per plant, secondary

branches per plant, days to 50% flowering, umbels per plant, Umbellates per umbel, seeds per umbellate, seeds per umbel, seed yield per plant (g), seed yield per ha (Q), biological yield per plant (g), harvest index (%) and test weight (g). Therefore there is a scope for selection of genotypes with desirable component characters in cross-breeding program.

CONCLUSION

From the present study it was concluded that there is a sufficient variability for different yield and its attributing characters in 50 genotypes of fennel evaluated under field conditions, which can be utilized in further crop improvement programme.

REFERENCES

- Bhunias, S. R., Chauhan, R. P. S. and Yadav, B. S. 2005. Effect of nitrogen and irrigation on water use, moisture extraction pattern, nutrient uptake and yield of fennel (*Foeniculum vulgare*). *Indian J. Agron.* 50 : 73-76.
- Ghanshyam, Dodiya, N. S., Sharma, S. P., Jain, H. K. and Dashora, A. 2015. Assessment of genetic variability, correlation and path analysis for yield and its components in ajwain (*Trachyspermum ammi* L.). *J. Spices and Aromatic Crops.* 24(1): 43-46.
- Mamatha, N.C., Tehlan, S.K., Srikanth, M., Ravikumar, T., Batra, V.K., Karthik Reddy, P. and Manoj Kumar Nalla, 2017. Mean performance of 150 fenugreek (*Trigonella foenum-graecum* L.) genotypes for yield and yield contributing traits. *Int. J. Pure & App. Biosci.*, 5 (3): 1097-1102.
- Miranldi, E. 1999. Comparison of the essential oil from ten *Foeniculum vulgare* Mill. samples of fruits of different origin. *Flavour and Fragrance J.* 14: 379-382.
- Mohamed, M. A. H. and Abdu, M. 2004. Growth and oil production of fennel (*Foeniculum vulgare* Mill): Effect of irrigation and organic fertilization. *Biological Agri. and Horti.* 22 : 31-39.
- Patel, D.G., Patel, P.S. and Patel, I.D. 2008. Studies on variability of some morphological characters in fennel (*Foeniculum vulgare* Mill.), *J. Spices and Aromatic Crops.* 17(1) : 29-32.
- Rawat, S. K., Sanjay, K. and Pandey, V. K., 2013. Determination of genetic variability, correlation and path analysis for yield advancement in fennel (*Foeniculum vulgare* Mill.). *Ind. J. Ecology.* 40 (2) : 272-275.
- Sengupta, S. K., Verma, B. K. and Naidu, A. K., 2014. Genetic variability study in fennel (*Foeniculum vulgare* Mill.). *Int. Sci. J.* 1(1) : 62-64.
- Singh, V. V., Singhania, D. L., Sastry, E. V. D., Sharma, K. C. and Rajput, S. S. 2004. Character association in half sib and S₁ progenies of fennel (*Foeniculum vulgare* Mill.). Published in *National Seminar on New Perspective in Commercial Cultivation, Processing and Marketing of Seed Spices and Medicinal Plants* held at S.K.N. College of Agriculture, Jobner (Rajasthan) pp. 12.
- Singh, Y. and Mittal, P. 2002. Studies on variability, heritability and scope of improvement in fennel (*Foeniculum vulgare* Mill.). *Bioved.* 13 : 7-9.
- Yogi, R., Meena, R. S., Kakani, R. K., Panwar, A. and Solanki, R. K. 2013. Variability of some morphological characters in fennel. *Int. J. Seed Spices.* 3 (1) : 41-43.