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Short communication

Growth and yield of cumin as influenced by irrigation and nutrient levels with varying crop geometry

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ABSTRACT

A field experiment was conducted during three *rabi seasons* to study growth, profitability and productivity of cumin (*Cuminum cyminum* L.) as influenced by irrigation and nutrient levels with varying crop geometry. Three irrigation levels (12, 15 and 18-day interval) in main plot, nutrient levels (N and P_2O_5 each of 20 + 10, 30 + 20 and 40 + 25 kg /ha, respectively) in sub-plot and crop geometry (20 cm × 10 cm, 25 cm × 10 cm and 30 cm × 10 cm) in sub-sub-plot were studied in sub-sub split plot design with three replications. The highest plant height at all the growth stages was recorded with irrigation at 12-day interval but branches/ plant at 18-day interval and dry matter accumulation per plant at all the growth stages of cumin was recorded with irrigation at 15-day interval. Yield attributes, seed yield (4.71 q/ha), straw yield (9.89 q/ha) and biological yield (14.60 q/ha) as well as net return (Rs. 43,497 per ha) and B:C ratio (3.33) was obtained with irrigation at 18-day interval. Higher growth parameters, yield attributes, seed yield (3.71 q /ha), straw yield (7.79 q /ha), net return (Rs. 30,502/-ha) and B:C ratio (2.23) were obtained with application of 30 N and 20 kg P_2O_5 /ha. Crop geometry of 25 cm × 10 cm resulted in 15 and 6% higher seed and straw yield over 20 cm × 10 cm, respectively. Thus, application of irrigation at 18-day interval with 30 kg N + 20 kg P_2O_5/ ha at 25 cm × 10 cm crop geometry was found better for realizing higher yields, net return and profitability in cumin production.

Key words: Cumin, irrigation, crop geometry, fertility.

Cumin, commonly known as *Zira in* Hindi a major seed spice crop belonging to Apiaceae family. In India it is mainly cultivated in Gujarat and Rajasthan. Gujarat ranks first in area and production of cumin followed by Rajasthan. It possesses many medicinal properties due to which it is used in domestic and Ayurvedic medicines. It is mainly carminative, stomachic and diuretic (Meena *et al.*, 6). Though, water requirement of cumin is low even though the limited quantity of available water for irrigation calls urgent need for application of water at appropriate intervals for ensuring better water use efficiency. Nitrogen and phosphorus are important essential plant nutrients for growth, development and various physiological and biochemical processes. The prices of fertilizers are escalating, which compelled us to enhance fertilizer use efficiency for reducing the cost of production. Therefore, standardization of optimum dose of fertilizers is urgent need of present time. Further, maintenance of optimum plant population is essential for interception of optimum quantity of solar radiation without exerting any competition for nutrient and water in plants. Very, meagre information on management of nutrient and water along with crop geometry is available. Thus, the present investigation was carried out with an object to find optimum irrigation interval, suitable fertilizer doses and efficient crop geometry in cumin.

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The field experiment on growth and yield of cumin as influenced by irrigation and nutrient levels with varying crop geometry was conducted at NRCSS, Ajmer during three consecutive *rabi* seasons. The soil of the experimental site was sandy loam with a pH of 8.92 having 0.21% organic carbon and 76.0, 33.4, and 234.1 kg/ha available N, P_2O_5 and K_2O, respectively. The experiment was laid out in split-split plot design comprising of three irrigation levels (I_1 - 12 day interval, I_2 - 15 day interval and I_3 - 18 day interval) in main plot, three doses of nitrogen and phosphorus (N and P_2O_5 each at 20 + 10, 30 + 20 and 40 + 25 kg/ ha, respectively) in sub-plot treatment and three crop geometry (20 cm × 10 cm, 25 cm × 10 cm and 30 cm × 10 cm) in sub-sub-plot treatment with three replications. Sowing of cumin cv. RZ-209 using 15 kg seed/ ha was done at 20, 25 and 30 cm line to line spacing keeping 10 cm plant to plant distance. Immediately after sowing, light irrigation was applied for ensuring proper germination and establishment of the crop. Thereafter, irrigation at 50 mm depth measured with Pashall flume of 7.5 mm throat placed at the head irrigation channel was provided as per irrigation intervals. Total 6, 5 and 4 irrigations were provided in 12, 15 and 18-day intervals, respectively. Fifty per cent of total nitrogen and full dose of phosphorus under study was provided at the time of sowing and remaining half

nitrogen was divided in two equal splits and applied at 30 and 60 DAS, respectively. The nitrogen and phosphorus were supplied through urea and DAP, respectively. Five plants were selected randomly from each plot and their dry weight was taken after drying in oven at 70°C for 72 h or till constant weight was obtained. Observations on plant height, branches per plant, yield attributing characters, *viz*., umbels per plant, umbellates per umbel and seeds per umbellate and yield were recorded. Statistical analysis was done with the procedure prescribed by Panse and Sukamte (8).

