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Growth and yield of coriander (*Coriandrum sativum* L) as influenced by irrigation and nutrient levels with varying crop geometry

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ABSTRACT

Field experiment was conducted during rabi season of 2003-06 at NRCSS, Ajmer (Rajasthan) to study the growth, profitability and productivity of coriander (*Coriandrum sativum* L) as influenced by irrigation and nutrient levels with varying crop geometry. Three irrigation levels (12, 15 and 18 days interval) in main plot, nutrient levels (N and P_2O_5 each of 30 +15 , 40+20 and 50+25 kg/ha, respectively) in sub plot and crop geometry (20 x 10, 25 x 10 and 30 x 10 cm) in sub-sub plot were studied in split-plot design with three replications. The highest plant height at all the growth stages, branches /plant, dry matter accumulation/plant at 80 DAS and harvest of coriander were recorded with application of irrigation at 15 days interval but higher dry matter /plant at 40 DAS was obtained with irrigation at 18 days interval. Yield attributes, seed yield (12.12 q/ha) and straw yield (18.43 q/ha) was recorded with irrigation at 15 days interval and remained at par with 18 days interval but the highest net return (Rs 41,565/ha) and B:C (2.27) was obtained with 18 days irrigation interval. The higher growth parameters, yield attributes, seed yield (12.48 q /ha), net return (Rs. 42,922/ha) and B:C (2.21) were obtained with application of 50 kg N and 25 kg P_2O_5 /ha. Crop geometry 30 x 10 cm resulted 9 % higher seed yield over 20 x10 cm. Thus, application of irrigation at 15 days interval with 50 kg N + 25 kg P_2O_5/ha at 30 x 10 cm crop geometry is better for realizing higher yields but higher net return and profitability in coriander production may be realized with application of irrigation at 18 days interval.

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

Coriander is a major seed spice crop belonging to Apiacae family. In India it is mainly cultivated in Rajasthan, MP, Gujarat and Karnataka. Rajasthan ranks first in area and production of coriander in our country. With burgeoning population the demand of water is increasing in other sector of economy. However, India has the largest irrigated area in the world, but the coverage of irrigation is only about 40% of the gross cropped area as of today. Hence, limited quantity of water 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 process. The prices of fertilizers are escalating and our country have to spent huge amount of foreign exchange for import of phosphatic and potassic fertilizer. Therefore standardization of optimum dose of fertilizers is the need of present situation for saving fertilizer. Singh and Rao (1994) obtained the highest seed yield of coriander with combined application of 480 mm irrigation water and 114 kg N/ha. Maintenance of optimum plant population is essential for interception of solar radiation without exerting competition for nutrient and water in plants. Very meager information on integrated management of nutrients and water along with crop geometry is available. Thus, the present investigation was carried out with an object to find out optimum irrigation interval, suitable fertilizer doses and efficient crop geometry in coriander.

MATERIALS AND METHODS

The field experiment on growth and yield of coriander as influenced by irrigation and

nutrient levels with varying crop geometry was conducted at NRCSS, Ajmer (Rajasthan) during three consecutive rabi season of 2003-04, 2004-05 and 2005-06. 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-plot design with three levels of irrigation (I_1-12 days interval, I_2-15 days interval and I_3-18 days interval) as main plot, three doses of nitrogen and phosphorus (N and P_2O_5 each of 30+15, 40+20 and 50+25 kg/ha, respectively) as sub plot treatment and three crop geometry (20 x 10, 25 x 10 and 30 x 10 cm) as sub-sub plot treatment and replicated thrice. Sowing of coriander (Var. Ajmer Coriander-1) 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. Afterward each irrigation of 50 mm depth measured with Parshall flume of 7.5 mm throat placed at the head irrigation channel was provided as per irrigation intervals under study. Total 6, 5 and 4 irrigations were provided in 12, 15 and 18 days irrigation interval, respectively. 50% 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. Five plants were selected randomly from each plot and their dry weight was taken after drying in oven at 70° C for 72 hours or till constant weight was obtained. Observations on plant height, branches per plant, yield attributing characters *viz.* umbel per plant, umbellate per umbel, and seed per umbellate and yield were recorded. Results were consistent during all the three years. Hence, the results were discussed based on pooled analysis.The statistical analysis was done as per the procedure suggested by Panse and Sukhatme (1985).

