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OIL CONTENT AND OTHER QUALITY ATTRIBUTES OF CORIANDER ACCESSIONS

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Abstract

A total of thirty genotypes of coriander (*Coriandrum sativum* L.) were evaluated during *rabi* season in the year 2015-2016 at HCRI Venkataramannagudem, Andhra Pradesh (A. P.), India. The genotype LCC-322 was found to have the highest plant height (74.68 cm). The genotype LCC-335 produced the maximum number of primary branches per plant (30.31), maximum leaf area was found in genotype LCC-325 (83.19 cm^2), the maximum dry weight (3.30 g) was observed in LCC-317, the highest herbage yield per plant (8.12 g) was recorded by the genotype Shiggaon-3, maximum biomass production (46.35 g) was recorded by LCC-321. The genotype commercial check Suguna recorded maximum harvest index (57.75), whereas maximum yield was achieved in genotype Suguna (commercial check) (502.17 kg/ha), which was significantly superior over than other genotypes evaluated. The highest oil content was recorded in the genotype LCC-335 (0.41%).

Key words : Coriander, leaf area, herbage, biomass, harvest index, yield, oil content.

Introduction

Coriander (*Coriandrum sativum* L.) is the most important seed spice crop cultivated throughout the world both for seed and leaf purpose. The crop grows in tropics and requires a cool, but comparatively dry frost-free climate, particularly at flowering and seed formation stages (Sharma and Sharma, 2004). It is grown in almost all the states of India either for grain or leaf or dual purpose. In India the crop is cultivated mainly in Rajasthan, Madhya Pradesh, Andhra Pradesh, Orissa, Tamil Nadu and Karnataka on an area of 5.43 lakh ha with a production of 5.24 lakh metric tonnes (Tiwari, 2014). The average crop productivity is only 965 kg ha^{-1} and is much lower in rainfed farming situation (477 kg ha^{-1}). The low productivity under rainfed situation is mainly due to terminal moisture stress that affects growth and productivity. Growing coriander in rainfed in Godavari zone farming situation demands highly productive types with short (75 days) to medium (85-100 days) duration for cultivation. Locally grown indigenous genotypes are low in productivity and give poor returns to the farmers. Critical evaluation of available selections of improved types with high yield potential/ traits is of great value to the breeder for crop improvement (Moniruzzaman, 2013). Mengesha and Getinetalemaw (2010) evaluated some Ethiopian coriander genotypes and reported that identification and evaluation of elite or promising genotypes for yield and quality is an important crop improvement strategy. Sarada and Giridhar (2009, 2011) opined that it is possible to realize 1500 kg ha^{-1} under rainfed conditions if a proper combination of genotypes and management are available to the farmers. Keeping this in view, the present study was undertaken to evaluate promising diverse genotypes from Godavri zone of Andhra Pradesh.

Materials and Methods

The present investigation entitled "Evaluation of Coriander (*Coriandrum sativum* L.) Genotypes in Godavari Zone of Andhra Pradesh" was carried out during the year 2015-16 at Horticulture College and Research Institute, Dr. Y.S.R Horticultural University, Venkataramannagudem, West Godavari District (A.P.), India. The location falls under Agro-climatic zone-10, humid, East Coast Plain and Hills (Krishna-Godavari zone) with an average annual rainfall of 900 mm at an altitude of 34 m (112 feet) above mean sea level. The geo-graphical situation is 16^{o} $63'$ $120''$ N latitude and 81^{o} $27'$ $568''$ E longitude. It experiences hot humid summer and mild winter. A total of thirty genotypes were taken for evaluation study out of which fifteen genotypes were sourced from HRS Devihosur (Haveri) Karnataka (Ranibennur-1, Ranibennur-2, Ranibennur-3, Byadagi-1, Hangel-1, Hangel-2, Savanur-1, Savanur-2, Savanur-3, Hirekerur-1, Hirekerur-2, Hirekerur-3, Shiggaon-1, Shiggaon-2, Shiggaon-3) whereas, the rest of the accessions were sourced from HRS Lam Guntur, Andhra Pradesh (LCC-200, LCC-331, LCC-321, LCC-323, LCC-325, LCC-334, LCC-335, LCC-316, LCC-328, LCC-320, LCC-317, LCC-319 and LCC-322; and two checks *viz*., AD-1 (local check) and Suguna (commercial check). The experiment was laid out in RBD with two replications and thirty genotypes. The observations were recorded on various growth, seed yield and quality parameters. The crop was raised at a plant spacing of 30 cm × 15 cm. The seed were sown during 2nd of November and harvested during 2nd fortnight of February. A basal fertilizer dose of 35 kg N, 35 kg P_2O_5 and 35 kg K_2O ha^{-1} was given at the time of soil preparation each year. Soil was prepared to a fine tilth and the seed sown in rows using a labor. At 20 days after sowing (DAS), the plants were thinned 15 cm apart to maintain a uniform plant population. Need-based plant protection measures were taken up to raise a healthy crop. Plants were uprooted at harvest. Threshing was done with wooden sticks and seeds winnowed to remove any impurities. Five randomly selected plants from each replication were used for recording of yield attributes. Plant height measured by scale, dry weight by weighing machine, number of primary was assessed by counting from the plant samples, leaf area by leaf area meter. Total grain yield was obtained from net plot yield which was converted to per hectare yield and oil content extracted by hydro-distillation method by using Clevenger's apparatus.

