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Evaluation of fennel (*Foeniculum vulgare* Mill.) germplasm for production and quality

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Abstract

Seventy four fennel (*Foeniculum vulgare* Mill.) accessions along with check varieties RF-101 and RF-125 were evaluated for yield and yield attributing characters. Eight promising accessions for seed yield were then evaluated for volatile oil content. The oil content of three most promising accessions along with check varieties were analyzed on a GLC. The accession, UF-178, exhibited superiority over other accessions in respect of yield attributing characters such as branches plant^{-1}, seeds umbel^{-1} and seed yield. UF-177 was found to be superior with respect to volatile oil content as well as volatile oil yield. UF-177 has the least fenchone content among the three. UF-179 was having maximum anethole content, which was found to be at par with variety RF-101. These three accessions may be exploited in breeding programmes for production and quality.

Key words: crop yield, fennel, *Foeniculum vulgare, germplasm*

The germplasm collection and evaluation is the basic requirement for the development of improved varieties. This depends upon the variability with respect to yield and other desired characters like biochemical constituents, which provide flavour and aroma to the spices. In the past, several fennel entries were evaluated for volatile oil constituents (Agrawal 1995; 1999; 2000). The main constraints for production of value added products are lack of sufficient number of improved varieties with high volatile oil content having desired constituents. Keeping this in mind, the present investigation was undertaken to evaluate 74 accessions of fennel along with two checks namely, RF-101 and RF-125. The experiment was conducted in augmented randomized block design in two row plots of 4.0m x 0.8 m size at Agricultural Farm of S.K.N. College of Agriculture, Jobner in *rabi* 2000-2001. These accessions were evaluated for yield attributes like days to flowering, plant height, branches plant^{-1}, umbels plant^{-1}, umbellets umbel^{-1}, seeds umbel^{-1} and seed yield plot^{-1}. The climate of Jobner is semi-arid with an average rainfall of about 500 mm and the soil in this area is light in texture varying from sandy to sandy loam. Plants in one meter section from each row were covered by muslin cloth bags before flowering for sib mating to recover seeds for next season. All the recommended agronomical practices were followed to raise a good crop. The volatile oil content of promising accessions were evaluated using Clevenger's apparatus (Guenther 1955). They were made moisture free by using anhydrous sodium sulphate and stored in glass vials. The promising samples were then subjected to gas chromatograph model 4000 (FID) with a stain-

Table 1. Yield and yield attributes in fennel germplasm

Entry	Days to flowering	Plant height (cm)	Branches plant^{-1}	Umbel plant^{-1}	Umbellets umbel^{-1}	Seeds umbel^{-1}	Seed yield plot^{-1} (g)
UF-144	114	107.6	8.0	13.6	18.2	169.6	100
UF-145	112	121.4	8.2	19.0	18.0	224.6	160
UF-146	112	101.0	8.0	19.8	18.6	201.8	150
UF-147	114	92.4	7.2	13.0	20.6	242.6	100
UF-150	111	96.8	9.8	22.4	20.4	237.8	150
UF-152	114	96.6	6.4	17.8	21.0	258.0	220
UF-153	114	94.6	7.6	21.6	26.6	227.8	100
UF-155	116	95.6	5.2	7.0	22.0	244.0	040
UF-156	116	98.4	5.0	6.6	16.0	125.8	070
UF-157	113	93.6	5.4	13.4	20.0	177.6	100
UF-159	112	106.0	6.4	15.6	15.0	248.8	040
UF-160	111	109.8	6.2	12.0	18.0	134.0	170
UF-162	111	120.0	6.2	13.6	14.2	157.6	100
UF-163	112	221.8	6.6	22.2	20.4	228.0	125
UF-166	112	108.8	5.8	23.0	20.0	129.4	150
UF-167	111	104.2	7.2	23.0	22.4	133.6	125
UF-168	114	98.0	8.2	21.8	20.4	148.0	170
UF-169	114	110.0	6.8	45.0	15.4	178.6	060
UF-170	113	110.8	8.2	48.4	17.0	266.4	100
UF-171	111	114.8	5.8	16.2	15.6	226.8	160
UF-173	110	118.0	6.8	17.6	17.4	227.6	200
UF-174	114	118.0	6.0	35.4	14.6	217.4	170
UF-181	113	93.2	9.2	32.0	19.2	214.6	080
UF-182	114	109.6	8.2	40.2	22.4	179.4	200
UF-183	112	115.0	11.0	43.2	19.6	255.0	100
UF-184	112	100.6	5.8	17.8	20.2	259.6	120
UF-134	113	146.8	8.2	26.2	19.4	213.0	180
UF-102	112	96.2	6.6	34.2	12.4	211.6	190
NS-8	110	98.6	6.0	14.4	14.8	211.6	170
NS-9	111	127.8	7.2	21.4	26.8	246.0	125
NS-10	113	95.4	7.0	18.0	17.2	231.8	150
NS-11	111	96.6	9.2	25.2	16.2	149.2	060
NS-13	112	128.2	7.2	22.2	23.4	268.0	100
NS-19	111	114.0	6.4	16.4	18.2	247.2	150
NS-22	111	106.6	6.0	18.8	12.0	184.0	150
NS-23	112	102.6	7.8	21.6	12.6	194.4	150
NS-27	112	94.2	7.2	32.6	17.6	244.4	100
NS-29	113	117.6	7.6	23.8	15.2	281.6	175
NS-30	113	112.2	8.6	30.6	20.4	179.0	125
NS-32	113	116.6	9.8	30.0	20.8	246.2	175
NS-34	112	119.6	7.0	20.8	18.2	231.6	100