Results and Discussion

Growth

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 days interval resulted higher plant height,dry matter accumulation and branches per plants. Application of 50+25 kg /ha N and P_2O_5 kg /ha gave significantly the highest plant height, branches/plant at all the growth stages. These results are in conformity with those of Sharma, and Israel, (1991) who reported higher growth parameters of coriander with increasing levels of nitrogen and phosphorus. Vinay *et al.* (1999) also reported similar results. Close spacing in coriander promoted plant height but higher dry matter accumulation/plant at all the growth stages as well as number of branches/plant were recorded with crop geometry of 30 x 10 cm row to row and plant to plant spacing (Table 1). Jat *et al.* (1996) also reported better growth parameters of coriander at 30 cm row spacing.

Yield attributes

The maximum number of umbels/plant, seeds/umbellate, umbellate/umbel, test weight and seed yield/plant were produced with application of irrigation at 15 days interval. The increase in umbel/plant, umbellate/plant and seed yield/plant with irrigation at 15 days interval was in order of 9.8, 9.6 and 18.9%, respectively over 12 days interval. Similar results were reported by Singh *et al.* (2002). Application of 50 + 25 kg /ha N and P_2O_5 produces 16.0, 13.8 and 8.7% more umbel/plant, umbellate/umbel and seed yield/plant respectively over 30 +15 kg N and P_2O_5 kg /ha. Application of higher dose of nitrogen results in promotion of growth parameters which results higher yield attributes. These results are in conformity with those of Sharma, and Israel, (1991) who reported higher yield attributes of coriander with increasing levels of nitrogen and phosphorus. Similar results were also reported by Naghera *et al*. (2000). Crop geometry of 30 x 10 cm in coriander resulted significantly higher yield attributes over 25 x 10 cm and 20 x 10 cm row to row and plant to plant spacing. Sowing of coriander with crop geometry of 30 x 10 cm gave 6.0, 9.0 and 7.2% higher umbel /plant, seed yield/plant, respectively over 20 x 10 cm crop geometry (Table 2).

Yield

The highest seed, straw and biological yield

Table 1. Effect of irrigation and fertility levels with varying crop geometry on growth parameters of coriander (Pooled data of 3 years)

Treatments	Plant height (cm)			Branches/plant	Dry matter accumulation/plant (g)		
	40 DAS	80 DAS	Harvest		40 DAS	80 DAS	Harvest
Irrigation intervals							
12 days	20.56	41.12	65.56	5.47	1.35	3.98	10.40
15 days	18.40	38.84	63.40	6.29	1.54	4.77	11.27
18 days	17.81	38.26	62.81	5.70	1.57	4.20	10.70
SEm ±	0.34	0.69	1.10	0.09	0.02	0.07	0.18
CD (P=0.05)	1.35	2.71	NS	0.37	0.09	NS	NS
N and P_2O_5 levels							
30 + 15 kg/ha	17.73	38.17	62.73	5.36	1.39	3.86	10.35
40 + 20 kg/ha	18.80	39.47	63.80	5.99	1.50	4.50	10.93
50 + 25 kg/ha	20.25	40.58	65.25	6.11	1.57	4.59	11.09
SEm±	0.29	0.60	0.97	0.09	0.02	0.06	0.16
CD (P=0.05)	0.90	1.85	NS	0.27	0.07	NS	NS
Crop geometry							
20 x 10cm	19.57	40.79	64.57	5.55	1.34	4.05	10.55
25 x 10 cm	18.88	39.10	63.88	5.85	1.51	4.35	10.85
30 x 10 cm	18.33	38.33	63.33	6.06	1.61	4.55	10.97
SEm ±	0.44	0.65	0.97	0.14	0.03	0.12	0.19
CD (P=0.05)	NS	1.86	NS	0.40	0.09	NS	NS

Table 2. Effect of irrigation and fertility levels with varying crop geometry on yield parameters of coriander (pooled data of 3 years)

Treatments	Umbel/plant	Seeds/ umbellate	Umbellates/ umbel	Test weight (g)	Seed yield/ plant(g)
Irrigation intervals					
12 days	47.10	44.85	5.40	11.97	5.48
15 days	51.71	48.09	6.27	12.13	6.52
18 days	49.08	46.52	5.70	11.52	5.70
SEm ±	0.82	0.75	0.09	0.20	0.09
CD (P=0.05)	3.22	2.94	0.36	0.79	0.37
N and P_2O_5 levels					
30 + 15 kg/ha	46.14	44.25	5.35	10.68	5.62
40 + 20 kg/ha	48.01	46.59	5.93	12.04	5.96
50 + 25 kg/ha	53.74	48.61	6.09	12.89	6.11
SEm±	0.75	0.70	0.09	0.18	0.09
CD (P=0.05)	2.30	2.15	0.27	0.56	0.27
Crop geometry					
20 x 10cm	48.01	44.31	5.55	11.25	5.66
25x10 cm	48.95	47.05	5.85	11.95	5.96
30x10 cm	50.93	48.10	5.97	12.42	6.07
SEm ±	1.21	0.87	0.14	0.32	0.11
CD (P=0.05)	3.48	2.51	0.40	0.56	0.32

of coriander was obtained with irrigation at 15 days interval being at par with irrigation at 18 days intervals (Table 3). Irrigation at 15 days interval produced 13.05, 8.92 and 10.00% higher seed, straw and biological yield over irrigation at 12 days interval. Favorable moisture status

