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Evaluation of coriander (*Coriandrum Sativum* L.) genotypes for growth, yield and quality under central dry zone of Karnataka

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Abstract
An investigation was carried out in ZAHRS, Babbur farm, Hiriyur during 2016- 2017 *rabi* season for evaluation of Coriander (*Coriandrum sativum* L.) genotypes for growth, yield and quality under central dry zone of Karnataka. The experiment was laid out in the Randomized Complete Block Design with 20 genotypes and were replicated thrice. Significant differences were observed among genotypes for all the characters under study. The results revealed that, Rcr-475 recorded maximum plant height (70.27 cm), number of primary branches per plant (7.33), number of umbels per plant (28.13), number of umbellets per umbel (5.50), number of seeds per umbellet (5.70), seed yield per plant (6.37 g), seed yield per hectare (16.83 q), highest test weight (14.53 g) and plant spread (645 cm^2). The genotype DCC-4 took minimum number of days for first flowering (39.33 days) and maximum essential oil content (0.8%) was recorded in Acr-1and Rcr-728. It might be concluded from the study Rcr-475, Rcr-446, Rcr-41, Co-4, Dcc-4 and Acr-1 were identified as best performing genotypes and offer a good scope of selection for desired traits.

Keywords: genotypes, umbels, umbellets, selection, essential oil, seed yield

Introduction
Coriander (*Coriandrum sativum* L.) belonging to the family Apiaceae (Umbelliferae), is an annual herb native to the Eastern Mediterranean region and Southern Europe (Gal, *et al.*, 2010) [3]. It is one of the most important annual seed spice produced throughout the country. In India it is mainly grown in Rajasthan, Gujarath, Madhya Pradesh, Andhra Pradesh and Tamil Nadu. It is used as both leaf purpose as well as seed. Seeds of the crop are used as spice, while its tender green leaves are used as culinary herb. Essential oil of seed is used in culinary and flavoring purpose. In Karnataka, coriander is mainly grown under rain fed conditions both in *kharif* and *rabi* season in an area of 2.65 thousand hectare with a production of 0.82 MT (Anon, 2015) [1]. The average seed yield of coriander is low in India. One of the reasons for low yield is lack of genotypes suited to a particular region. Very limited scientific information is available on germplasm evaluation of coriander under central dry zone of karnataka, though farmers are using their own genotypes for cultivation. Since the crop is grown mainly as sole crop in *rabi* season under *rainfed* or protective irrigation, moisture availability, short duration high yielding genotype for the particular zone/ region is boon to farmer to realize higher yield and returns.

Materials and Methods
The present investigation was carried out at Zonal Agricultural and Horticultural Research station (ZAHRS), Babbur farm, Hiriyur coming under the central dry zone of Karnataka. The experimental material comprised of twenty diverse genotypes like Rcr-475, RCr-480, RCr-728, RCr-446, RCr-20, RCr-41, RCr-435, RCr-436, RCr-684, GCr-1, GCr-2, ACr-1, Co-1, Co-2, Co-3, Co-4, DCC-1, DCC-2, DCC-3 and DCC-4. These genotypes are collected from SKNA-Sri karana narendra agriculture, Jobner, Rajastan, HRES- Horticultural Research and Extension Station, Devihosur, TNAU- Tamilu Nadu Agriculture University, Coimbatore, GAU- Gujarath Agriculture University, Gujarat, NRC- National Research center Seed Spice, Ajmer, Rajasthan.

The experiment was laid out in the Randomized Complete Block Design with replicated thrice. The seeds of twenty genotypes were sown on 3rd Nov 2016 at ZAHRS, Babbur farm, Hiriyur during *rabi* season with a spacing of 30 x 22.5 cm between row to row and plant to plant spacing were maintained. All the agronomic package of practices was adapted to grow a healthy crop. In each replication five plants randomly selected were marked for observation. Observations were recorded for 17 characters *viz.,* plant height (cm), number of primary branches per plant, number of secondary branches per plant, plant spread (cm^2), days to first flowering, days to 50 percent flowering, days to harvesting, number of umbels per plant, number of umbellets per umbel, number of seeds per umbel, days taken to maturity, dry matter production (g), seed yield per plant (g), seed yield per hectare (q), harvest index (%), test weight (g) and essential oil content (%). The analysis of variance for testing the variation among treatments was carried out as per the method suggested by Panse and Sukhatm, (1957) [10].

