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Effect of plant growth regulators on growth and yield of coriander

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ABSTRACT

An experiment was conducted during *rabi* 2007-08 at Research Farm, College of Horticulture, Mandsaur (Madhya Pradesh) to study the effect of plant growth regulators on growth and yield of coriander (*Coriandrum sativum* L.) cv. NRCSS ACr-1. The seven treatments included control (water spray), three concentrations of NAA (25, 50 and 75 ppm) and three concentrations of GA_3 (10, 25 and 50 ppm). Among different PGRs applied, spray of 50 ppm of GA_3 resulted in significant maximum plant height, fresh weight of leaves, dry weight of leaves, number of branches, number of umbels per plant, umbellates per umbel, seeds per umbel, biological yield, seed yield, harvest index and test weight of coriander followed by spray of 75 ppm NAA. The maximum cost: benefit ratio (1:4.33) was also found with 50 ppm GA_3.

Keywords: Coriander, growth regulator, yield, quality, economics of treatment.

INTRODUCTION

Coriander (*Coriandrum sativum* L.) is an annual spice and condiments herb that is mostly used for pleasant aromatic odour. The aroma and test in coriander are due to the presence of essential oil, which is used for flavoring liquors, cocoa preparations in confectionary and the mask offensive odours in pharmaceutical preparations. The dried fruits are major ingredients of curry powder. The young plants, as well as the leaves are used in preparation of chutney and also for seasoning in curries and soups. The green leaves are good source of vitamin C (12.0 mg) and A (175 IU/100 g), while seeds are rich in carbohydrates and protein content. In agriculture, yield of any crop increased by the use of fertilizers, pesticides, irrigation and better management coupled with varietals and genetic improvement (Verma, 6). Similarly, the growth yield and quality of coriander could be improved by the use of plant growth regulators, as their use has resulted in some outstanding achievements with respect to growth, yield and quality of several other crops. Among the various plant growth regulators, the use of gibberellic acid (GA_3) and α-naphthalene acetic acid (NAA) have been found to increase the economic yield of several leafy crops. The PGRs are applied on crop to increase yield and to improved quality, thereby meeting commercial demand and quality standards. Effectiveness of PGRs depends upon several factors, *viz*., concentration, method and time of application etc. Therefore, considering significance of coriander in the national economy, the present experiment was undertaken.

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MATERIALS AND METHODS

An experiment was conducted during *rabi* 2007-08 at Research Farm, College of Horticulture, Mandsaur (Madhya Pradesh) to see the effect of different plant growth regulators on growth and yield of coriander. The soil of experimental field was light black loamy in texture, with 7.2 pH, low in available nitrogen (216.3 kg/ha), low in available phosphorus (10.0 kg/ha) and high in available potassium (448.0 kg/ha). The seven treatments tested include control (water spray), three concentrations of NAA (25, 50 and 75 ppm) and three concentrations of GA_3 (10, 25 and 50 ppm). These treatments were tested in randomized block design with three replications. The seed of coriander cultivar NRCSS ACr -1 was sown on 11th October, 2007 keeping a row spacing of 30 cm and the crop was harvested on 19th March, 2008. The crop was fertilized with 12 t of FYM along with NPK @ 15:30:10 kg ha^{-1} as basal dose. Another 15 kg N ha^{-1} was top-dressed at 45 DAS. Growth regulators were applied at 45 and 60 DAS as foliar spray as per treatments and untreated plots were sprayed with water twice. The economics of treatment was calculated on the basis of prevailing market rates.

RESULTS AND DISCUSSION

The results revealed that application of PGRs significantly improve vegetative growth of coriander. Among different PGRs applied, 50 ppm GA_3 recorded significantly maximum plant height at 45 DAS (21.25 cm), 90 DAS (85.87 cm) and at harvest (118.04 cm); fresh weight of leaves per plant at 45 DAS (16.22 g), 90 DAS (21.51 g), at harvest (27.22 g); number of nodes on main shoot at harvest (11.89) and number of branches per plant at harvest (14.29). Control (water spray) exhibited minimum influence with respect to plant height at 45 DAS (13.85 cm), 90 DAS (55.82 cm) and at harvest (78.25 cm); fresh weight of leaves per plant at 45 DAS (11.09 g), 90 DAS (15.95 g), at harvest (18.54 g), number of nodes on main shoot at harvest (8.40) and number of branches per plant at harvest (9.28). The 50 ppm GA_3 treatment was found to be more effective for influencing the vegetative growth as evaluated by various parameters. The increase in vegetative growth might be due to stimulation of cell division and cell elongation, while increasing plasticity of cell wall. The primary physiological effect of PGRs is to stimulate the elongation of cells due to increased enzymatic activities, permeability of cell wall and formation of energy rich phosphates (Salisbury and Ross, 5). Another possible explanation for better growth might be due to the increased osmotic uptake of water and nutrients under the influence of PGRs and in turn improving nutrient metabolism of plant system. These observations are quite in line with those Verma (6), Verma and Sen (7), Kolev *et al*. (2), Meena *et al.* (3), and Panda *et al.* (4) in coriander.