Table 3: Effect of irrigation and fertility levels with varying crop geometry on yield, return and B:C of coriander (Pooled data of 3 years)

Treatments	Seed yield (q/ha)	Straw yield (q/ha)	Biological yielda) (q/ha)	Harvest Index (%)	Cost of cultivation (Rs./ha)	Gross return (Rs./ha)	Net return (Rs./ha)	B:C ratio
Irrigation intervals								
12 days	10.72	16.92	28.00	36.81	20,279	53,594	33,315	1.64
15 days	12.12	18.43	30.92	39.15	19,279	60,599	41,320	2.14
18 days	11.97	18.32	30.62	39.07	18,279	59,844	41,565	2.27
SEm ±	0.18	0.29	0.48	0.83	340	914	578	0.02
CD(P=0.05)	0.72	1.13	1.87	NS	1,335	3,589	2,269	0.09
N and P_2O_5 levels								
30 + 15 kg/ha	10.51	16.58	27.46	36.80	19,076	52,540	33,465	1.77
40 + 20 kg/ha	11.82	18.11	30.29	38.99	19,284	59,098	39,814	2.07
50 + 25 kg/ha	12.48	18.98	31.79	39.24	19,478	62,399	42,922	2.21
SEm ±	0.17	0.27	0.45	0.83	297	864	571	0.03
CD(P=0.05)	0.53	0.83	1.38	NS	916	2,661	1,759	0.09
Crop geometry								
20 x 10cm	11.18	17.08	28.78	38.76	19,279	55,887	36,608	1.91
25x10 cm	11.43	17.86	29.83	36.88	19,279	57,167	37,888	1.97
30x10 cm	12.20	18.73	30.93	39.38	19,279	60,984	41,705	2.18
SEm ±	0.29	0.39	0.68	1.03	280	1461	1279	0.06
CD(P=0.05)	0.84	1.12	1.94	NS	804	4,189	3,668	0.09

in the root zone of the crop through irrigation at 15 days interval favored growth and development of plant and thus increased growth and yield attributes which increased seed, straw and biological yield of coriander over 12 and 18 days interval. These results corroborated with the findings of Singh *et al.* (1971) in coriander who also reported the highest seed yield with application of irrigation at 15 days interval. Application of 50+ 25 kg/ha N and P_2O_5 exhibited 19,14 and 16% higher seed, straw and biological yield over 30 +15 kg/ha N and P_2O_5/ ha, respectively. Application of increasing levels of N and P enhanced vegetative growth and thus yield attributes which results increase in seed and biological yield of coriander. These results are in conformity with those of Sharma, and Israel (1991) who reported higher seed and straw yield of coriander with increasing levels of nitrogen and phosphorus. Naghera *et al.* (2000) and Singh (1998) had also reported the same result. Significantly higher seed, straw and biological yield was recorded with crop geometry of 30 x 10 cm which was on account of higher dry matter accumulation and yield attributes. Sowing of coriander at 30 x 10 cm spacing resulted 9.12 and 9.70% higher seed and straw yields, respectively over 20 x 10 cm crop geometry whereas Jat *et al.* (2002) reported higher seed and straw yield in coriander sowing at 30 cm row spacing. Malav and Yadav (1997) also reported similar result in coriander.

Economics analysis

Irrigation and N + P_2O_5 levels significantly influenced the net return and B:C ratio in coriander The highest net return and B:C was found for application of irrigation at 18 days intervals (Table 3). Application of 50 + 25 kg/ha N and P_2O_5 /ha exhibited the highest net return and B:C over their respective lower levels. The results are in close conformity with those of findings of Thakral *et al.* (1992) who reported the highest cost benefit ratio with application of 60 kg N/ha in coriander. Similar results were also reported by Naghera *et al.* (2000). Sowing of coriander with 30 cm x 10 cm crop geometry resulted significantly the highest net return and B:C over rest of the crop geometries under study.

Thus, the application of irrigation at 18 days interval with 50 kg N + 25 kg P_2O_5 /ha at 30 x 10 cm crop geometry is better for realizing higher net return and profitability in coriander production.

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