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Varietal response of coriander (*Coriandrum sativum* L.) for growth, yield and quality attributes

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Abstract

The study was carried out at Department of Plantation, Spices, Medicinal and Aromatic crops, College of Horticulture, UHS campus, GKVK, Bengaluru, during November 2016 to February 2017. Sixteen coriander varieties were collected from different institutes and were evaluated using RCBD with three replications. From the study on mean performance of genotypes, based on growth, yield and quality attributes, the maximum plant height (99.45 cm), and plant spread (1470.40 cm²) were recorded in RCr-446 followed by RCr-475. Number of primary branches per plant (13.65), number of umbels per plant (31.70), number of umbellets per umbel (8.25), dry weight (9.64 g), test weight (19.50 g), seed yield per plant (7.36 g) and seed yield per hectare (14.35 q) was recorded in (CO(CR)-4) followed by ACr-1 and RCr-446. The maximum essential oil content was recorded in CO(Cr)-4 (0.66 %), CO-3 (0.60 %) and RCr-446 (0.53%). While, maximum linalool content was observed in RCr-728 (92.33%) and RCr-480 (89.13 %).

Keywords: *Coriandrum sativum*, RCBD, Number of umbellets, Essential oil, linalool

Introduction

Coriander (*Coriandrum sativum* L.) is an important seed spice crop belongs to family Apiaceae (Umbelliferae) with a chromosome number of 2n=22. Mediterranean region is the centre of origin of this crop. Coriander is an annual herbaceous cross pollinated crop. Its name has been derived from Greek word "Koris" means bed-bug, because of unpleasant, fetid bug like odour of the green unripened fruits. Coriander ranks first among the seed spices with respect to export. It is the major ingredient of curry powder up to 40% by weight and also forms an important ingredient for several alcoholic beverages, particularly gin. Seeds are also used as tonic, carminative, diuretic, stomachic and as an aphrodisiac. Oleoresin from coriander is used as a flavouring agent and as an ingredient in pharmaceutical formulation and in perfumery (Singh *et al.*, 2006) [14]. In commerce, coriander is broadly classified into two types according to the size of the fruit, which is an indication of its volatile oil content and suitability for particular end-use, as the variety Vulgare (diameter 3-5 mm) and the variety Microcarpum (diameter 1.5-3 mm). Vulgare types are mainly grown in tropical and sub-tropical countries and generally will have low volatile oil content (0.1-0.35%) and are used extensively for blending purposes. The Microcarpum types are produced in temperate regions and they have higher volatile oil content (0.4-1.8%) and are used for extraction of the essential oil (Anonymous 1977, Purseglove *et al.*, 1981 and Singh and Singh, 1996) [2, 6, 7].

In India, coriander is mainly cultivated in Rajasthan and Gujarath with a sizeable acreage in Madhya Pradesh, Haryana, Punjab, Uttar Pradesh, Andhra Pradesh, Tamil Nadu, Bihar and to a limited extent in Karnataka. Presently it occupies an area of 4.47 lakh hectares with the production of 482 lakh tonnes with a productivity of 0.7 tonnes per hectare. (Anonymous, 2015) [3]. Use of improved varieties/cultivars is one of the strategy for increasing the area and production of the crop.

Material and methods

The experimental material for the present study comprised of 16 coriander varieties obtained from different institutions and these were tested for growth and yield attributes during

November, 2016 to February, 2017 at Plantation, Spices, Medicinal and Aromatic crops department, College of Horticulture, Bengaluru, located at an altitude of 930 m above MSL at 12°58' North Latitude and 77°35' East Longitude lying in the Eastern Dry Zone (zone-5) of Karnataka. The list of varieties and suppliers/source are presented in Table-1.