NS-35	111	111.4	8.2	26.8	12.0	229.6	050
NS-36	113	106.0	8.0	16.2	17.2	216.6	050
NS-37	112	83.0	10.6	13.8	12.8	248.6	030
NS-38	113	94.6	6.2	12.0	16.2	286.2	050
NS-39	114	84.6	6.2	15.6	13.8	242.6	110
NS-40	111	104.2	6.8	20.8	19.4	187.0	050
NS-41	113	102.6	6.6	15.4	21.6	268.8	125
NS-42	115	88.6	8.2	9.4	21.6	281.8	100
NS-45	115	128.4	8.2	16.4	21.4	257.0	040
NS-46	113	111.2	7.8	27.8	19.2	264.0	070
NS-47	113	122.0	6.8	16.6	17.6	243.2	125
NS-48	112	104.0	8.2	19.0	18.4	299.8	030
NS-49	114	113.0	8.2	16.8	18.2	261.0	040
NS-50	113	117.4	7.4	18.8	20.2	370.4	150
NS-51	112	104.4	8.8	15.8	19.6	319.8	030
NS-52	112	125.4	6.8	17.4	20.8	309.0	050
NS-53	113	124.6	7.4	23.4	14.8	219.0	050
NS-54	113	95.4	6.8	12.6	17.0	163.6	100
NS-55	114	109.0	8.4	16.2	21.6	205.8	080
NS-56	114	104.2	7.4	18.0	19.6	288.8	050
NS-57	113	102.0	6.2	10.6	17.6	319.8	040
NS-58	112	124.4	6.2	16.8	18.8	327.4	100
NS-59	112	124.4	7.2	15.0	19.4	279.6	050
NS-60	113	113.8	7.0	15.4	18.2	271.6	040
NS-61	113	112.8	7.8	11.6	15.0	257.2	030
NS-62	112	108.6	8.8	12.2	17.0	261.0	125
NS-63	113	113.2	8.2	18.2	19.0	276.6	040
NS-64	114	121.2	8.0	18.4	18.2	252.4	050
NS-65	113	118.6	7.8	11.8	11.6	261.4	075
NS-66	114	117.8	7.8	8.2	14.6	249.0	020
UF-179	116	127.5	8.0	28.9	23.2	310.3	250
UF-177	116	153.1	10.6	45.5	20.8	381.5	300
UF-178	116	140.4	11.7	45.7	22.7	380.9	400
RF-101 Ch.	112	102.8	8.0	24.8	20.8	230.0	140
RF-125 Ch.	113	87.8	5.6	19.0	19.8	226.0	150
Mean	112.8	110.9	8.24	20.89	18.39	235.54	112.5
CV(%)	1.24	16.83	79.23	44.57	17.34	25.58	59.56

less steel column packed with SE-30 (10%) deposited over chromosorb W (Agrawal 1995). The identity of main components i.e. anethole, methyl chavicol and fenchone was ascertained by comparison of relative retention time compared with that of authentic standards.