Results and Discussion

Plant height and number of primary branches

The data of 2015-2016 year indicated that the genotypes under evaluation varied significantly with respect to qualitative and seed yield attributes studied (table 1). Significant differences were observed among the genotypes with respect to plant height at all stages of growth (table 1). The plant height at 75 DAS was found to be the highest (74.68 cm) in the genotype LCC-322 which was on par with LCC-200 and LCC-319 (72.42, 71.00 cm, respectively). The genotype Hangel-1 recorded the minimum plant height of 50.49 cm which was on par with Rabibennur-1 and Ranibennur-3 (51.11, 51.05 cm respectively). Sixteen genotypes were significantly taller than the local check AD-1 (61.04 cm). The number of primary branches per plant was found to show significant differences among the genotypes at all stages of plant growth (table 1). The genotype LCC-335 produced the maximum number of primary branches per plant (30.31) at 75DAS, while the genotype Ranibennur-2 had the minimum number of primary branches per plant (9.65) which was on par with Savanur-3 (10.66). A total of 13 genotypes showed significantly higher number of primary branches per plant when compared to the commercial check Suguna (19.44). The height of plant normally denotes how many nodes are born and how long the internodes are. Therefore, the number of primary branches born may have a positive association with the height of main axis, though not compulsory in every case. It is evident from the results that there is a slight but not strong association between the height of plant and number of primary branches and in turn with number of secondaries. Genotypes or accessions reaching maximum height at maturity normally were noticed to possess reasonably good number of branches and however, slightly shorter genotypes also possessed number of branches on par with the tallest accessions. This can be attributed to the reason that there would be differences in the apical dominance property that might be due to differential contents or synthesis of auxins or their suppression due to antagonising plant hormones. These results are in concurrence with the findings of those reported by Meena *et al*. (2014) in coriander, Beemnet *et al*. (2013) in coriander, Anubha *et al*. (2013) in fenugreek and Bandela *et al*. (2014) in coriander.

