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Performance of fennel varieties for quality attributes under eastern dry zone of Karnataka

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Abstract
An experiment was conducted at the department of plantation, spices, medicinal and aromatic crops, College of Horticulture, UHS campus GKVK post, Bangalore, during November 2016 to April 2017. Twelve fennel (*Foeniculumvulgare*Mill.) varieties were evaluated for quality attributes. Maximum oil content (1.94 %) was noticed in RF 281 followed by GF 12 (1.93 %), but maximum oil yield (kg/ ha) was obtained from GF 12 (52.02 kg). Anethole content ranged from 22.87 per cent (RF 125) to 69.75 per cent (GF 2). From this study we can conclude that, RF 281, GF 12 and GF 2 varieties may be exploited in breeding programmes for quality attributes to be incorporated.

Keywords: Seed yield, Anethole, Quality, oil content

Introduction
fennel (*Foeniculumvulgare*Mill.) 2n= 22 belongs to the family apiaceae, an important seed spice cum essential oil yielding crop grown for its seeds in the states of Gujarath, Rajasthan, Madhya pradesh, Uttar Pradesh, Punjab and Haryana. Fennel seeds are aromatic, stimulant and carminative, which are used in diseases like cholera, bile and nervous disorders (Thakral *et al*., 2002) [10]. It is grown in an area of 46760 ha with a production of 78570 tones, with an export of 11650 tonnes worth of 131.65 crores (NHB, 2015) [5]. The principle constituent of fennel oil is trans- anethole (50-60 %), fenchone (12- 33 %), and methyl chavicol (2-5 %). Indian fennel oil contains over 70 per cent anethole and six per cent fenchone. The higher percentage of anethole (up to 90 %) and lower amount of fenchone are responsible for its delicate sweet odour and flavor. The other constituents are α- pinene, camphene, P-cymene, myrcene, limonin and α&β- phellandrene (Farooqi and sreeramu. 2001) [6].
The germplasm collection and study on their performance is a basic requirement for the development of improved varieties. This mainly depends upon presence of variability in germplasm with respect to yield and quality attributes specially phytochemicals, which are responsible for flavor and aroma in aromatic crops. In the past, several fennel genotypes were evaluated for volatile oil constituents (Agrawal. 1993, 1999 and Agrawal) [4, 3]. The main constraint for production of value added products islack of sufficient number of improved varieties having high volatile oil content with higher concentration of desired constituents. Keeping in this view present investigation was taken up.

Material and methods
The experiment was carried out at the Department of plantation, spices, medicinal and aromatic crops, College of Horticulture, University of Horticultural Sciences campus, G.K.V.K post, Bangalore during November 2016 to April 2017. The experimental field is located at an altitude of 930 m above MSL at 12°58[1] North latitude and 77°35[1] East-longitude in the Eastern Dry Zone of Karnataka.12 varieties were received from different research institutes of the country (table 1). The experiment was laid out in RCBD with 12 varieties replicated thrice. Each experimental plot measuring 2 m × 3 m in which fennel was sown at a spacing of 50 cm rows and 20 cm within the rows on 3rd November 2016. All the recommended agronomical practices were followed to raise a good crop. The essential oil content of fennel varieties was estimated using clavenger's apparatus (Guenther. 1955) [8].

Moisture from essential oil was completely removed by adding anhydrous sodium sulphate and stored in a glass vials. Anethole content was estimated from oil samples by subjecting to gas chromatography- mass spectroscopy (GC-MS).

Result and discussion

On the basis of statistical analysis, significant difference were noticed for seed yield per plant, seed yield per hectare, oil content, oil yield and anethole content. The seed yield per plant and seed yield per hectare among different varieties ranged from 18.02 g (RF 101) to 31.33 g (RF 145) and 1802.2 kg (RF 101) to 3133.33 kg (RF 145) respectively. Significant variation among the varieties is due to genetic characters. Seed yield mainly depends upon number of umbels per plant, number umbellets per umbel, number of seeds per umbellet and test weight. The present results are in close agreement with the findings of (Thakral and Tehlan. 2006) [9] in fennel.

Table 1: List of fennel varieties used to evaluate for growth, yield and quality attributes.

Sl. no	Source of collection (Institutes)	Varieties
1.	Horticulture College & Research institute, Coimbatore	CO- 1
2.	Center for Research on Seed Spices, Jagudan	GF- 2, GF- 11 and GF- 12
3.	S.K.N College of Agriculture, Jobner	RF- 157, RF- 125, RF- 281, RF- 205, RF- 143, RF- 178, RF- 101 and RF- 145

Present study also revealed a significant difference among different fennel varieties for oil content and oil yield. Oil content ranged from 1.10 (RF 178) to 1.94 per cent (RF 281). Oil yield ranged 21.92 kg (RF 178) to 52.02 kg (GF 12), maximum oil was obtained in GF 12 followed by RF 145 (41.11 kg/ha) maximum oil yield is due to cumulative effect of genetic makeup, fairly high oil content and high seed yield. These findings are in consonance with the findings of (Giridhar *et al*., 2014) [7] in coriander.

