Growth analysis of coriander (*Coriandrum sativum* L.) as influenced by different sowing dates and planting geometry in Chhattisgarh plains zone

ABSTRACT

An experiment was conducted to assess the effect of different sowing dates and planting geometry on coriander during the winter seasons of 2020-21 and 2021-22 at Instructional farm, College of Agriculture and Research Station, IGKV, Raigarh, Chhattisgarh. The experiment was laid out in split-plot design, comprised of four date of sowing *viz.,* D_1: 25th October, D_2: 10th November, D_3: 25th November and D_4: 10th December as 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 as sub-plot, and replicated trice. Influence of above treatments on crop was studied regarding growth parameters of coriander and analyzed statistically. The result showed that the crop sown on 25th October recorded significantly higher growth parameters *viz.,* plant height, number of branches, dry matter accumulation, crop growth rate and relative growth rate. Among planting geometry, sowing of coriander at 30 x 12.5 cm spacing produced significantly taller plants, higher number of branches plant^{-1}, dry matter accumulation plant^{-1}, crop growth rate and relative growth rate. Coriander sown on 25th October interacted with the 30 x 12.5 cm spacing and registered significantly higher dry matter accumulation.

Key words: Coriander, Date of sowing, Planting geometry

Introduction

Coriander (*Coriandrum sativum* L.), which belongs to the family of umbelliferae (Apiaceae) is one of the most important annual spice and medicinal herb, native to the Eastern Europe and Asia. Coriander is commercially grown in India, Morocco, Romania, USSR, Mexico, Argentina, Hungary, Poland, Bulgaria and USA. In India it is mainly grown in the states of the Madhya Pradesh, Rajasthan, Gujrat, Assam, Odisha, West Bangal, Andhra Pradesh and Uttar Pradesh in a limited extent, it is also grown in Karnataka, Uttar Pradesh, Bihar, Tamil Nadu, Chhattisgarh and Punjab. (Anonymous, 2021).

It is grown as a field crop for its seeds commonly known as "*Dhania*" which has a fragrant odor and aromatic test. The dry seeds are said to have carminative diuretic, stomachic and aphrodisiac properties. On stem distillation, coriander seeds yield 0.2 to 1.2% essential oil. The major components of essential oil are linalool (67.7 %) followed by 1-pipen (10.5 %), 1-terpinin (9.0 %), geranyl acetate (4 %) and geraniol (1.9 %). The success of coriander production is influenced by genetic, weather and agronomic factors (Szemplinski and Nowak, 2015). The maximum seed and essential oil yields are attained only when an appropriate combination of these factors is provided for the plant (Rangappa *et al.*, 1997; Gill *et al*., 2001). Date of sowing is an important management factor for almost all seed spices including coriander. Coriander exploits the environment most favorably when it is sown at the optimum time (Kuri *et al*., 2015), since the sowing date significantly affects the photoperiodic response of plants and determines yields and qualities (Rassam *et al*., 2007). Change in sowing time leads to significant changes in weather microclimate and subsequently the performance of the crop. In addition, the physical environment has a profound influence on growth, partitioning and ultimately the yield of coriander. Temperature, humidity, rainfall and other meteorological factors may individually or collectively limit the plant growth and production. The establishment of an appropriate spacing for maintaining the optimum plant population per unit area is the main pre- requisite to obtaining maximum yields from any crop. Optimal planting arrangements also contribute to enhanced crop growth and development, thereby resulting in increased production yields. To increase the productivity of local and improved varieties of coriander, it is important that farmers adopt the recommended sowing date and planting geometry.