Results and Discussion

The data pertaining to the growth parameter like plant height, primary branches, secondary branches and plant spread of different genotypes differed significantly at various growth stages are presented in (Table 1). The genotype Rcr-475 recorded highest plant height of (18.64, 58.73 and 70.27 cm) and followed by the genotype Rcr-446 (15.90, 55.48 and 62.93 cm). The minimum plant height of (8.13, 34.93 and 37.47 cm) was recorded by DCC-4.Variations in plant height were mainly due to genetic factors of the respective genotype as well as influence of the growing environmental conditions which in turn increases vegetative growth leading to synthesis of more carbohydrates and their utilization for food production and effective absorption of the nutrients resulting in increased yield. The maximum number of primary branches per plant was recorded by genotype Rcr-475 (5.25, 5.90 and 7.33, respectively) followed by Rcr-446 (4.90, 5.87 and 6.80, respectively). The genotype DCC-4 recorded minimum number of primary branches per plant (3.33, 3.40 and 4.13, respectively). This might be due to the increased vegetative growth and crop duration. The results similar with the results of Giridhar and Sarada (2005) [4], Moniruzzaman *et al*. (2013) [8], Malik and Tehlan (2013) [6] and Phurailatpam *et al*. (2014) [11].

The maximum number of secondary branches per plant was recorded in genotype Rcr-475 coriander (4.80, 11.30 and 13.90, respectively) followed by Rcr-446 (4.69, 10.50 and 13.40, respectively).The genotype DCC-4 recorded minimum number of secondary branches per plant (2.40, 7.0 and 8.33, respectively). The maximum plant spread was significantly found in Rcr-475 (645 cm^2) followed by Acr-1 (596 cm^2). The minimum plant spread was recorded in the genotype DCC-4 (380.67 cm^2). Such variations could be attributed to genetic constituents of the particular variety and its response to environmental conditions of particular region which favors good growth leading to production of more number of spreading branches. The results regarding plant spread at different stages are more or less in consonance with the results of Giridhar and Sarada (2005) [4], Moniruzzaman *et al*. (2013) [8], Malik and Tehlan (2013) [6] and Phurailatpam *et al*. (2014) [11].

Table 1: Performance of coriander (*Coriandrum sativum* L.) genotypes for growth parameters

Genotypes	Plant height (cm)			Number of primary branches plant[1]			Number of secondary branches plant[1]			Plant spread (cm^2)
	30DAS	60 DAS	At harvest	30 DAS	60 DAS	At harvest	30 DAS	60 DAS	At harvest	
T_1-Rcr-684	8.87	48.13	52.67	4.87	5.40	6.07	2.73	8.13	10.60	525.00
T_2-Rcr-728	8.35	36.40	42.80	4.27	5.07	5.97	4.20	9.93	11.73	451.00
T_3-Rcr-446	15.90	55.48	62.93	4.90	5.87	6.80	4.69	10.50	13.40	596.00
T_4-Rcr-20	9.32	44.53	46.93	4.60	4.73	5.20	4.00	9.13	10.73	467.00
T_5-Rcr-436	9.50	36.13	40.00	4.00	4.20	4.40	3.80	9.87	10.00	388.33
T_6-Rcr-41	10.00	36.20	58.87	4.33	5.80	6.53	4.00	8.67	13.13	581.00
T_7-Rcr-480	9.63	42.73	44.80	4.80	5.53	6.13	3.40	9.93	10.53	487.00
T_8-Rcr-475	18.64	58.73	70.27	5.25	5.90	7.33	4.80	11.30	13.90	645.00
T_9-Rcr-435	10.89	39.00	40.93	4.60	5.00	6.07	3.73	8.67	11.47	435.33
T_{10}-Co-1	10.48	41.20	45.40	4.60	5.00	5.20	3.73	10.27	10.47	548.67
T_{11}-Co-2	9.37	40.93	41.13	4.30	4.60	5.20	4.63	9.47	10.07	486.00
T_{12}-Co-3	11.08	50.47	52.47	4.00	4.20	4.40	4.67	9.73	11.93	575.00
T_{13}-Co-4	10.02	49.07	54.60	4.60	5.33	6.27	4.33	9.53	11.07	582.00
T_{14}-Gco-1	10.56	54.00	58.67	4.90	5.00	6.27	4.00	9.07	10.60	449.33
T_{15}-Gco-2	11.86	51.33	55.87	4.80	5.53	6.07	4.27	10.33	13.27	557.33
T_{16}-Acr-1	10.10	44.40	49.20	4.85	5.47	7.07	3.33	9.60	12.47	569.67
T_{17}-Dcc-1	9.18	45.20	46.00	4.53	4.67	4.80	3.60	9.13	9.47	389.33
T_{18}-Dcc-2	10.01	45.07	45.13	4.87	4.67	4.60	3.53	9.13	10.40	439.33
T_{19}-Dcc-3	9.97	38.53	39.33	4.00	4.13	4.47	3.53	8.47	9.27	392.67
T_{20}-Dcc-4	8.13	34.93	37.47	3.33	3.40	4.13	2.40	7.00	8.33	380.67
S. Em ±	0.65	3.00	3.03	0.28	0.41	0.52	0.34	0.53	0.96	45.05
C.D @ 5%	1.87	10.10	8.90	1.20	1.30	1.54	0.99	1.51	2.84	132.6