Treatment GA_3 50 ppm significantly decreased the days to 50 per cent flowering (79.30 days) and increased the number of umbels per plant (42.50), umbellates per umbel (8.13), seeds per umbel (50.02), biological yield (50.34), seed yield (18.48 q/ha) and test weight (11.97 g) as compared to other treatments. Among various PGRs used in the present study the control (water spray) exhibited maximum days to 50 per cent flowering (96.75 days) and minimum number of umbellate per umbel (4.90), number of umbels per plant (26.25), seeds per umbel (35.50), biological yield (35.75 q/ha), seed yield (11.10 q/ha), harvest index (31.09 %) and test weight (9.86 g).

Improved vegetative growth due to PGR application coupled with increased photosynthesis on one hand and greater mobilization of photosynthates toward reproductive sites, on the another sight, might have been found to increase the yield attributes. Thus, the cumulative effect of all these yield attributes resulted in significant increase in seed yield. The improvement in vegetative growth led to increased biological yield significantly. Higher yield attributes and yield as a result of application of PGRs were also reported by Verma (6), Verma and Sen (7), Kolev *et al*. (2), Meena *et al.* (3) and Panda *et al.* (4) in coriander; Durrani *et al*. (1) in spinach.

Quality parameters (chlorophyll and carotenoids content of leaves and essential oil content of seeds) were also found to be influenced significantly as a result of PGR application. The maximum total chlorophyll content of leaves at 45 DAS (1.563 mg/g) and 90 DAS (1.700 mg/g); carotenoids content of leaves at 45 DAS (0.620 mg/g) and 90 DAS (0.775m g/g) were recorded in 50 ppm GA_3. However essential oil content of seeds was highest (0.558%) with 25 ppm GA_3. The mean minimum total chlorophyll content of leaves 45 DAS (1.015 mg/g) and 90 DAS (1.028 mg/g) and carotenoids content of leaves at 45 DAS (0.345 mg/g) and 90 DAS (0.645 mg/g) and essential oil content of seeds (0.405 %) were found under control. The increase in the peroxidase and catalase activities as a result of application of PGRs might have led to the increased chlorophyll content and its metabolism. Application of PGRs increase carotenoids content as it depends upon higher chlorophyll content which in turn increases the carotenoids. The increase in oil content due to the PGRs, might be because of their role in directing the translocation of metabolites to the seed which synthesize more oil in seeds. The present results on chlorophyll, carotenoids and oil content are in close accordance with those of Verma and Sen (7), Kolov *et al*. (2), Meena *et al.* (3); and Panda *et al.* (4) in coriander.

The maximum net returns and cost benefit ratio were obtained with 50 ppm GA_3 treatment, *i.e*. Rs. 45,048 /ha and 4.33:1, respectively. This was because of higher seed and biological yield of coriander crop under 50 ppm GA_3 as compared to other treatments.

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Table 1. Effect of plant growth regulators on growth attributes of coriander.

Treatment	Plant height (cm)			Nodes at main shoot/ plant	Branches per plant	Fresh weight of leaves (g per m^2)			Days to 50% flowering
	45 DAS	90 DAS	At harvest	At harvest	At harvest	45 DAS	90 DAS	At harvest	
Control	13.85	55.82	78.25	8.40	9.28	11.90	15.95	18.54	96.75
NAA 25 ppm	15.15	61.03	85.57	8.50	10.40	12.67	17.19	21.30	95.00
NAA 50 ppm	17.11	68.70	94.11	9.72	11.89	13.80	18.60	23.26	87.25
NAA 75 ppm	19.75	79.58	110.65	11.02	13.18	15.02	20.07	25.22	85.95
GA_3 10 ppm	16.46	66.09	92.66	9.28	11.18	12.43	17.11	20.40	93.00
GA_3 25 ppm	17.89	74.12	101.11	10.02	12.58	14.01	19.27	24.30	86.00
GA_3 50 ppm	21.25	85.87	118.04	11.89	14.29	16.22	21.51	27.22	79.30
CD at 5%	1.37	5.21	7.33	0.73	0.89	1.00	1.93	1.93	6.63

Table 2. Effect of plant growth regulators on yield attributes and yield of coriander.

Treatment	Umbels $plant^{-1}$	Umbellates $umbel^{-1}$	Seeds $umbel^{-1}$	Test weight (g)	Biological yield (q ha^{-1})	Seed yield (q ha^{-1})	Harvest index (%)	Cost of cultivation (Rs. ha^{-1})	Net profit (Rs ha^{-1})	B:C ratio
Control	26.25	4.90	35.50	9.86	35.75	11.71	32.83	7,892	25,408	3.22
NAA 25 ppm	31.50	6.30	37.13	10.40	38.20	13.31	34.45	8,142	28,878	3.55
NAA 50 ppm	36.31	6.90	42.50	10.94	41.52	14.74	35.51	8,392	32,108	3.83
NAA 75 ppm	39.38	7.50	46.38	11.45	46.71	16.13	34.57	8,642	37,108	4.29
GA_3 10 ppm	33.50	5.90	39.03	10.34	39.29	13.83	35.25	8,932	35,558	3.98
GA_3 25 ppm	37.00	7.10	44.50	10.90	44.42	15.10	34.10	9,142	39,158	4.28
GA_3 50 ppm	42.50	8.13	50.02	11.97	50.34	17.48	34.79	10,392	39,158	4.33
CD at 5%	3.02	0.54	3.53	0.50	3.20	1.19	NS			

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