Material and methods

The experiment was laid out for two consecutive *Rabi* seasons of 2020-21 and 2021-22 at Instructional Farm, College of Agriculture and Research Station, Raigarh, IGKV, Raipur, Chhattisgarh, which is situated at 21.9' North latitude, 83.4' East longitude and at an altitude of 215 meters above mean sea level. The experimental soil was loamy sand in texture, slightly acidic in reaction, low in organic carbon and available nitrogen, phosphorus, sulphur and zinc and medium in available potassium, having low moisture retention capacity. The experiment was carried 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 sub-plot treatments. Recommended dose of fertilizer of 80:60:40 N: P_2O_5: K_2O kg ha^{-1} was applied. Data on the growth behavior of coriander i.e. plant height, number of branches, dry matter accumulation, crop growth rate and relative growth rate were collected and analyzed statistically using *F*- test, the procedure given by Gomez and Gomez (1984). Critical difference (CD) values at *P*=0.05 were used to determine the significance of mean differences between treatments.

Results and discussion

Coriander sown on 25th October recorded significantly higher plant population in both seasons, which were not significantly different from those recorded with the 10th November and 25th November sowing during both seasons. Sowing of coriander on 25th October produced significantly taller plants, higher number of branches plant^{-1} (Table 1), dry matter plant^{-1} (Table 2), crop growth rate (Fig. 1) and relative growth rate (Fig. 2) and minimum was observed when coriander was sown on 10th December at all the crop growth stages during both seasons (Table 1 and 2). In early growing season, i.e. 25th October sowing, coriander resulted in to healthy crop growth. The crop sown on 25th October enjoyed favourable environment particularly optimum cardinal temperatures might have helped in better physiological functions of the plant as manifested in increase in plant height, branches per plant increased accumulation of dry matter per plant. Whereas, the plant did not have optimum opportunity for photosynthesis when it was sown lately. The results are in agreement with Khoja (2005), Meena *et al.* (2006), Nath *et al.* (2008) in fennel and Moniruzzaaman *et al.* (2013) in coriander.

Coriander sown with the planting geometry 30 x 5 cm recorded significantly higher plant population and taller plants followed by 30 x 7.5 cm, 30 x 10 cm and 30 x 12.5 cm during both seasons of experimentation. Sowing of coriander with 30 x 12.5 cm spacing, produced significantly higher number of branches plant^{-1} (Table 1), dry matter plant^{-1} (Table 2), crop growth rate (Fig. 1) and relative growth rate (Fig. 2). Tallest plants under closer spacing may be attributed to more competition for light amongst the plants. Increased growth

under 30 x 12.5 cm spacing might be attributed to more space plant^{-1}, available under wider spacing. The larger canopy development, associated with profuse branching, most likely increased interception, absorption and utilization of solar energy resulting in formation of higher photosynthates and finally dry matter plant^{-1}, which has resulted in better growth and development of coriander. The results are in line with Kiran *et al*. (2019), Bhapkar *et al*. (2019) and Nethravathi (2019).

The plant population and growth characteristics of coriander, such as plant height, number of branches per plant, crop growth rate, and relative growth rate, did not show significant differences due to the combined influence of sowing date and planting arrangement. However, these parameters exhibited numerically superior values when sown on October 25th with a spacing of 30 x 12.5 cm, except plant height which was maximum under 25th Octoer sowing with 30 x 5 cm spacing. Among growth parameters, dry matter accumulation of coriander varied significantly and was recorded significantly maximum under sowing date 25th October along with 30 x 12.5 cm, which was at par with 25th October sowing along with 30 x 10 cm spacing during both the years and on mean basis (Table 3). These results are in conformity with those reported by Meena *et al*. (2015) and Haq *et al*. (2015).

Conclusion

Based on the two-season experiments it has been concluded that the crop sown on 25th October and 30 x 12.5 cm spacing resulted in significantly better growth and development of coriander.