The experiment was laid out by adopting Randomized Complete Block Design (RCBD) with three replications and the treatments in each replication were allotted randomly. Farm Yard Manure at the rate of 20 tons per hectare along

with full dose of phosphorus and potassium and half dose of nitrogen (60:40:20 kg NPK/ha) was applied and beds (3m X 1.5m) were leveled and shallow furrows were made. The crop was sown at November, 6th 2016 at a spacing of 30 × 10 cm (shallow depth of 1-1.5cm) and seeds germinated in 10 days. The crop was irrigated through drip system. Thinning was done at 30 days after sowing to maintain a spacing of 10 cm within a row. Aphids and powdery mildew were found serious pest and disease and need based plant protection measures were taken throughout crop period.

Table 1: List of coriander varieties evaluated in the study

Sl. No.	Variety	Source
1	RCr-684	S.K.N.C.A – Jobner, Rajasthan
2	RCr-728	S.K.N.C.A – Jobner, Rajasthan
3	RCr-446	S.K.N.C.A – Jobner, Rajasthan
4	RCr-20	S.K.N.C.A – Jobner, Rajasthan
5	RCr-436	S.K.N.C.A – Jobner, Rajasthan
6	RCr-41	S.K.N.C.A – Jobner, Rajasthan
7	RCr-480	S.K.N.C.A – Jobner, Rajasthan
8	RCr-475	S.K.N.C.A – Jobner, Rajasthan
9	RCr-435	S.K.N.C.A – Jobner, Rajasthan
10	ACr-1	NRCSS – Ajmer, Rajasthan
11	GCo-1	SDAU, Palanpur, Gujarat
12	GCo-2	SDAU, Palanpur, Gujarat
13	CO-1	HC & RI, TNAU, Coimbatore, TN
14	CO-2	HC & RI, TNAU, Coimbatore, TN
15	CO-3	HC & RI, TNAU, Coimbatore, TN
16	CO(CR)-4	HC & RI, TNAU, Coimbatore, TN

S.K.N.C.A – Sardar Krushinagar College of Agriculture, NRCSS – National Research Centre for Seed Spices, SDAU – Sardar Krushinagar Dantiwada Agriculture University, HC & RI - Horticulture College and Research Institute, TNAU - Tamil Nadu Agricultural University

The crop was allowed to mature completely till the seeds turn chestnut colour in the field before harvest. Five plants in each variety in each replication were selected randomly and tagged for recording observations for plant characters and yield attributes. Periodically, observations recorded on plant height (cm), plant spread (cm²), days to first flowering, days to 50% flowering, number of primary branches, number of secondary branches, number of umbels per plant, number of umbellets per umbel, number of seeds per umbellet, fresh and dry weight

of plant (g), test weight (g), harvest index (%), days to seed maturity, seed yield per plant (g) and seed yield per hectare (q). The essential oil content was estimated using cleverger's apparatus and the oil samples were subjected to Gas Chromatography-Mass Spectroscopy (GC-MS) analysis for linalool estimation. Data was analyzed for different parameters by method suggested by Panse and Sukathme 1961.

Results and Discussion

Significant variations were observed among the varieties for growth and reproductive parameters and are presented in Table. 2.

Table 2: Growth and reproductive parameters of sixteen coriander varieties

Treatment	Plant height at harvest (cm)	Plant spread at harvest (cm)	Days to first flowering	Days to fifty per cent flowering	Number of primary branches per plant	Number of secondary branches per plant
RCr-684	88.45	901.70	42.50	53.00	8.00	14.40
RCr-728	77.95	957.10	42.50	50.50	8.60	15.80
RCr-446	99.45	1470.40	38.50	46.00	10.75	18.15
CO-3	85.50	729.20	40.50	48.00	7.70	10.30
CO(CR)-4	86.55	955.00	39.50	44.50	13.65	19.80
GCo-2	82.75	873.70	42.50	49.50	7.90	14.40
RCr-20	89.50	833.70	40.00	47.00	7.50	14.70
RCr-436	75.20	752.30	46.50	58.00	8.80	15.40
RCr-41	87.90	1316.45	42.50	48.50	8.60	16.10
RCr-480	86.25	814.60	41.50	48.00	8.00	15.80
CO-2	75.00	922.00	42.50	49.00	7.60	14.50
RCr-475	97.30	1323.95	40.00	45.50	7.10	13.80
CO-1	86.50	905.50	43.50	49.00	7.80	14.90
GCo-1	73.15	798.60	47.50	51.50	8.40	15.30
ACr-1	97.15	1114.00	39.50	45.50	11.25	21.15
RCr-435	70.50	788.90	47.50	56.50	8.50	16.10
F-test	**	**	*	*	*	*
SEm ±	3.13	56.72	1.64	2.16	1.01	1.50
CD at 5%	9.44	170.98	4.95	6.51	3.06	4.53

