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Effect of PGRs on Growth, Yield and Quality of Coriander (*Coriandrum sativum* L.) cv. NRCSS-Acr-1

Amit Kumar Kurmi[1*], I.S. Naruka[1], S.S. Kushwah[2] and G.S. Chouhan[2]

[1]Department of Plantation, Spices, Medicinal and Aromatic Crops,
[2]Department of Vegetable Science, College of Horticulture, Mandsaur-458 001, Madhya Pradesh, India

**Corresponding author*

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A B S T R A C T

An experiment was conducted during rabi 2016-17 at Research Farm, College of Horticulture, Mandsaur (Madhya Pradesh) to study the effect of PGRs on growth yield and quality of coriander (*Coriandrum sativum* L.) cv. NRCSS Acr-1. The ten treatments included control (water spray), three concentrations of NAA (25, 50 and 75 ppm), three concentrations of GA_3 (10, 25 and 50 ppm) and three concentrations of Cycocel (100, 200 and 300 ppm). Among different PGRs applied, spray of GA_3 50 ppm significantly registered highest value of plant height (cm), Fresh weight of plant (g), minimum days taken to 50 % flowering, test weight (g), SPAD value, essential oil content in seed (%) and dry matter content in seed (%).However the maximum number of branches, number of umbels, number of umbellets, number of seeds, seed yield (q ha^{-1}) and biological yield(q ha^{-1}) were recorded with the foliar application of Cycocel 300 ppm. The maximum benefit:cost ratio (4.05:1) was also found with 50 ppm GA_3.

Introduction

Coriander (*Coriandrum sativum* L.) popularly known as "Dhania'' is one of the oldest and most widely used seed spice crop by entire mankind of the world. It is a thin-stemmed, small bushy herb, much branched and grows about 25 to 50 cm tall, with alternate and compound leaves become highly segmented and linear as they reach upper extremities. Inflorescence is a compound umbel and usually comprises about five smaller umbellets. Fruits are globular, yellow brown when ripened and are 3 to 4 mm in diameter. The fruits consist of two halves, the single seeded mericarps. The fruits have a fragrant odour and pleasant aromatic taste. The odour and taste are due to the compound containing d-linalool or coriandrol. Coriander is used as a spice, in culinary, medicine and in perfumery, food, beverage and pharmaceuticals industries. The dried ground fruits are the major ingredient of the curry powder. The whole fruits are also used to

flavour foods like pickles, sauces and confectionary. The seed contain 18-21 per cent fatty oil which is used in the cosmetic industries. The young plants as well as the leaves are used in the preparation of chutney and are also used as seasoning in curries, soups and sauces.

Use of plant growth regulators may be one of the best possible way in affecting production and productivity as they provide an immediate impact on crop improvement programmes and are less time consuming. Gibberellic acid is found to induce stem and internode elongation, flowering and fruit setting and growth. Application of naphthalic acetic acid (NAA) is also known to induce higher physiological efficiency including photosynthetic ability of plants. Plant growth regulators leads also to better growth and yield without substantial increase in the cost of production. Therefore standardizations of levels of growth regulators determine the growth, yield and quality of coriander (Haokip *et al*., 2016).

Materials and Methods

An experiment was conducted during *rabi* 2016-17 at Research Farm, College of Horticulture, Mandsaur (Madhya Pradesh) to see the effect of different plant growth regulators on growth, yield and quality of coriander. The soil of experimental field was light black loamy in texture, with 7.2 pH, low in available nitrogen (243.2 kg/ha), medium in available phosphorus (19.75 kg/ha) and high in available potassium (448.0 kg/ha). The ten treatments tested include control (water spray), three concentrations of NAA (25, 50 and 75 ppm), three concentrations of GA3 (10, 25 and 50 ppm) and three concentrations of Cycocel (100, 200 and 300 ppm). These treatments were tested in randomized block design with three replications. The seed of coriander cultivar NRCSS Acr -1 was sown on 20th October, 2016 keeping a row spacing of 30 cm and the crop was harvested on 05th March, 2017. The crop was fertilized with NPK @ 60:40:30kg ha^{-1} as basal dose. Growth regulators were applied at 30 DAS as foliar spray as per treatments and untreated plots were sprayed with water. The economics of treatment was calculated on the basis of prevailing market rates.