Leaf area and dry weight of plant

The data in table 1 revealed that there were significant differences among genotypes with respect to leaf area at different stages of plant growth. The genotype LCC-325 showed maximum leaf area (83.19 cm^2) at 75 DAS which was on par with LCC-320 (82.44 cm^2), LCC-323 (81.94 cm^2), Hangel-1(81.85 cm^2), LCC-328 (80.69 cm^2), LCC-316 (80.48 cm^2), LCC-319 (80.42 cm^2) and Shiggaon-2 (80.07 cm^2) whereas, LCC-200 showed minimum leaf area (68.30 cm^2) which was on par with Ranibennur -3 (68.68 cm^2), Savanur-2 (70.01 cm^2) and Savanur-3 (71.21 cm^2). Nineteen genotypes excelled the local check AD-1 (74.44 cm^2) with respect to leaf area per plant. The number of leaves is dependent largely upon the number of nodes and also on the number of branches both primaries and secondaries arising on the main shoot of the plant. When there are more branches a plant is likely to have more leaves but depending on the expansion of them the leaf area per plant may show a different trend. Therefore the number of leaves and leaf area may not behave in association however, they can follow similar trend partially due to variations in the individual growth of leaf laminae. In the present study, it is observed that though not very strong there is an association between the number of leaves and leaf area *i.e.* more the leaves in a genotype maximum is the leaf area per plant or at least on par with the most superior accession. The observations recorded by Banerjee and Kole (2004) and Mourya *et al*. (2015) in fenugreek for grain yield per plant were also in conformity with this. The trait exhibited significant differences among the genotypes under study at different stages (table 1). The maximum dry weight (3.30 g) was observed in LCC-317 at 75 DAS, which was on par with LCC-323 (3.27 g), LCC-328 (3.14 g), LCC-320 (3.06 g), Shiggaon-3 (2.97 g), Local check AD-1 (2.93 g), LCC-331 (2.88 g), LCC-200 (2.87 g) and LCC-316 (2.86 g). The minimum dry weight of whole plant was found in Ranibennur-1 (1.47 g), which was on par with Byadagi-1 (1.58 g), Hangel-1 (1.59 g), Hangel-2 (1.67 g), Savanur-2 (1.72 g), Hirekerur-2 (1.73 g), Savanur-3 (1.82 g), Ranibennur-3 (1.83 g), Ranibennur-2 (1.99 g) and Shiggaon-2 (2.0 g). A total of five genotypes had significantly higher dry weight of whole plant than the local check AD-1(4.89 g). Leaf area is the area of assimilation of light energy into chemical energy through a process known as photosynthesis. The effectiveness of photosynthetic apparatus inside the plant is quantitatively delimited by leaf area per plant. Since the photosynthetic products contribute to the protoplasm inside the cells, tissues and organs, it is the area of assimilation that governs the gross material ingested and synthesised within the plant system. Therefore, the fresh weight of whole plant is dependent on leaf area per plant and also the number of leaves per plant. Fresh weight of plant largely includes moisture in the cellular environment. The tenacity with which the moisture is held can be different in different cells or tissues or organs and also largely in genotypes. A genotype that loses moisture loosely may be left with very little dry matter and similarly when the vegetative parts are stronger and not plump in any accession, they may show slightly more dry matter disproportioning with its corresponding fresh weight. However, there is slightly similar ranking or at par ranking between fresh weight and dry weight values among the genotypes in the present study. Similar influence of these characters and their interdependence was also compiled by Meena *et al*. (2014) in coriander.

Herbage yield, biomass production and harvest index

The genotypes varied significantly in terms of herbage yield per plant at 45DAS (table 2). The highest herbage yield per plant (8.12 g) was recorded by the genotype Shiggaon-3 which was on par with LCC-328 (8.06 g), LCC-325 (7.63 g), AD-1 (7.61 g), LCC-200 (7.59 g) and LCC-331 (7.32 g). The genotype Ranibennur-3 produced the lowest herbage yield per plant (4.33 g) on par with Byadagi-1 (4.49 g) and Ranibennur -2 (5.20 g). Six genotypes had significantly more herbage yield per plant as compared to the local check AD-1 (7.61 g). The biomass production exhibited significant differences among the genotypes studied (table 2). Maximum biomass production (46.35 g) was recorded by LCC-321 which was on par with LCC-331 (43.43 g). The genotype Ranibennur-3 recorded the lowest biomass production (18.51 g), which was on par with Shiggaon-3 (19.00 g),

Table 1 : Vegetative traits in coriander genotypes.

Genotypes	Plant height (cm)	No. of primary branches	Leaf area (cm^2)	Dry weight (g)
Ranibennur-1	51.11	17.16	74.53	1.47
Ranibennur-2	54.12	9.65	71.73	1.99
Ranibennur-3	51.05	17.78	68.68	1.83
Byadagi-1	56.83	16.24	76.80	1.58
Hangel-1	50.49	17.25	81.85	1.59
Hangel-2	60.98	17.14	78.35	1.67
Savanur-1	58.77	14.28	74.26	1.97
Savanur-2	61.92	14.99	70.01	1.72
Savanur-3	56.54	10.66	71.21	1.82
Hirekerur-1	62.68	16.07	73.55	2.04
Hirekerur-2	60.84	19.00	77.13	1.73
Hirekerur-3	66.78	17.40	76.03	2.27
Shiggaon-1	59.92	17.39	78.96	2.43
Shiggaon-2	63.42	19.16	80.07	2.00
Shiggaon-3	62.22	17.91	78.85	2.97
AD-1 (check)	61.04	19.23	74.44	2.93
Suguna (check)	56.46	19.44	73.55	2.71
LCC-200	72.42	20.92	68.30	2.87
LCC-331	60.50	23.59	74.27	2.88
LCC-321	56.74	20.17	76.08	2.63
LCC-323	68.59	21.13	81.94	3.27
LCC-325	61.75	20.53	83.19	2.66
LCC-334	70.66	22.71	72.62	2.54
LCC-335	64.34	30.31	78.79	2.53
LCC-316	66.14	23.93	80.48	2.86
LCC-328	66.70	23.31	80.69	3.14
LCC-320	66.82	21.13	82.44	3.06
LCC-317	65.54	20.70	78.42	3.30
LCC-319	71.00	20.53	80.42	2.61
LCC-322	74.68	19.85	76.58	2.56
Mean	**62.03**	**18.99**	**76.47**	**2.39**
S Em ±	0.76	1.32	1.03	0.19
CD	2.20	3.83	2.99	0.54