The data pertaining to yield and quality parameter of different genotypes differed significantly at various growth stages are presented in (Table 2). The genotype DCC-4 (39.33 days) has recorded less number of days for first flowering (39.33 days) whereas, genotype Rcr-41 was late flowering type. Hence, it took maximum days to first flowering (58.67 days). Growth is also one of the important characters, which determines the earliness of the variety which is controlled by the genetic factors. Similar results were reported by Moniruzzaman *et al*. (2013) [8] and Malik and Tehlan (2013) [6].

The genotype Dcc-3 and Dcc-4 has recorded less number of days to 50 per cent flowering (43.67 days) whereas genotype Rcr-41 was late flowering type as it took maximum days to 50 percent flowering (63.67 days).

Highest number of umbels, umbellets per plant was recorded in the genotype Rcr-475 (28.13 and 5.50) and it was lowest in the genotypes Acr-1 (13.20) and DCC-4 (3.97). This variation in the yield could be attributed to genotypic character and response of the particular genotype to the specified environment conditions. These results more or less in consonance with the results of Giridhar and Sarada (2005) [4], Moniruzzaman *et al*. (2013) [8], Malik and Tehlan (2013) [6] and Phurailatpam *et al*. (2014) [11].

The maximum number of seeds per umbellet was recorded in the genotype Rcr-475 (5.70) while, the minimum was found in the genotypes DCC-4 (3.80). The maximum days taken for maturity was recorded in the genotype Rcr-446 (110 days) and Rcr-41(110 days) While, it was minimum in the genotype DCC-3 (94.00 days). This may be due to its early flowering nature of the particular genotype and crop duration. Thease results more or less in consonance with the results of Giridhar and Sarada (2005) [4], Moniruzzaman *et al*. (2013) [8], Malik and Tehlan (2013) [6].

The maximum dry matter production (8.22 q) was recorded in the genotype Rcr-41 while, the genotype DCC-4 has recorded a low dry matter production (2.80 q). The dry matter accumulation efficiency differs with different genotypes. If the dry matter is more, it is evident that the photosynthetic system is efficient. In the present study, the total dry matter production of whole plant varied significantly due to genotypes. The present findings are in consonance with the findings of Velayudham *et al*. (2004) [15] and Maurya *et al*. (1989) [7].

The genotype Rcr-475 has recorded highest seed yield per plant, plot and hectare (6.37g, 505g and16.83 q respectively) and minimum in genotype DCC-4(2.67 g, 279.5 g and 9.31q respectively). The difference in seed yield per plant might be due to the genotypic difference and ecological variation. The results are more or less in consonance with the results of Moniruzzaman *et al*. (2013) [8], Malik and Tehlan (2013) [6] and Phurailatpam *et al*. (2014) [11].

Test weight was also found to be one of the important yield components in deciding the seed yield per hectare. The genotype Rcr-475 (14.53 g) has recorded the highest test weight. While, it was lowest in the genotype Rcr-436 (8.07 g). This may be mainly due to genetic factor of the respective genotype as well as influence of the growing environmental conditions. Lowest test weight (8.07 g) was recorded in genotype Rcr-436.The present findings are in consonance with the findings of Gurbuz *et al*. (2001) [5] and Velayudham *et al*. (2004) [15].

Harvest index was found to be maximum (56.52 %) in the genotype Acr-1 while the genotype DCC-2 (38.36 %) had lowest harvest index. Seed yield is more compare to its dry matter yield due to its remobilization of photosythates to the sink. Similar variation in harvest index among the varieties was reported by several workers (Maurya, 1989; Shridhar, 1989; Velayudham, 2004) [15, 7, 14].

Essential oil content was found to be maximum (0.8 %) in the genotype Acr-1, and Rcr-728, while the genotype DCC-4 had lowest essential oil content (0.1%). Essential oil content is found to be significantly varied among the genotypes studied. This could be attributed to the lower starch content. Starch being a primary metabolite, may affect the accumulation of secondary metabolites like oil. This is in confirmation with the studies of earlier workers Rajagopalan *et al*., 1996 [13]; Prabhu and Balakrishnamurthy 2006 [12]; Velayudham *et al*., 2006 [15]. These results are in conformity results of the (Palanikumar and Rajamani, 2012) [9].

