Coriander yield characteristics as influenced by varied date of sowing and planting geometry under Chhattisgarh plain zone

ABSTRACT

A field experiment was carried out during the *rabi* season of 2020-21 and 2021-22 at Instructional farm, College of Agriculture and Research Station, IGKV, Raigarh, Chhattisgarh to find out the influence of different sowing dates and planting geometry on coriander. The experiment was laid out in split plot design with sixteen treatment combinations of main and sub plots, replicated trice. Four Dates of sowing *viz.* D_1: 25th October, D_2: 10th November, D_3: 25th November and D_4: 10th December were arranged in main plot and four planting geometries *viz.,* S_1: 30 x 5 cm, S_2: 30 x 7.5 cm, S_3: 30 x 10 cm and S_4: 30 x 12.5 cm were taken as subplot treatments. Results revealed that coriander sown on 25th October registered significantly yield attributing characters *viz.*, number of umbels plant^{-1}, number of umbellets umbel^{-1}, number of umbellets plant^{-1}, number of seeds umbel^{-1}, number of seeds umbellet^{-1}, length of umbel, diameter of umbel, weight of umbels, test weight, seed yield plant^{-1} and seed yield ha^{-1}. Among planting geometry, sowing of coriander at 30 x 12.5 cm spacing produced significantly higher values of aforesaid characters except for seed yield ha^{-1}, which was maximum under 30 x 10 cm spacing. The interaction effect of 25th October coupled with the spacing 30 x 12.5 cm produced significant maximum seed yield plant^{-1}.

Key words: Coriander, Date of sowing, Planting geometry, yield attributes, umbel

Introduction

Coriander (*Coriandrum sativum* L.) is a significant annual spice and medicinal herb belonging to the Apiaceae family, native to Eastern Europe and Asia. Cultivated for its fragrant seeds, commonly known as "Dhania," it possesses carminative, diuretic, stomachic, and aphrodisiac properties when dried. The essential oil extracted from coriander seeds during stem distillation comprises major components such as linalool (67.7%), 1-pipen (10.5%), 1-terpinin (9.0%), geranyl acetate (4%), and geraniol (1.9%).

Successful coriander production is influenced by genetic, weather, and agronomic factors (Szemplinski and Nowak, 2015). Optimal fruit and essential oil yields are achieved when the right combination of these factors is provided (Rangappa *et al*., 1997; Gill *et al*., 2001). The date of sowing plays a crucial role in coriander management, affecting the photoperiodic response, yields, and qualities (Kuri *et al*., 2015). Changes in sowing time impact weather microclimates and subsequently crop performance. The physical environment, including temperature, humidity, and rainfall, can limit plant growth and production individually or collectively.

Establishing suitable spacing for maintaining the optimum plant population per unit area is essential for maximizing yields in any crop. Adequate planting geometry supports better crop growth and development, ultimately leading to higher production. Enhancing the productivity of both local and improved coriander varieties through the adoption of recommended sowing dates and planting geometries is crucial in contemporary agriculture.

Material and methods

The study was conducted over two consecutive *Rabi* seasons, namely 2020-21 and 2021-22, at the Instructional Farm of the College of Agriculture and Research Station, Raigarh, IGKV, Chhattisgarh. The location is positioned at 21.9' North latitude, 83.4' East longitude, and has an altitude of 215 meters above mean sea level. The experimental soil at the site is characterized as loamy sand, slightly acidic, low in organic carbon, and deficient in available nitrogen, phosphorus, sulfur, and zinc. However, it exhibits medium availability of potassium and has low moisture retention capacity.