The plant height, dry matter accumulation /plant at all the growth stages and branches /plant were significantly influenced with application of varying levels of irrigation. Application of irrigation at 15 day interval resulted higher plant height, dry matter accumulation per plant and branches per plant. Yadav and Dahama (10) reported higher growth with application of four irrigations in cumin. The significant increase in plant height, branches/ plant and dry matter accumulation was obtained with increase in nitrogen and phosphorus levels. Application of 30 + 20 kg/ ha (N and P_2O_5) gave significantly the highest plant height, branches/ plant at all the growth stages. The growth parameters of cumin with application of 30 kg N and 8.75 kg P_2O_5/ ha was also reported by Bhati *et al*. (1). Close spacing in cumin promoted plant height but higher dry matter accumulation/plant at all the growth stages as well as branches/plant were recorded with crop geometry of 25 cm × 10 cm row to row and plant to plant spacing (Table 1).

The maximum number of umbels / plant, seeds/ umbellate, umbellates/ umbel, test weight and seed yield/ plant were produced with application of irrigation at 18-day interval. The increase in umbels/ plant, umbellates/ plant and seed yield/ plant with irrigation at 18-day interval was in order of 7, 17 and 21 per cent respectively over 12-day interval. Application of 30 + 20 kg /ha N and P_2O_5 produced 7, 12 and 6% more umbels/ plant, umbellates/umbel and seed yield /plant respectively over 20 + 10 kg N and P_2O_5 kg/ ha. Application of higher level of nitrogen and phosphorus enhance growth and yield parameters which in turn result in higher seed, straw and biological yield. Similar results were reported by Meena *et al.* (5) in coriander. Bhati *et al.* (1) also obtained higher yield attributes and yield of cumin with application of N and P_2O_5. Crop geometry of 25 cm × 10 cm in cumin resulted significantly higher yield attributes over 30 × 10 cm and 20 × 10 cm row to row and plant to plant spacing. Sowing of cumin with crop geometry of 25 cm × 10 cm gave 7.5, 15.25 and 10.4% higher umbels/ plant, umbellates/ umbel and seed yield per plant, respectively over 20 cm × 10 cm crop geometry (Table 2). Sowing of cumin at 25 cm × 10 cm facilitate proper growth and development of individual cumin plant resulting in higher yields. Choudhary (2) also reported that higher yield and its attributes of cumin were obtained with spacing of

Table 1. Effect of irrigation and fertility levels with varying crop geometry on growth and yield attributes of cumin.

Treatment	Plant height (cm)			Branches/ plant	Dry matter accumulation/ plant (g)		
	40 DAS	80 DAS	Harvest		40 DAS	80 DAS	Harvest
Irrigation interval (day)							
12	5.87	34.05	40.05	4.44	0.86	2.01	3.30
15	5.21	32.43	38.43	5.94	1.00	2.61	3.86
18	5.02	30.13	36.13	6.28	0.87	2.59	3.84
CD (P = 0.05)	0.41	2.22	2.61	0.29	0.06	0.12	0.21
N and P_2O_5 level (kg/ha)							
20 + 10	4.82	31.23	37.23	5.32	0.67	2.08	3.34
30 + 20	5.79	33.51	39.51	5.73	1.03	2.67	3.94
40 + 25	5.49	31.87	37.87	5.61	1.04	2.47	3.72
CD (P = 0.05)	0.26	1.51	1.79	0.24	0.05	0.11	0.17
Crop geometry (cm × cm)							
20 × 10	5.69	33.50	39.50	5.43	0.77	2.28	3.53
25 × 10	5.19	31.80	37.80	5.55	1.00	2.60	3.89
30 × 10	5.23	31.32	37.32	5.69	0.96	2.34	3.59
CD (P = 0.05)	NS	1.54	1.75	0.29	0.15	0.25	0.27

22.5 cm. Meena *et al.* (7) also reported similar results in anise in which 20 cm × 10 cm spacing resulted higher productivity and profitability.

The highest seed, straw and biological yield of cumin were obtained with irrigation at 18 day interval (Table 3) over irrigation at 12 and 15-day intervals. The harvest index was not influenced with irrigation levels. The optimum moisture status in the root zone of the crop through irrigation at 18-day interval favoured higher yield attributes which increased seed, straw and biological yield of cumin over 12- and 15-day intervals. Yadav and Dahama (10) also

Table 2. Effect of irrigation and fertility levels with varying crop geometries on growth parameters of cumin.