Table 2 : Herbage, biomass, harvest index, seed yield and oil content traits in coriander genotypes.

Genotypes	Herbage yield (g)	Biomass production at harvest (g)	Harvest index (%)	Grain yield per plant (g)	Grain yield per plot (g)	Grain yield per ha (kg)	Oil content (%)
Ranibennur-1	5.36	20.50	42.92	8.80	105.60	255.07	0.20
Ranibennur-2	5.20	23.00	41.67	9.59	115.03	277.84	0.24
Ranibennur-3	4.33	18.51	30.61	5.67	82.50	199.28	0.33
Byadagi-1	4.49	22.00	21.57	4.75	74.64	180.29	0.32
Hangel-1	5.78	22.00	40.56	8.93	107.10	258.70	0.25
Hangel-2	5.41	31.01	21.59	6.70	94.15	227.42	0.34
Savanur-1	6.32	19.50	21.02	4.10	65.80	158.94	0.31
Savanur-2	5.60	24.50	45.56	11.17	133.98	323.62	0.28
Savanur-3	5.83	30.50	33.61	10.25	123.00	297.10	0.27
Hirekerur-1	6.47	25.00	43.26	10.82	129.78	313.48	0.31
Hirekerur-2	6.51	21.82	53.49	11.67	140.07	338.33	0.32
Hirekerur-3	5.80	27.01	40.14	10.84	130.10	314.24	0.36
Shiggaon-1	6.87	26.51	21.68	5.75	79.80	192.75	0.24
Shiggaon-2	5.95	27.95	30.86	8.63	103.53	250.07	0.35
Shiggaon-3	8.12	19.00	54.60	10.38	124.50	300.72	0.18
AD-1 (check)	7.61	22.50	41.10	9.25	110.97	268.04	0.26
Suguna (check)	7.12	30.00	57.75	17.33	207.90	502.17	0.24
LCC-200	7.59	36.90	34.06	12.57	150.84	364.35	0.32
LCC-331	7.32	43.43	31.77	13.80	165.60	400.00	0.26
LCC-321	6.31	46.35	24.81	11.50	138.00	333.33	0.34
LCC-323	6.32	33.74	37.52	12.66	151.92	366.96	0.30
LCC-325	7.63	34.00	29.34	9.98	119.70	289.13	0.35
LCC-334	5.78	37.41	23.86	8.93	107.10	258.70	0.39
LCC-335	7.25	34.31	27.33	9.38	112.50	271.74	0.41
LCC-316	5.89	38.01	35.36	13.44	161.25	389.49	0.39
LCC-328	8.06	38.22	40.82	15.60	187.20	452.17	0.18
LCC-320	7.08	33.66	22.05	7.42	98.54	238.02	0.31
LCC-317	6.77	23.61	31.67	7.48	96.72	233.62	0.18
LCC-319	7.01	29.86	38.68	11.55	138.60	334.78	0.24
LCC-322	6.60	26.63	37.55	10.00	120.00	289.86	0.29
Mean	**6.41**	**28.92**	**35.23**	**9.96**	**119.55**	**296.01**	**0.29**
S Em ±	0.32	1.85	1.12	0.80	12.10	25.88	0.02
CD	0.94	5.36	3.25	2.32	34.99	74.85	0.06