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Table 1. Growth of coriander as influenced by different date of sowing and planting geometry

Treatment	Plant population (No. m^{-2})						Plant height (cm)												Number of branches $plant^{-1}$					
	20 DAS			At harvest			30 DAS			60 DAS			90 DAS			At harvest			60 DAS			At harvest		
	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																								
25^{th} October	42.62	43.03	42.82	39.92	40.33	40.12	11.13	11.63	11.38	30.19	34.66	32.42	90.77	96.24	93.50	114.40	121.41	117.90	5.83	6.39	6.11	8.32	8.69	8.50
10^{th} November	41.69	42.64	42.17	38.99	39.94	39.47	9.74	10.23	9.98	27.93	30.82	29.37	85.68	90.04	87.86	105.89	111.80	108.84	5.27	5.82	5.50	7.73	7.98	7.85
25^{th} November	40.78	41.48	41.13	38.08	38.78	38.43	8.80	9.20	9.00	24.89	26.55	25.72	80.12	83.68	81.90	90.98	95.15	93.06	4.72	5.12	4.92	7.26	7.47	7.37
10^{th} December	38.61	40.06	39.34	35.91	37.36	36.64	8.13	8.49	8.31	22.77	24.07	23.42	74.83	77.68	76.26	81.04	84.51	82.78	4.38	4.74	4.56	6.72	6.88	6.80
SEm±	0.71	0.54	0.61	0.63	0.53	0.57	0.17	0.21	0.18	0.72	0.92	0.70	2.49	2.21	2.22	2.86	2.84	3.01	0.15	0.13	0.12	0.17	0.23	0.19
CD (*P*=0.05)	2.47	1.86	1.76	2.13	1.81	1.93	0.60	0.72	0.63	2.23	3.18	2.41	8.61	7.63	7.69	9.88	9.82	9.36	0.51	0.44	0.42	0.59	0.79	0.65
Planting geometry																								
30 cm x 5 cm	63.37	65.65	64.51	59.37	61.65	60.51	10.37	10.78	10.58	31.05	34.53	32.79	87.86	93.13	90.49	105.47	112.18	108.82	4.25	4.55	4.39	6.58	6.86	6.72
30 cm x 7.5 cm	43.24	43.77	43.51	40.24	40.77	40.51	9.94	10.38	10.16	28.80	31.55	30.18	85.36	90.15	87.76	103.58	108.45	106.02	4.82	5.17	4.98	7.22	7.38	7.30
30 cm x 10 cm	31.68	32.22	31.95	29.38	29.92	29.65	9.04	9.49	9.27	24.75	26.99	25.87	81.47	85.19	83.33	94.08	99.22	96.65	5.46	6.03	5.73	7.98	8.24	8.11
30 cm x 12.5 cm	25.40	25.58	25.49	23.90	24.08	23.99	8.44	8.89	8.66	21.18	23.03	22.11	76.71	79.17	77.94	89.18	93.02	91.10	5.68	6.32	5.98	8.25	8.55	8.40
SEm±	0.47	0.45	0.21	0.47	0.45	0.21	0.19	0.13	0.15	0.52	0.61	0.38	1.74	1.64	1.47	2.12	1.48	1.51	0.16	0.15	0.15	0.20	0.16	0.16
CD (*P*=0.05)	1.38	1.31	0.61	1.38	1.31	0.61	0.57	0.39	0.48	1.52	1.77	1.12	5.09	4.80	4.30	6.18	4.32	4.40	0.45	0.44	0.43	0.58	0.46	0.47
Interaction																								
CD (*P*=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	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	Dry matter accumulation (g plant^{-1})											
	30 DAS			60 DAS			90 DAS			At harvest		
	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	0.33	0.37	0.35	3.40	3.69	3.54	11.68	12.18	11.93	13.98	15.19	14.58
10th November	0.31	0.35	0.33	3.10	3.33	3.22	10.85	11.37	11.11	12.31	13.54	12.92
25th November	0.29	0.32	0.31	2.74	2.92	2.83	9.98	10.57	10.28	10.81	11.70	11.25
10th December	0.26	0.29	0.27	2.17	2.29	2.23	8.94	9.22	9.08	9.31	9.93	9.62
SEm±	0.01	0.01	0.01	0.06	0.05	0.05	0.37	0.30	0.32	0.28	0.33	0.23
CD (*P*=0.05)	0.03	0.02	0.02	0.22	0.17	0.16	1.28	0.92	0.98	0.97	1.14	0.79
Planting geometry												
30 cm x 5 cm	0.20	0.22	0.21	1.77	1.87	1.82	5.02	5.40	5.21	5.62	6.43	6.03
30 cm x 7.5 cm	0.25	0.28	0.27	2.41	2.59	2.50	8.52	9.17	8.85	9.55	10.66	10.10
30 cm x 10 cm	0.35	0.39	0.37	3.53	3.75	3.64	13.29	13.70	13.49	14.78	15.73	15.25
30 cm x 12.5 cm	0.39	0.43	0.41	3.70	4.02	3.86	14.63	15.08	14.85	16.46	17.54	17.00
SEm±	0.01	0.01	0.01	0.09	0.09	0.08	0.23	0.18	0.14	0.27	0.30	0.24
CD (*P*=0.05)	0.03	0.03	0.03	0.25	0.27	0.22	0.68	0.51	0.40	0.79	0.86	0.69
Interaction												
CD (*P*=0.05)	NS	NS	NS	S	S	S	S	S	S	S	S	S