The experimental design employed a split-plot layout with sixteen treatment combinations in main and sub-plots, replicated thrice. The main plots involved four different sowing dates: 25th October, 10th November, 25th November, and 10th December. The subplots consisted of four planting geometries: 30 x 5 cm, 30 x 7.5 cm, 30 x 10 cm, and 30 x 12.5 cm. The recommended fertilizer dose of 80:60:40 kg N: P_2O_5: K_2O ha^{-1} was applied. The impact of these treatments on coriander cultivation's yield characteristics was examined, and statistical analysis, using the F-test following Gomez and Gomez's (1984) procedure, was performed. Significance of mean differences among treatments was determined using Critical Difference (CD) values at P=0.05.

Results and discussion

Coriander planted on October 25th exhibited notably higher yield-related characteristics, including the number of umbels plant^{-1}, number of umbellets umbel^{-1}, number of umbellets plant^{-1}, number of seeds umbel^{-1}, number of seeds umbellet^{-1}, umbel length, umbel diameter, weight of umbels, test weight, seed yield plant^{-1}, and seed yield ha^{-1} compared to other sowing dates (Table 1 and 2). This trend was observed consistently across both years and in the pooled analysis. Early sowing dates contribute to ample moisture availability, improved nutrition, maximal interception of photosynthetically active radiation (PAR), and increased synthesis of photosynthates. This leads to luxurious plant growth, resulting in enhanced growth and yield characteristics and ultimately an increase in seed yield. Similar findings were reported by Khoja (2005) in fenugreek, Anitha *et al.* (2016) in fenugreek, and Kiran (2018) in black cumin.

Regarding planting geometry, the use of 30 x 12.5 cm spacing resulted in significantly higher values for the number of umbels plant^{-1}, number of umbellets umbel^{-1}, number of umbellets plant^{-1}, number of seeds umbel^{-1}, number of seeds umbellet^{-1}, umbel length, umbel diameter, weight of umbels, test weight, and seed yield plant^{-1} over the two years and on average, whereas the seed yield ha^{-1} was recorded significantly maximum under 30 x 10 cm spacing (Table 1 and 2). The observed outcome can be attributed to the heightened growth and yield characteristics in the 30 cm × 12.5 cm planting configuration. This success is a consequence of sufficient moisture availability, improved nutrition, and optimal interception of photosynthetically active radiation (PAR). The resulting profuse branching and higher biomass accumulation per plant contribute to increased growth and yield characteristics, ultimately leading to a higher seed yield. The abundant branching appears to stimulate increased flowering initiation, and the augmented supply of metabolites, facilitated by the higher biomass plant^{-1}, likely aids in flower retention. This, in turn, promotes greater seed formation and seed growth. While, under wider spacing i.e. 30 x 12.5 cm, reduced plant population per unit area though, improved overall growth of crop, but due to less plants per units area of crop it failed to record highest yield per hectare. Similar findings were documented by Ajay *et al*. (2016), Diwan *et al*. (2018), and Nethravathi (2019).

The interaction between sowing date and planting geometry did not show significance in various aspects of coriander yields, however, there were notable variations in number of umbellets plant^{-1} and seed yield plant^{-1} due to these interactions. Specifically, the combined effect of sowing on October 25th along with a spacing of 30 x 12.5 cm resulted in significantly higher number of umbellets plant^{-1} and seed yield plant^{-1}. This performance was comparable to the combination of October 25th sowing with 30 x 10 cm spacing across both years and on average (Table 3). Kiran (2018) also reported comparable findings in black cumin, supporting similar results.

Conclusion

The findings from the two-year experiments lead to the conclusion that coriander crops sown on October 25th and utilizing a spacing of 30 x 12.5 cm exhibited significantly superior yield characteristics and the per hectare yield was maximum under 30 x 10 cm spacing.