Treatment	Umbels/plant	Seeds/ umbellate	Umbellates/ umbel	Test weight (g)	Seed yield/plant (g)
Irrigation interval (day)					
12	33.09	23.12	5.51	2.62	1.55
15	34.73	24.05	5.47	2.97	1.69
18	35.92	24.80	6.42	2.94	1.88
CD (P = 0.05)	2.16	1.49	0.36	0.17	0.10
N and P_2O_5 level (kg/ha)					
20 + 10	33.23	22.76	5.43	2.61	1.53
30 + 20	35.57	24.96	6.07	2.94	1.93
40 + 25	34.93	24.25	5.91	2.98	1.66
CD (P = 0.05)	1.58	1.10	0.27	0.13	0.08
Crop geometry (cm × cm)					
20 × 10	33.27	23.08	5.31	2.72	1.63
25 × 10	35.76	24.82	6.12	2.94	1.82
30 × 10	34.71	24.07	5.97	2.86	1.67
CD (P = 0.05)	1.64	1.25	0.33	NS	0.16

Table 3. Effect of irrigation and fertility levels with varying crop geometry on yield, return and B:C ratio of cumin.

Treatment	Seed yield (q/ ha)	Straw yield (q/ ha)	Biological yield (q/ ha)	Harvest index (%)	Cost of cultivation (Rs./ ha)	Gross return (Rs./ ha)	Net return (Rs./ ha)	B:C ratio
Irrigation interval (day)								
12	2.22	4.94	7.16	29.67	15,049	26,595	11,545	0.76
15	3.47	8.05	11.53	30.05	14,049	41,693	27,644	1.97
18	4.71	9.89	14.60	32.22	13,049	56,546	43,497	3.33
CD (P = 0.05)	0.17	0.37	0.54	NS	996	2,017	1,339	0.10
N and P_2O_5 level (kg/ha)								
20 + 10	3.04	7.41	10.46	27.57	13,792	36,498	22,706	1.71
30 + 20	3.71	7.79	11.51	32.24	14,075	44,576	30,502	2.23
40 + 25	3.65	7.68	11.32	32.12	14,281	43,760	29,478	2.12
CD (P = 0.05)	0.16	0.33	0.49	1.91	672	1,865	1,294	0.10
Crop geometry (cm × cm)								
20 × 10	3.17	7.39	10.56	29.64	14,049	38,015	23,966	1.76
25 × 10	3.65	7.84	11.49	30.56	14,049	43,818	29,769	2.18
30 × 10	3.58	7.66	11.24	31.73	14,049	43,000	28,951	2.12
CD (P = 0.05)	0.29	0.35	0.60	NS	603	3,483	3,121	0.10

obtained higher yield of cumin with application of four irrigations. Rao *et al*. (9) also reported higher cumin yield with irrigation at 0.8 IW/ CPE ratio. Application of 30 + 20 N and P_2O_5 exhibited 22, 5 and 10% higher seed, straw and biological yield over 20 + 10 kg/ha N and P_2O_5/ ha respectively. Jangir *et al*. (4) reported that application of five irrigations and 20 kg N /ha gave higher seed yield of cumin. Gora *et al.* (3) also reported similar results in cumin. Significantly higher seed, straw and biological yield was recorded with crop geometry of 25 cm × 10 cm, which was on account of higher dry matter accumulation and yield attributes. Sowing of cumin at 25 cm × 10 cm to row and plant to plant spacing resulted 15, 6 and 9% higher seed and straw yields, respectively over 20 cm × 10 cm crop geometry. Choudhary (2) also obtained higher yield of cumin with sowing of cumin at row to row spacing of 22.5 cm.

Varying irrigation intervals as well as nitrogen and phosphorus levels significantly influenced the gross return, net return and BCR (Table 3). The highest net return and BCR was obtained with application of 30 + 20 kg/ha N and P_2O_5 over rest of the treatments. Irrigation at 18-day interval proved superior in respect to net return and highest BCR. These results are in conformity with the findings of Bhati *et al.* (1). Sowing of cumin with 25 cm × 10 cm crop geometry resulted significantly the highest net return and B:C ratio over rest of the crop geometries under study. These results are in conformity with those reported by Chaudhary (2).Thus, application of irrigation at 18-day interval with 30 kg N + 20 kg P_2O_5/ ha at 25 cm × 10 cm crop geometry is better for realizing higher yield, net return and profitability in coriander production.

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