Table 3. Interaction effects between different sowing dates and planting geometry on dry matter accumulation of coriander

Dry matter accumulation (g plant^{-1}) at 60 DAS														
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	2.41	1.51	0.70	0.55	S_1	2.61	1.60	0.95	0.65	S_1	2.51	1.56	0.83	0.60
S_2	2.92	2.44	1.68	0.86	S_2	3.16	2.59	2.00	0.96	S_2	3.04	2.52	1.84	0.91
S_3	4.05	3.75	3.37	1.54	S_3	4.36	3.98	3.10	1.88	S_3	4.21	3.87	3.24	1.71
S_4	4.20	3.91	3.57	1.71	S_4	4.63	4.11	3.62	2.05	S_4	4.42	4.01	3.60	1.88
SEm±	**0.10**				**SEm±**	**0.09**				**SEm±**	**0.07**			
CD (P=0.05)	**0.28**				**CD (P=0.05)**	**0.25**				**CD (P=0.05)**	**0.22**			
Dry matter accumulation (g plant^{-1}) at 90 DAS														
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	6.8	4.8	2.5	2.0	S_1	6.5	4.7	3.7	2.2	S_1	6.6	4.7	3.1	2.1
S_2	10.6	9.1	6.8	4.6	S_2	9.9	9.1	7.9	5.1	S_2	10.2	9.1	7.4	4.9
S_3	16.0	14.2	12.1	7.9	S_3	15.5	14.1	12.4	8.2	S_3	15.7	14.1	12.2	8.1
S_4	17.4	15.3	13.5	9.2	S_4	16.8	15.3	13.5	10.1	S_4	17.1	15.3	13.5	9.7
SEm±	**0.70**				**SEm±**	**0.44**				**SEm±**	**0.27**			
CD (P=0.05)	**2.05**				**CD (P=0.05)**	**1.29**				**CD (P=0.05)**	**0.79**			
Dry matter accumulation (g plant^{-1}) at harvest														
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	7.4	4.9	2.7	2.1	S_1	8.5	5.7	4.0	2.6	S_1	8.0	5.3	3.4	2.3
S_2	11.5	9.5	7.3	5.0	S_2	12.8	10.2	8.6	5.7	S_2	12.2	9.9	8.0	5.3
S_3	17.8	15.0	12.3	8.3	S_3	19.2	16.2	13.4	8.8	S_3	18.5	15.6	12.9	8.5
S_4	19.9	16.5	14.0	9.7	S_4	21.4	18.5	14.5	10.5	S_4	20.7	17.5	14.2	10.1
SEm±	**0.463**				**SEm±**	**0.49**				**SEm±**	**0.33**			
CD (P=0.05)	**1.351**				**CD (P=0.05)**	**1.42**				**CD (P=0.05)**	**0.96**			