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Table 1. Coriander yield characteristics as influenced by different date of sowing and planting geometry

Treatment	No. of umbels plant^{-1}			No. of umbellets umbel^{-1}			No. of umbellets plant^{-1}			No. of seeds umbel^{-1}			No. of seeds umbellet^{-1}			Length of Umbel (cm)			Diameter of umbel (cm)			Weight of umbel (g)		
	20-21	21-22	Mean	20-21	21-22	Mean	20-21	21-22	Mean	20-21	21-22	Mean	20-21	21-22	Mean	20-21	21-22	Mean	20-21	21-22	Mean	20-21	21-22	Mean
Date of sowing																								
25th October	21.33	23.16	22.25	5.03	5.49	5.26	109.38	129.24	119.31	32.06	34.86	33.46	6.65	7.11	6.88	10.66	11.31	10.98	8.32	9.19	8.75	0.34	0.37	0.35
10th November	18.07	19.37	18.72	4.65	5.04	4.84	86.51	100.15	93.33	29.68	31.39	30.53	6.46	6.83	6.64	10.37	10.97	10.67	7.97	8.82	8.39	0.30	0.34	0.32
25th November	16.31	17.28	16.79	4.16	4.52	4.34	68.66	79.70	74.18	24.60	26.02	25.31	5.97	6.32	6.15	9.47	9.89	9.68	7.84	8.53	8.19	0.28	0.31	0.29
10th December	13.53	14.32	13.92	4.00	4.28	4.14	55.20	62.75	58.97	21.29	22.42	21.86	5.36	5.61	5.48	9.18	9.51	9.34	7.14	7.72	7.43	0.25	0.28	0.26
SEm±	0.62	0.58	0.46	0.15	0.13	0.14	4.59	3.62	3.51	0.63	0.82	0.69	0.20	0.19	0.18	0.20	0.20	0.20	0.17	0.19	0.18	0.01	0.01	0.01
CD (*P*=0.05)	2.15	2.01	1.61	0.51	0.46	0.44	15.89	12.53	12.16	2.17	2.85	2.40	0.62	0.65	0.61	0.69	0.69	0.69	0.60	0.66	0.63	0.03	0.03	0.03
Planting geometry																								
30 cm x 5 cm	11.86	12.72	12.29	3.97	4.29	4.13	47.87	55.75	51.81	20.23	21.58	20.91	5.12	5.33	5.22	8.99	9.34	9.16	7.23	7.89	7.56	0.22	0.24	0.23
30 cm x 7.5 cm	14.95	16.13	15.54	4.26	4.61	4.44	64.73	75.49	70.11	25.61	27.34	26.47	6.04	6.33	6.18	9.61	10.08	9.85	7.73	8.45	8.09	0.27	0.31	0.29
30 cm x 10 cm	20.25	21.72	20.98	4.62	5.01	4.81	94.87	110.95	102.91	29.88	31.78	30.83	6.54	7.07	6.80	10.45	11.02	10.73	8.00	8.80	8.40	0.33	0.36	0.34
30 cm x 12.5 cm	22.17	23.57	22.87	4.98	5.43	5.20	112.28	129.64	120.96	31.92	33.99	32.96	6.74	7.15	6.95	10.63	11.23	10.93	8.30	9.12	8.71	0.35	0.39	0.36
SEm±	0.44	0.48	0.36	0.10	0.13	0.11	2.65	3.62	2.31	0.51	0.72	0.58	0.16	0.21	0.16	0.14	0.14	0.14	0.10	0.11	0.11	0.01	0.01	0.01
CD (*P*=0.05)	1.27	1.41	1.04	0.28	0.39	0.32	7.73	10.56	6.74	1.50	2.11	1.70	0.46	0.61	0.47	0.40	0.40	0.40	0.30	0.34	0.31	0.02	0.03	0.02
Interaction																								
CD (*P*=0.05)	NS	NS	NS	NS	NS	NS	S	S	S	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 2. Growth of coriander as influenced by different date of sowing and planting geometry

