Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
www.phytojournal.com
JPP 2020; 9(6): 1468-1471
Received: 11-08-2020
Accepted: 17-10-2020

SP Deokar
M.Sc. Student, Department of Vegetable Science, Faculty of Horticulture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India

AP Wagh
Professor of Horticulture, Department of Vegetable Science, Faculty of Horticulture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India

NM Arolkar
M.Sc. Student, Department of Vegetable Science, Faculty of Horticulture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India

PK Nagre
Dean of Horticulture, Department of Vegetable Science, Faculty of Horticulture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India

SP Umbarkar
M.Sc. Student, Department of Vegetable Science, Faculty of Horticulture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India

Corresponding Author:
SP Deokar
M.Sc. Student, Department of Vegetable Science, Faculty of Horticulture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India

Effect of different plant growth regulators and methods of application on growth of coriander (*Coriandrum sativum* L.)

SP Deokar, AP Wagh, NM Arolkar, PK Nagre and SP Umbarkar

DOI: https://doi.org/10.22271/phyto.2020.v9.i6u.13156

Abstract
The experiment was carried out during *rabi* season of academic year 2018-2019 at Instructional Farm, Department of Vegetable Science, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola to study the effect of different plant growth regulators and methods of application on growth of coriander (*Coriandrum sativum* L.). The experiment conducted in factorial randomized block design with three replication and eighteen treatment combinations. There were two factors, main factor being methods of application of PGRs *viz*. seed soaked, foliar spray and seed soaked + foliar spray and sub factor was six concentrations of PGRs *viz*. GA_3 (50, 75 and 100 ppm) and CCC (200, 250 and 300 ppm) growth parameters like plant height and number of branches per plant were influenced by M_3 (seed soaked + foliar spray). The treatment combination M_3P_3 (GA_3 @ 100 ppm as seed soaked + foliar spray) and M_3P_6 (CCC @ 300 ppm as seed soaked + foliar spray) recorded significantly maximum result in respect of plant height and number of branches per plant, respectively. Maximum plant height (75.11 cm) was recorded in M_3P_3 and maximum number of branches (9.61) were recorded in M_3P_6 treatment combination.

Keywords: Coriander, cycocel, GA_3, growth, plant growth regulators, methods of application

Introduction
Coriander is one of the earliest and most important seed spices known to mankind and is acclaimed throughout the globe for its enormous uses for seeds as well as for leaf purpose (Hnamte *et al.*, 2013) [2]. India is the leading producer, consumer and exporter of spices in the world. It is popularly known as 'Land of Spices' or 'Spice Basket'. Coriander is popularly known as "Dhaniya". It is also known as 'Chinese Parsley' and the stems and leaves are particularly called 'Cilantro' in North America. In India, it is grown in Andra Pradesh, Tamil Nadu, Karnataka, Rajasthan and Madhya Pradesh. The coriander plant is gaining importance rapidly for its multiferous utility. The young plant as well as the leaves are used in the preparation of chutney and are also used as seasoning in curries, soups and sauces.
The botanical name of coriander is *Coriandrum sativum* L. which belongs to family Apiaceae (Umbellifereae) and having chromosome number 2n=22. Coriander is native of the Mediterranean region. Coriander is an herbaceous plant, grows up to two feet in height with branching stems, featuring deep-green soft, hairless bi-lobed or tri-lobed leaves. The mature plant bears small white or pale pink color flowers that subsequently turn into globular or oval-shape fruits (seed). Inflorescence is a compound umbel and usually comprises about five smaller umbellets.
Horticultural research primarily has been concerned with increasing crop yields by the use of fertilizers, pesticides, irrigation, better management coupled with variety development and genetic improvements. Little attention has been given to regulation of the biological processes that limit crop productivity. Plant growth regulators (PGRs) are the magic chemicals that could boost horticultural production at an unprecedented rate and help in removing many of the barriers forced by genetics and the environment (Nickell, 1982) [5]. Use of PGRs has resulted in some outstanding achievements in several crops with respect to growth. Hence, keeping in view the above, the present investigation was undertaken to study the effect of different plant growth regulators and methods of application on growth of coriander (*Coriandrum sativum* L.)

Material and Methods
An experiment entitled "Effect of different plant growth regulators and methods of application on growth of coriander (*Coriandrum sativum* L.)." was carried out during rabi season of academic year 2018-19 at Instructional Farm, Department of Vegetable Science, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (M.S.). The experiment was conducted in Factorial

Randomized Block Design with three replications and eighteen treatment combinations. There were two factors, main factor being methods of application of PGRs *viz*. seed soaked, foliar spray, seed soaked + foliar spray and another sub factor was six concentrations of PGRs *viz.* GA_3 (50, 75 and 100 ppm) and CCC (200, 250 and 300 ppm). Seeds were sown in the plot of 1.80 x 1.20 m at spacing of 30 x 10 cm. The crop was fertilized with NPK @ 60:20:30 Kg ha^{-1} (RDF). Growth regulators were applied as pre-soaking, foliar spray at 30 and 45 DAS as per the treatment combinations. Need based cultural and plant protection samples from each replication in each treatment were selected at random to record data on growth attributing characters. The experimental data was analysed statistically by the method of analysis of variance as out lined by Panse and Sukhatme (1995) [6].