Table 2: Performance of Coriander (*Coriandrum sativum* L.) Genotypes for Yi eld and Quality parameters

Genotypes	Days to first flowering	Days to 50 % flowering	Days to maturity	Umbels plant^{-1}	Umbellet umbel^{-1}	Seeds umbellete^{-1}	Seed yield (g) plant^{-1}	Seed yield (g plot^{1})	Seed yield (qha^{-1})	Dry matter (q ha^{-1})	Test weight (g)	Harvest index (%)	Essential oil (%)
T_1-Rcr-684	47.00	53.67	101.67	18.40	4.80	5.14	4.03	300.00	10.00	3.66	9.57	52.41	0.5
T_2-Rcr-728	53.00	59.00	98.33	21.07	4.53	5.30	5.29	390.50	13.01	3.96	9.37	41.92	0.8
T_3-Rcr-446	47.33	54.33	110.00	27.87	5.47	5.52	6.20	497.50	16.58	6.89	14.10	47.36	0.4
T_4-Rcr-20	46.67	52.00	96.33	21.67	4.94	4.61	3.55	295.00	9.83	5.34	14.27	39.93	0.3
T_5-Rcr-436	39.67	44.00	96.00	18.19	5.03	4.80	5.27	317.50	10.58	5.57	11.73	48.62	0.4
T_6-Rcr-41	58.67	63.67	110.00	25.00	5.33	5.39	6.07	487.00	16.23	8.22	9.73	42.54	0.3
T_7-Rcr-480	45.00	48.67	99.33	22.60	4.77	4.48	5.37	421.00	14.03	7.69	12.60	41.12	0.4
T_8-Rcr-475	45.33	51.00	102.00	28.13	5.50	5.70	6.37	505.00	16.83	6.74	14.53	48.59	0.6
T_9-Rcr-435	52.33	56.00	100.67	22.07	4.37	4.43	5.13	364.50	12.15	4.40	11.47	53.83	0.4
T_{10}-Co-1	39.67	45.00	99.33	17.20	4.63	3.93	4.90	393.00	13.10	7.40	10.00	39.84	0.4
T_{11}-Co-2	42.33	46.33	99.00	18.93	4.81	4.83	5.07	360.50	12.01	5.72	10.43	46.99	0.4
T_{12}-Co-3	41.67	46.33	97.33	18.60	5.39	5.17	5.31	341.00	11.36	5.77	10.77	47.92	0.6
T_{13}-Co-4	44.33	47.33	99.33	23.00	5.06	5.33	5.77	444.00	14.80	8.06	12.97	41.72	0.5
T_{14}-Gco-1	48.67	54.67	98.67	17.93	4.83	4.13	3.53	357.00	11.90	5.42	11.20	39.44	0.4
T_{15}-Gco-2	42.00	46.00	99.67	17.10	5.00	5.03	3.73	326.50	10.88	7.33	12.10	48.50	0.4
T_{16}-Acr-1	52.67	59.67	108.33	18.13	5.03	5.30	5.33	387.00	12.90	4.10	10.77	56.52	0.8
T_{17}-Dcc-1	39.67	45.33	94.33	17.00	4.97	5.15	2.93	301.50	10.05	3.36	8.63	46.58	0.2
T_{18}-Dcc-2	39.67	45.00	94.33	16.57	4.83	4.53	2.80	334.00	11.13	4.50	10.00	38.36	0.3
T_{19}-Dcc-3	40.00	43.67	94.00	15.94	4.10	3.83	2.73	299.50	9.98	3.86	9.10	41.43	0.2
T_{20}-Dcc-4	39.33	43.67	95.00	13.20	3.97	3.80	2.67	279.50	9.31	2.80	8.07	48.81	0.1
S. Em ±	1.83	2.08	3.41	1.73	0.26	0.40	0.75	21.48	0.72	1.54	0.85	2.38	0.04
C.D @ 5%	5.32	6.06	10.00	5.10	0.76	1.16	2.2	63.27	2.10	4.51	2.50	6.93	0.12

Conclusion

Based on growth, yield and quality, it can be concluded that the genotypes Rcr-475, Rcr-446, DCC-3, DCC-4, Rcr-728 and Acr-1 were found to perform well under central dry zone of Karnataka. These genotypes can be used in further of crop improvement programme.

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