Treatment	Test weight (g)			Seed yield Plant^{-1} (g)			Seed yield (q ha^{-1})		
	20-21	21-22	Mean	20-21	21-22	Mean	20-21	21-22	Mean
Date of sowing									
25th October	12.98	13.82	13.40	5.27	5.84	5.55	18.16	20.35	19.26
10th November	12.12	12.94	12.53	4.48	4.91	4.70	14.86	16.65	15.76
25th November	11.03	11.66	11.34	3.86	3.98	3.92	12.40	13.14	12.77
10th December	10.84	11.24	11.04	3.13	3.35	3.24	9.72	10.80	10.26
SEm±	0.16	0.21	0.12	0.13	0.15	0.12	0.59	0.68	0.45
CD (*P*=0.05)	0.55	0.72	0.43	0.45	0.51	0.42	2.06	2.34	1.53
Planting geometry									
30 cm x 5 cm	10.52	10.99	10.75	1.81	2.02	1.91	10.79	12.49	11.64
30 cm x 7.5 cm	11.52	12.21	11.87	3.28	3.60	3.44	13.28	14.74	14.01
30 cm x 10 cm	12.31	13.05	12.68	5.39	5.75	5.57	16.01	17.39	16.70
30 cm x 12.5 cm	12.61	13.41	13.01	6.26	6.71	6.48	15.06	16.30	15.68
SEm±	0.18	0.17	0.14	0.12	0.14	0.12	0.63	0.74	0.62
CD (*P*=0.05)	0.53	0.50	0.40	0.36	0.41	0.35	1.84	2.16	1.80
Interaction									
CD (*P*=0.05)	NS	NS	NS	S	S	S	NS	NS	NS

Table 3. Interaction effects between different sowing dates and planting geometry on number of umbellets plant^{-1} and seed yield plant^{-1}

Number of umbellets plant^{-1}														
2020-21					2020-21					Mean				
Sowing date / Spacing	D_1	D_2	D_3	D_4	Sowing date / Spacing	D_1	D_2	D_3	D_4	Sowing date / Spacing	D_1	D_2	D_3	D_4
S_1	69.47	44.98	37.33	26.38	S_1	86.36	52.54	43.45	30.04	S_1	77.91	48.76	40.39	28.21
S_2	93.57	64.01	52.04	35.45	S_2	109.76	82.15	60.79	44.95	S_2	101.66	73.08	56.42	40.20
S_3	126.24	109.44	72.03	57.43	S_3	151.99	122.85	89.30	63.92	S_3	139.12	116.14	80.67	60.68
S_4	147.91	127.91	88.30	69.33	S_4	170.70	144.34	108.53	81.28	S_4	159.30	136.13	98.41	75.31
SEm±	**4.31**				**SEm±**	**3.608**					**2.663**			
CD (P=0.05)	**12.57**				**CD (P=0.05)**	**10.530**					**7.772**			

Seed yield plant^{-1}														
Sowing date / Spacing	D_1	D_2	D_3	D_4	Sowing date / Spacing	D_1	D_2	D_3	D_4	Sowing date / Spacing	D_1	D_2	D_3	D_4
S_1	2.45	1.59	0.86	0.56	S_1	2.87	1.87	1.27	0.80	S_1	2.66	1.73	1.06	0.68
S_2	4.14	3.29	2.46	1.62	S_2	4.71	3.60	2.92	1.86	S_2	4.43	3.45	2.69	1.74
S_3	6.77	5.50	4.51	2.81	S_3	7.46	6.04	4.98	3.03	S_3	7.11	5.77	4.74	2.92
S_4	7.98	6.34	5.26	3.38	S_4	8.74	7.27	5.52	3.75	S_4	8.36	6.81	5.39	3.57
SEm±	**0.161**				**SEm±**	**0.193**				**SEm±**	**0.162**			
CD (P=0.05)	**0.470**				**CD (P=0.05)**	**0.563**				**CD (P=0.05)**	**0.474**			

D_1: 25th October, D_2: 10th November, D_3: 25th November, D_4: 10th December,
S_1: 30 cm x 5 cm, S_2: 30 cm x 7.5 cm, S_3: 30 cm x 10 cm, S_4: 30 cm x 12.5 cm