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

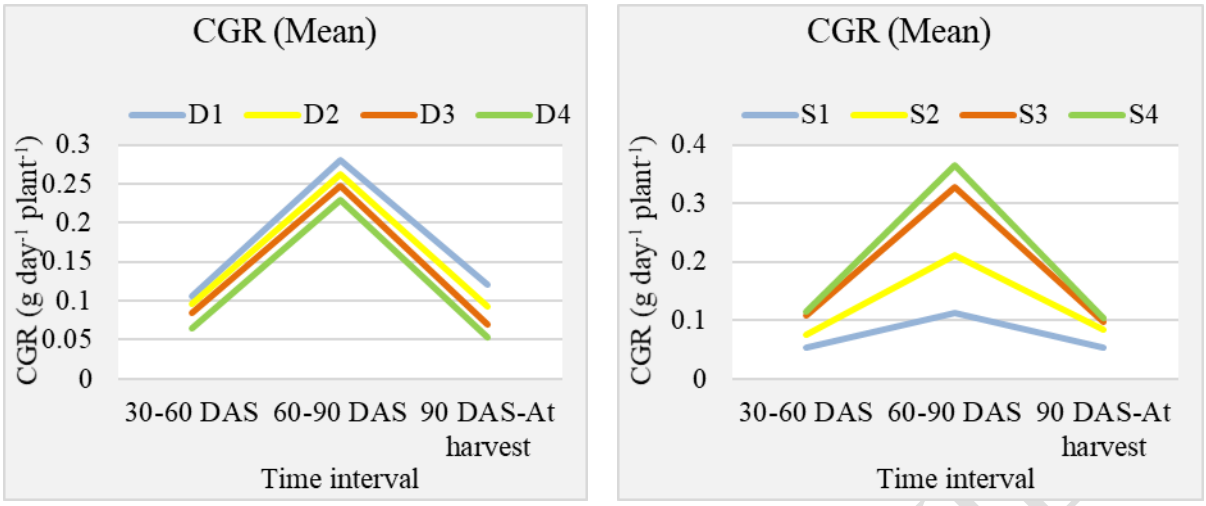

Fig. 1: Crop growth rate of coriander as influenced by different date of sowing and planting geometry

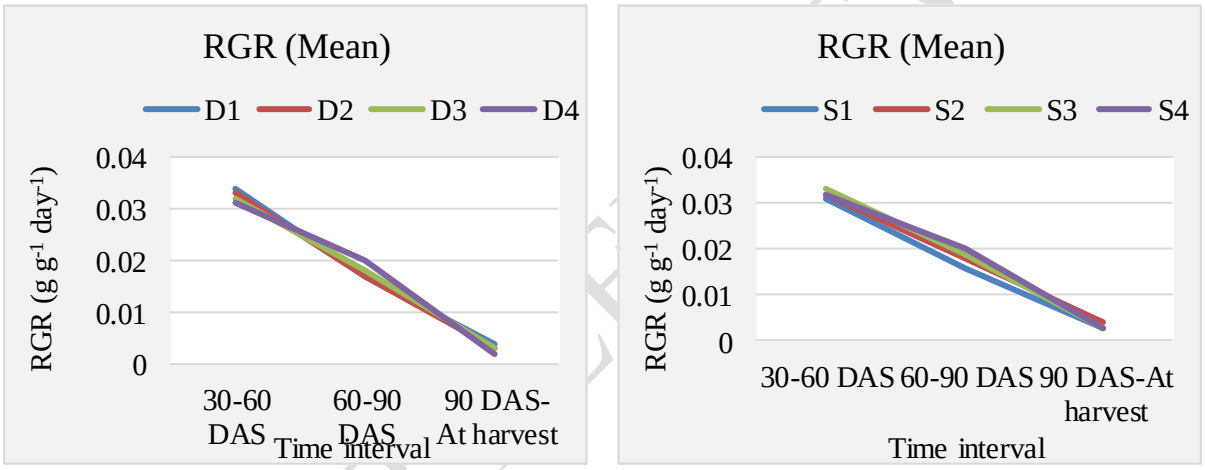

Fig. 2: Relative growth rate of coriander as influenced by different date of sowing and planting geometry