Results and Discussion

Growth attributes

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 40 DAS (19.53 cm), 60 DAS (54.73 cm) and at harvest (122.70 cm) fresh weight of plant at 40 DAS (15.80 g), 60 DAS (57.60 g), at harvest (46.34 g) and decreased the days to 50 percent flowering (79.33 days). Treatment CCC 300 ppm exhibited minimum influence with respect to plant height at 40 DAS (10.07 cm), 60 DAS (38.80 cm) and at harvest (103.13 cm) whereas the control (water spray) exhibited maximum days to 50 percent flowering (93.33 days) and minimum fresh weight of plant at 40 DAS (10.97 g), 60DAS (40.07 g), at harvest (30.08 g).

The 50 ppmGA_3 treatment was found to be more effective for influencing the vegetative growth as evaluated by various parameters. The increase in vegetative growth seems to be due to enhanced cell division and cell enlargement. Promotion of protein synthesis by GA_3 application exogenously might have resulted in enhanced vegetative growth. Similar results were reported by Singh *et al.*, (2012) in coriander, Gour *et al.*, (2010), Bairva *et al.*, (2012) in fenugreek and Abbas (2013) in dill (Table 1).

Table.1 Effect of PGRs on growth attributes of coriander

treatment	Plant height (cm)			Fresh weight of plant (g)			Number of branches plant^{-1}	Days to 50 percent flowering
	40 DAS	60 DAS	At harvest	40 DAS	60 DAS	At harvest	At harvest	
T_1 – Control	11.53	43.07	108.30	10.97	40.07	30.08	5.17	93.33
T_2 – NAA @ 25 ppm	12.63	45.05	109.53	11.50	47.37	35.14	5.70	86.33
T_3 – NAA @ 50 ppm	13.50	45.83	112.37	12.20	49.87	37.37	5.80	84.67
T_4 – NAA @ 75 ppm	17.47	50.23	118.97	14.30	53.93	42.98	6.27	82.67
T_5 – GA_3 @ 10 ppm	14.10	46.63	114.43	12.03	50.20	36.17	5.77	85.67
T_6 – GA_3 @ 25 ppm	15.50	47.07	115.33	12.73	51.07	39.74	5.87	84.00
T_7 – GA_3 @ 50 ppm	19.53	54.73	122.70	15.80	57.60	46.34	6.77	79.33
T_8 – Cycocel @ 100 ppm	10.77	42.27	105.57	11.13	44.77	34.49	6.30	91.00
T_9 – Cycocel @ 200 ppm	10.23	40.93	104.30	11.60	47.33	36.87	6.37	89.67
T_{10} – Cycocel @ 300 ppm	10.07	38.80	103.13	11.93	48.20	37.15	7.20	89.33
S.Em.±	**0.5379**	**1.0513**	**1.084**	**0.4582**	**0.9443**	**1.0636**	**0.1258**	**0.3635**
C.D. at 5%	**1.5983**	**3.1235**	**3.2208**	**1.3615**	**2.8056**	**3.1602**	**0.3736**	**1.0799**