Variability existed for all the yield attributing characters, except for days to flowering. Branches plant^{-1}, seed yield plot^{-1} and umbels plant^{-1} were very highly variable as indicated by coefficient of variation for these characters. The plant height varied from 83.0 cm in NS-37 to 221.8 cm in UF-163. Branches plant^{-1} ranged from 5.0 (UF-156) to 11.7 (UF-178). Umbels plant^{-1} varied from 6.6 in UF-156 to 48.4 in UF-170. The umbellets umbel^{-1} varied from 12.0 in NS-22 to 26.8 in NS-9. The seeds umbel^{-1} varied from 125.8 in UF-156 to 381.5 in UF-177. The minimum seed yield of 20 g plot^{-1} was observed in NS-66 due to very low umbels plant^{-1} and maximum of 400 g plot^{-1} was observed in UF-178 due to more umbels plant^{-1} (Table 1).

Accessions, which gave seed yield of 180 g plot^{-1} or above were considered as promising and eight accessions were found to be promising. The seed yield of check varieties, RF-101 and RF-125 were observed to be 140 g plot^{-1} and 150 g plot^{-1}, respectively under similar conditions. These promising accessions along with checks were evaluated for volatile oil content. The volatile oil content ranged from 1.4% to 2.6% (Table 2). The maximum volatile oil was observed in UF-177 (2.6%) and minimum of 1.4% in UF-152 and UF-134. Among them, three accessions were found to be promising with respect to volatile oil content as well as seed yield plot^{-1}. These were UF-179, UF-177 and UF-178. The volatile oil of these promising accessions along with checks RF-101 and RF-125 were fractionated on GLC column to determine the main constituents i.e. anethole, fenchone and methyl chavicol (Table 3). The accession UF-179 was found to have 40.49% anethole, which was almost equal to variety RF-101. The seed yield plot^{-1} in this accession was also good. This accession may be useful for value addition purpose. The accession, UF-178 was found to have maximum seed yield of 400 g plot^{-1} compared to 150 g and 140 g plot^{-1} in check varieties, RF-125 and RF-101, respectively. The accession, UF-178 may be exploited for production point of

Table 2. Evaluation of promising accession of fennel for volatile oil content

Entry	Seed yield plot^{-1} (g)	Volatile oil (%)
UF-178	400	1.6
UF-177	300	2.6
UF-179	250	2.0
UF-152	220	1.4
UF-182	200	1.6
UF-173	200	1.5
UF-102	190	1.8
UF-134	180	1.4
RF-101 check	140	2.3
RF-125 check	150	2.3
Mean	223	1.85
CV(%)	34.80	23.11

Table 3. Volatile oil content and its main constituents in promising fennel germplasm

Entry	Seed yield plot^{-1} (g)	Volatile oil (%)	Anethole (%)	Fenchone (%)	Methyl chavicol (%)
UF-179	250	2.0	40.49	15.32	19.33
UF-177	300	2.6	29.27	13.63	27.22
UF-178	400	1.6	10.08	22.77	42.38
RF-101 check	140	2.3	40.51	16.44	15.65
RF-125 check	150	2.3	09.30	11.80	52.80
Mean	248	2.16	25.93	15.99	31.48
CV(%)	43.75	17.51	59.85	26.11	49.97

view. The accession UF-177 was found to have high volatile oil content i.e. 2.6% and seed yield plot^{-1} was 300 g, which was the second highest. This accession was also having 29.27% anethole, comparatively higher than UF-178 and RF-125. These accessions are good and may be exploited for quality breeding programme.

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