*Significant at 5 per cent probability level and ** Significant at 1 per cent probability level

Among the growth attributes, the maximum plant height was recorded in RCr-446 (99.45 cm) which was on par with RCr-475 (97.30 cm) while, minimum plant height was found in RCr-435 (70.50 cm). Whereas, the maximum plant spread was recorded in RCr-446 (1470.40 cm²) followed by RCr-475 (1323.95 cm²) and ACr-1 (1114.0 cm²) and the minimum plant spread was recorded in CO-3 (729.20 cm²). The maximum number of primary branches per plant was recorded in CO(CR)-4 (13.65) followed by ACr-1 (11.25) and RCr-446 (10.75). While, the minimum number of primary branches per plant was found in RCr-475 (7.10). Whereas, the maximum number of secondary branches per plant was recorded in ACr-1 (21.15) and CO(CR)-4 (19.80) followed by RCr-446 (18.15) and the minimum number of secondary branches per plant was found in CO-3 (10.30). Similar findings were reported by (Rajagopalan *et al.* 1996, Rajput and Dhirendrasingh 2003 and Garid *et al.* 2015)^[7, 8, 4]. Among reproductive parameters, RCr-446 (38.50 and 46.00), CO(CR)-4 (39.50 and 44.50) and ACr-1 (39.50 and 45.50) took less number of days to first flowering and fifty per cent flowering respectively. (Velayudham 2004)^[4].

Significant differences were observed for yield parameters and were presented in Table. 3. The maximum number of umbels per plant and number of umbellets per umbel was recorded in CO(CR)-4 (31.70 and 8.25) followed by ACr-1 (29.90 and 7.80) and RCr-446 (29.90 and 7.45) respectively. While minimum number of umbels per plant and number of

umbellets per umbel was found in RCr-475 (15.35 and 4.49) respectively. There was no significant difference among the varieties for number of seeds per umbellet. (Rajagopalan *et al.*, 1996, Singh *et al.*, 2002, Saxena *et al.*, 2005 and Velayudham *et al.*, 2006)^[7, 12, 10, 14] have also reported the performance of coriander genotypes which fall in line with our findings. The variety ACr-1 (17.65 g) recorded the maximum fresh weight of plant followed by CO-3 (17.13 g) and maximum dry weight was by CO(CR)-4 (9.64 g) followed by ACr-1 (8.21 g). (Agasimani, 2014)^[1]. The maximum test weight was recorded in CO(CR)-4 (19.50) followed by RCr-446 (17.10) and GCo-2 (12.70) and minimum test weight was found in RCr-684 (9.20) and RCr-728 (9.25). Whereas, the maximum harvest index was recorded in RCr-446 (71.38 %) followed by CO-3 (69.26 %) and CO(CR)-4 (61.25 %) and minimum harvest index was observed in RCr-41 (29.55 %). Varieties *viz.*, CO(CR)-4 (7.36 g and 14.35 q), ACr-1 (7.15 g and 13.95 q) and RCr-446 (7.07 g and 13.85 q) recorded higher seed yield per plant and also seed yield per hectare respectively. While, minimum seed yield per hectare was recorded in RCr-475 (7.28 q) and RCr-728 (7.62 q). Characters that contributed for higher yield are number of primary branches per plant, number of umbels and umbellets per plant. (Rajagopalan *et al.*, 1996, Singh *et al.*, 2002, Saxena *et al.*, 2005 and Velayudham *et al.*, 2006)^[7, 12, 10, 14].