Table.2 Effect of PGRs on yield attributes and quality attributes of coriander

Treatment	Number of umbels plant^{-1}	Number of umbellets umbel^{-1}	Number of seed umbel^{-1}	Test weight (g)	Seed yield (q ha^{-1})	Biological yield (q ha^{-1})	Harvest index (%)	SPAD value	Essential oil content in seed (%)	Dry matter content in seed (%)	Benefit: cost ratio
T_1 – Control	26.40	4.93	33.07	9.56	11.17	34.62	32.33	37.67	0.33	80.14	3.10:1
T_2 – NAA @ 25 ppm	31.60	6.20	35.43	10.03	11.85	35.83	35.95	40.27	0.34	84.72	3.26:1
T_3 – NAA @ 50 ppm	32.53	6.40	36.93	11.28	13.28	37.53	38.01	41.06	0.43	85.78	3.68:1
T_4 – NAA @ 75 ppm	34.73	7.03	41.27	12.05	14.26	40.32	37.79	42.25	0.47	88.01	3.93:1
T_5 – GA_3 @ 10 ppm	32.73	6.53	36.20	11.65	13.36	39.17	36.74	41.33	0.44	85.96	3.73:1
T_6 – GA_3 @ 25 ppm	34.27	6.80	40.07	11.90	14.15	38.97	38.89	41.51	0.45	86.24	3.76:1
T_7 – GA_3 @ 50 ppm	39.47	7.33	46.47	12.95	16.27	43.96	36.99	45.08	0.51	90.80	4.05:1
T_8 – Cycocel @ 100 ppm	36.00	7.20	43.93	10.37	15.48	43.25	35.76	37.95	0.33	82.57	3.84:1
T_9 – Cycocel @ 200 ppm	36.07	7.27	45.73	10.91	15.69	43.72	35.89	38.43	0.35	84.44	3.27:1
T_{10} – Cycocel @ 300 ppm	42.93	7.87	49.60	11.27	18.20	47.03	38.71	40.38	0.36	85.63	3.39:1
S.Em.±	**1.1173**	**0.1556**	**0.9274**	**0.298**	**0.638**	**0.9851**	**1.3256**	**0.8079**	**0.0131**	**0.8796**	3.10:1
C.D. at 5%	**3.3198**	**0.4623**	**2.7555**	**0.887**	**1.898**	**2.92**	**NS**	**2.400**	**0.0388**	**2.6133**	3.26:1

Treatment CCC 300 ppm recorded the maximum number of branches plant^{-1} (7.20) while the minimum number of branches plant^{-1} (5.17) was recorded in T_1 (control). The increase in number of primary branches could be due to suppression of apical dominance by the application of growth retardant Cycocel which diverts the polar transport of auxin towards the basal buds there by leads to increased branching. These results were in conformation with Vaidehi *et al.,* (2015), Haokip *et al.,* (2016), Yugandhar *et al.,* (2016) in coriander, Bairva *et al.,* (2012) in fenugreek and Rohamare *et al.,* (2013) in Ajwain.

Yield and yield attributes parameters

The results revealed that application of PGRs significantly improve yield and yield attributes parameters of coriander except harvest index (%). Among different PGRs applied, 300 ppm CCC recorded significantly maximum number of umbels plant^{-1} (42.93) number of umbellets per umbel^{-1} (7.87) number of seed umbel^{-1} (49.60) seed yield (18.20q ha^{-1}) biological yield (47.03q ha^{-1}). Among various PGRs used in the present study the control (water spray) exhibited minimum number of umbels plant^{-1} (26.40) number of umbellets umbel^{-1} (4.93) number of seed umbel^{-1} (33.07) seed yield (11.17q ha^{-1}) biological yield (34.62q ha^{-1}). The increase in number of umbels plant^{-1} could be attributed due to the increase in the number of both primary and secondary branches plant^{-1} with the application of Cycocel 300 ppm. The increase in number of umbellets per umbel by Cycocel might be due to accumulation of metabolites which get translocated towards the reproductive sinks and these in turn resulted in stimulation of umbellets. The increment in seed yield and biological yield was significantly higher in Cycocel which might be due to enhanced in growth and yield attributes. The above results were in conformity with the finding Meena *et al.,* (2006), Kumar and Sundareswaran (2011), Vaidehi *et al.,* (2015), Haokip *et al.,* (2016), Yugandhar *et al.,* (2016) in coriander.

Foliar application of GA_3 50 ppm was recording the maximum test weight, while the minimum test weight was recorded with the control (T_1). Similar results were reported by Panda *et al.,* (2007), Singh *et al.,* (2012) in coriander and Meena *et al.,* (2014) in fenugreek (Table 2).

Quality parameters

The results revealed that application of PGRs significantly improve quality parameters of coriander. Among different PGRs applied, $GA_3$50 ppm recorded significantly the maximum SPAD value (45.08), essential oil content in seed (0.51%) and dry matter content in seed (90.80), while it was lowest with the control (T_1). The increment in SPAD value, essential oil content in seed and dry matter content in seed may be due to the positive effect of GA_3 50 ppm improved overall growth and metabolism and also the better translocation of carbohydrates and utilization by the plant for good growth. These findings are in close conformity with the findings of Verma and Sen (2008), Singh *et al.,* (2012), Kuri *et al.,* (2015), Vugandhar *et al.,* (2016) and Haokip *et al.,* (2016) in coriander.

The maximum benefit cost ratio was obtained with 50 ppm GA_3 treatment, compared to other treatments.

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