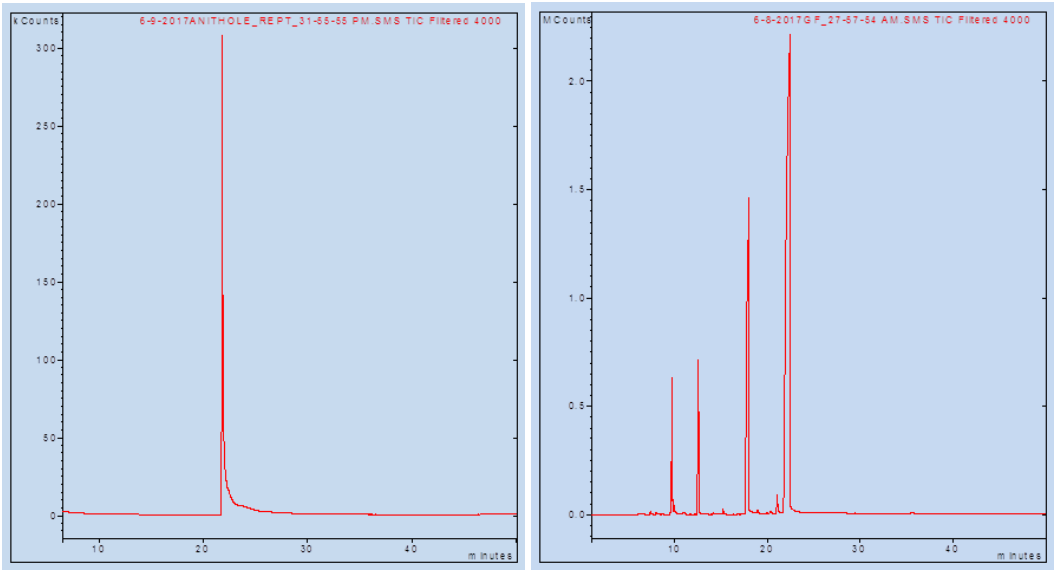
Anethole estimated in different fennel varieties ranged from 22.87 per cent (RF 125) to 69.75 per cent (GF 2). Maximum anethole content was noticed in GF 2 followed by GF 11 and CO1. These findings are in line with the findings of (Agrawal *et al*., 2003) [1].

Table 2: Yield and quality attributes of fennel varieties.

Treatment	Seed yield/ plant (g)	Seed yield/ ha (kg)	Oil content (%)	Oil yield (kg)	Anethole (%)
CO 1	19.04	1904.40	1.66	31.44	65.69
GF 2	20.93	2094.40	1.40	29.41	69.75
GF 11	21.41	2142.16	1.46	31.08	67.75
GF 12	26.84	2684.43	1.93	52.02	63.61
RF 157	18.80	1880.50	1.60	30.11	54.76
RF 125	18.70	1868.33	1.69	31.47	22.87
RF 281	19.82	1982.20	1.94	38.86	44.98
RF 205	21.69	2172.20	1.34	29.09	51.69
RF 143	24.08	2408.30	1.63	39.31	29.76
RF 178	19.91	1991.66	1.10	21.92	51.91
RF 101	18.02	1802.20	1.68	30.48	23.56
RF 145	31.33	3133.33	1.33	41.11	40.7
F-test	*	*	*	*	-
SEm ±	1.71	171.65	0.06	2.75	-
CD at 5%	5.03	503.42	0.17	8.06	-

Conclusion

GF 2 is rich in anethole content, which could be utilized for future breeding programmes. RF 145 and GF 12 are the varieties with maximum seed yield and oil yield respectively along with fair amount of anethole. Therefore, these two varieties can be exploited for commercial cultivation and further breeding programme with high anethole bearing varieties such as GF 2 or other promising varieties.



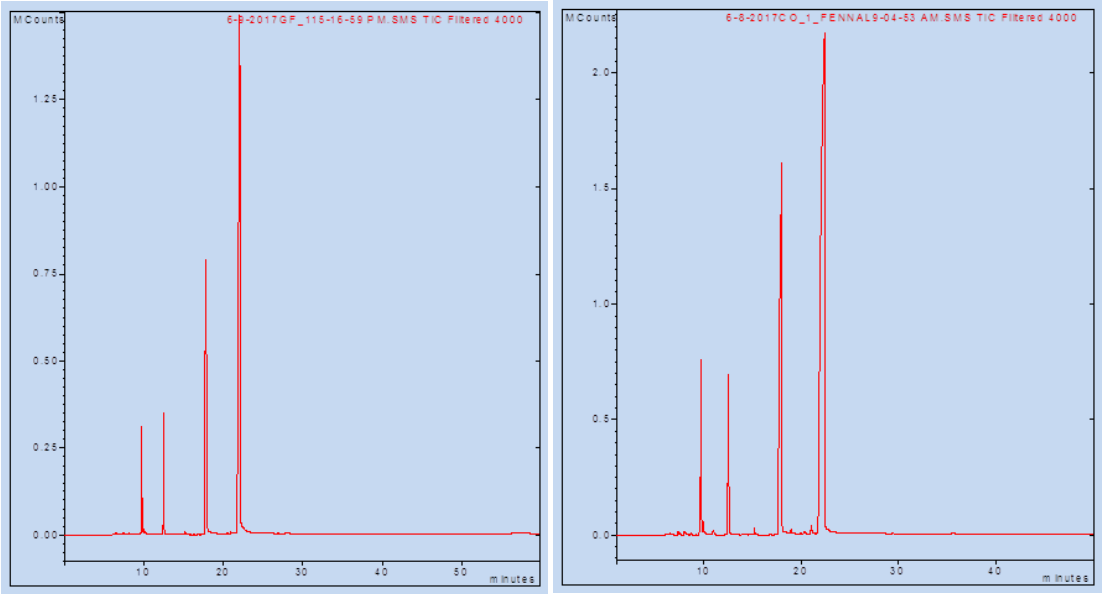


Fig 1: Chromatographs showing anethole content in standard and essential oil of top three fennel varieties

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