Table 3: Performance of sixteen coriander varieties for yield parameters

Treatment	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
RCr-684	17.50	4.99	4.83	103.00	12.18	5.21	4.58	8.75	9.20	36.92
RCr-728	16.45	4.59	5.01	101.00	15.55	6.36	3.36	7.62	9.25	32.69
RCr-446	29.90	7.45	5.44	107.50	13.04	7.27	7.07	13.85	17.10	71.38
CO-3	29.00	6.31	5.27	90.50	17.13	7.15	6.88	13.50	10.75	69.26
CO(CR)-4	31.70	8.25	7.35	108.00	14.80	9.64	7.36	14.35	19.50	61.25
GCo-2	19.70	5.68	4.93	93.50	11.27	7.07	3.95	12.70	12.70	59.12
RCr-20	21.90	5.45	4.92	97.00	14.73	6.19	5.13	11.35	9.95	45.83
RCr-436	24.60	5.02	5.20	105.00	17.09	6.40	4.08	12.36	10.05	49.15
RCr-41	24.70	5.20	4.74	97.50	10.75	4.25	4.02	8.92	12.25	29.55
RCr-480	27.70	5.60	5.25	92.50	12.75	6.65	6.25	9.19	9.55	43.94
CO-2	22.80	5.04	5.08	96.00	9.22	6.95	6.70	8.76	12.50	60.36
RCr-475	15.35	4.49	5.13	100.50	15.59	4.50	3.01	7.28	9.55	40.87
CO-1	22.30	4.90	5.09	106.50	11.31	5.63	4.70	9.30	10.60	42.53
GCo-1	23.10	5.03	5.16	103.50	13.04	5.86	4.14	9.75	9.80	46.63
ACr-1	29.90	7.80	6.14	111.00	17.65	8.21	7.15	13.95	10.50	55.60
RCr-435	17.10	4.95	5.23	101.00	9.02	3.21	3.57	8.67	9.80	43.71
F-test	*	**	NS	*	**	**	**	**	*	*
SEm ±	2.97	0.55	0.45	3.60	1.01	0.50	0.32	1.04	1.65	6.72
CD at 5%	8.95	1.66	-	10.84	3.05	1.50	0.96	3.12	4.98	20.55

*Significant at 5 per cent probability level and ** Significant at 1 per cent probability level

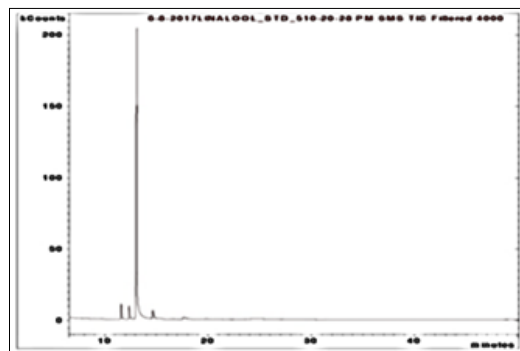
X1: Number of umbels per plant X4: Days to seed maturity
X7: Seed yield per plant (g)
X2: Number of umbellets per umbel X5: Fresh weight of plant (g)
X8: Seed yield per ha (q)
X3: Number of seeds per umbellet X6: Dry weight of plant (g)
X9: Test weight (g)
X10: Harvest index (%)

The data pertaining to quality traits are presented in Table 4 and Fig. 1. The maximum oil content was found in variety