Savanur-1 (19.50 g), Rabibennur-1 (20.50 g), Hirekerur-1 (21.82 g), Byadagi-1 (22.00 g), Hangel-1 (22.00 g), AD-1 (22.50 g) and Ranibennur -2 (23.00 g). A total 12 genotypes had significantly maximum biomass production as compared to the commercial check Suguna (30.00 g). The differences noticed in respect of harvest index among the genotypes under study were found to be significant (table 2). The genotype commercial check Suguna recorded maximum harvest index (57.75), which was on par with Shiggaon-3 (54.60). The genotype Savanur-1 recorded minimum harvest index (21.02) on par with Byadagi-1 (21.57), Hangel-2 (21.59), Shiggaon-1 (21.68), LCC-320 (22.05) and LCC-334 (23.86). Genotype Suguna had significantly maximum harvest index as compared to other than all genotypes (57.75). During reproductive phase, coriander produces umbellets in each umbel and these umbellets bear the schizocarps. It is the effectiveness of the schizocarp bearing points on the umbellets that decides the productivity of each umbel. The number of umbellets per umbel is not showing very wide variations perhaps it may be a crop bound character and not so dynamic with genotype.

Grain yield

The genotypes varied significantly in terms of grain yield per plant (table 2). The highest grain yield per plant (17.33 g) was recorded by commercial check Suguna which was on par with LCC-328 (15.60 g). The genotype Savanur-1 produced the lowest grain yield per plant (4.10 g) on par with Byadagi-1 (4.75 g), Ranibennur-3 (5.67 g) and Shiggaon-1 (5.75 g). Twenty nine genotypes had significantly lower grain yield per plant as compared to the commercial check Suguna (17.33 g). The grain yield per plot exhibited significant differences among the genotypes studied (table 2). Maximum grain yield per plot at (207.90 g) was recorded by Suguna which was on par with LCC-328 (187.20 g). The genotype Savanur-1 recorded the lowest grain yield per plot (65.80 g) on par with Byadagi-1 (74.64 g), Shiggaon-1 (79.80 g), Ranibennur-3 (82.50 g), Hangel-2 (94.15), LCC-317 (96.72) and LCC-320 (98.50 g). The commercial check Suguna genotype had significantly maximum grain yield per plot as compared to the all other genotypes (207.90 g). The grain yield per hectare exhibited significant differences among the genotypes studied (table 1). Maximum grain yield per hectare (502.17 kg) was recorded by Suguna which was on par with LCC-328 (452.10 kg). The genotype Savanur-1 recorded the lowest grain yield per hectare (158.94 kg) on par with Byadagi-1 (180.29 kg), Shiggaon-1 (192.75 kg), Ranibennur-3 (199.28 kg), Hangel-2 (227.42 kg) and LCC-317 (233.62 kg). The commercial Suguna genotypes had significantly maximum grain yield per hectare as compared to the all other genotypes (502.17 kg). The percentage of oil varied significantly among the genotypes (table 2). The genotype LCC-335 was recorded maximum percentage of oil (0.41%) which was on par with LCC-334 (0.39%), LCC-316 (0.39%), Hirekerur -3 (0.36%), Shiggaon-2 (0.35%) and LCC-325 (0.35%). The genotype Shiggaon-3, LCC-328 and LCC-317 recorded minimum percentage of oil (0.18%) on par with Ranibennur-1 (0.20%), Ranibennur-2, Shiggaon-1, Suguna and LCC-319 (0.24%). A total ten genotypes were more oil content as compared to the local check AD-1 (0.26%).

The boldness of grain and its weight and oil content are dependent on how it was able to drag the assimilates from different sources and also perhaps due to its genetic makeup. It is the speed and steady flow of the photosynthetic products that decides over time the size of the fruits and its weight. Therefore, these quality parameters are necessarily influenced by greater values of vegetative parameters as evident from the data obtained on these parameters from various genotypes. Bold grains and in higher quantities would definitely lead to greater grain yield per plant which in turn govern corresponding top rank of a genotype in grain yield per plot and per hectare. However, grain quality has no bearing on total yield or quantity produced by an accession. In the present study, it is evident that genotypes had independent ranking with regard to quality parameters as against grain yield. Yield is a complex character and is influenced by several attributing parameters. Similar trends were also noted by Meena *et al*. (2014) in coriander and Anubha *et al*. (2013) in fenugreek.

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