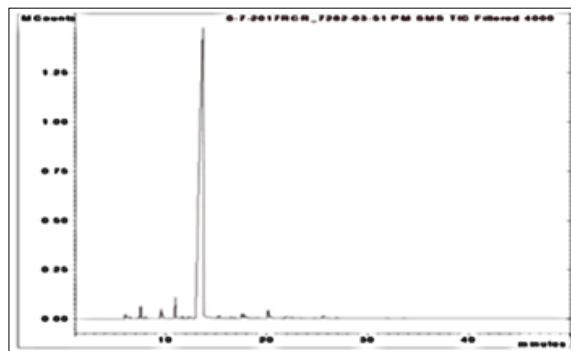
CO(CR)-4 with 0.66 %, which is followed by CO-3 (0.60 %) and RCr-446 (0.53%), while minimum oil content was observed in RCr-435 (0.13 %) followed by RCr-20 (0.26 %), RCr-41 (0.33 %) and RCr-728 (0.36 %). The maximum linalool content among the sixteen varieties was found in RCr-728 (92.33%), followed by RCr-480 (89.13 %), RCr-435 (88.83 %), RCr-475 (88.48 %), while minimum was recorded in variety CO(CR)-4 (75.97 %), followed by RCr-20 (80.22 %), CO-2 (80.45 %) and CO-3 (81.54 %).

Table 4: Performance of sixteen coriander varieties for Quality parameters

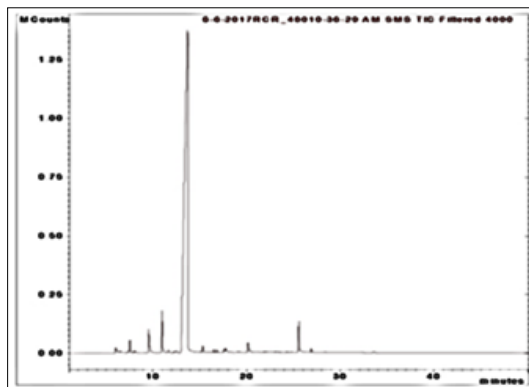
Treatments	Essential oil content (%)	Linalool content (%)
RCr-684	0.50	86.29
RCr-728	0.36	92.33
RCr-446	0.53	88.34
CO-3	0.60	81.54
CO(CR)-4	0.66	75.97
GCo-2	0.40	83.73
RCr-20	0.26	80.22
RCr-436	0.43	84.84
RCr-41	0.33	87.47
RCr-480	0.43	89.13
CO-2	0.50	80.45
RCr-475	0.46	88.48
CO-1	0.40	84.53
GCo-1	0.50	82.27
ACr-1	0.43	82.41
RCr-435	0.13	88.83
F-test	-	-
SEm \pm	-	-
CD at 5%	-	-



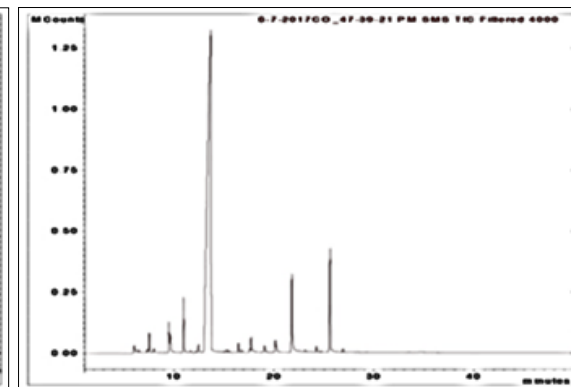
Chromatogram of Standard linalool



Chromatogram of RCr-728



Chromatogram of RCr-480



Chromatogram of CO(CR)-4

Fig. 1: Chromatograms of standard linalool and linalool content of coriander varieties

Conclusion

Some of the desirable varieties identified by this study were CO(CR)-4, ACr-1 and RCr-446 for higher seed yield, CO(CR)-4, CO-3, CO-2 for higher essential oil content and varieties RCr-728 and RCr-480 for higher linalool content. Further these varieties found to be best for multiple traits and can be used for future breeding programme.

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