Table 1: Different treatment combinations use in the experiment

Treatments	Treatment combinations	Treatment details
T_1	M_1P_1	GA_3 50 ppm seed soaked
T_2	M_1P_2	GA_3 75 ppm seed soaked
T_3	M_1P_3	GA_3 100 ppm seed soaked
T_4	M_1P_4	CCC 200 ppm seed soaked
T_5	M_1P_5	CCC 250 ppm seed soaked
T_6	M_1P_6	CCC 300 ppm seed soaked
T_7	M_2P_1	GA_3 50 ppm foliar spray
T_8	M_2P_2	GA_3 75 ppm foliar spray
T_9	M_2P_3	GA_3 100 ppm foliar spray
T_{10}	M_2P_4	CCC 200 ppm foliar spray
T_{11}	M_2P_5	CCC 250 ppm foliar spray
T_{12}	M_2P_6	CCC 300 ppm foliar spray
T_{13}	M_3P_1	GA_3 50 ppm seed soaked + foliar spray
T_{14}	M_3P_2	GA_3 75 ppm seed soaked + foliar spray
T_{15}	M_3P_3	GA_3 100 ppm seed soaked + foliar spray
T_{16}	M_3P_4	CCC 200 ppm seed soaked + foliar spray
T_{17}	M_3P_5	CCC 250 ppm seed soaked + foliar spray
T_{18}	M_3P_6	CCC 300 ppm seed soaked + foliar spray

Results and Discussion

Plant height (cm)

The data pertaining to plant height as influenced by different concentration of plant growth regulators (PGRs) and methods of application presented in Table 2.

Effect of methods of application of PGRs

Plant height was significantly influenced by methods of application of PGRs at different growth stages. It is evident from the data presented in Table 2 at 30, 60 and 90 DAS, significantly maximum plant height (10.62, 39.58 and 59.25 cm) was recorded with seed soaked + foliar spray application (M_3), which was found at par with M_1 at 30 DAS and M_2 for 60 and 90 DAS. Whereas, minimum plant height (10.03 cm) was observed with foliar spray (M_2) at 30 DAS and at 60 and 90 DAS (36.68 and 54.75 cm) was observed with seed soaked (M_1) application, respectively.

Effect of concentration of PGRs

The effect of various concentrations of PGRs on plant height was found statistically significant. Significantly maximum plant height (13.50, 49.50 and 70.42 cm) was obtained due to application of GA_3 @ 100 ppm (P_3) at 30,60 and 90 DAS, respectively, which was found at par with P_2 at 60 DAS. The minimum plant height (8.51 cm) was obtained due to application of CCC @ 250 ppm (P_5) at 30 DAS, while at 60 and 90 DAS significantly the minimum plant height (28.00 and 45.17 cm) was noticed with application of CCC @ 300 ppm (P_6).

Interaction effect

At 30 DAS, interaction effect in between the methods of application and concentration of PGRs was found statistically significant. Significantly the maximum (14.60 cm) plant height was recorded due to an application of GA_3 @ 100 ppm when applied as seed soaked treatment combination (M_1P_3), which was found at par with treatment combination M_3P_3. Whereas, the minimum (7.71 cm) plant height was obtained, when CCC @ 300 ppm was applied as seed soaked (M_1P_6) treatment combinations (Table 2). At 60 and 90 DAS, significantly maximum plant height (53.75 and 75.11 cm) was recorded with application of GA_3 @ 100 ppm as seed soaked + foliar spray treatment combination (M_3P_3), which was found at par with treatment combinations M_3P_2, M_3P_1 and M_2P_3 at 60 DAS and 90 DAS. Whereas, minimum plant height (27.00 and 43.15 cm) was recorded when CCC was applied @ 300 ppm as seed soaked + foliar spray (M_3P_6) treatment combination.

Vegetative growth seems to be increased due to enhanced cell division and cell enlargement. Promotion of protein synthesis by GA_3 application exogenously might have resulted in enhanced vegetative growth and plasticity of the cell wall followed by hydrolysis of starch to sugars which lowers the water potential of cell there by resulting in the entry of water into the cell causing elongation. These results were in conformity with the finding of Panda *et al*. (2007) [7], Singh *et al*. (2012) [8] and Kumar *et al.* (2018) [3] in coriander.

Number of branches per plant

The data pertaining to number of branches per plant as influenced by different concentration of plant growth regulators (PGRs) and methods of application were recorded and presented in Table 3.

Effect of methods of application of PGRs

It is evident from the data presented in Table 3, at 30 DAS, the number of branches per plant were found maximum (4.05) in both the methods of application i.e. seed soaked and seed soaked + foliar spray (M_1 and M_3). While, it was recorded minimum (2.80) when PGRs was applied as foliar spray (M_2). At 60 and 90 DAS, significantly maximum number of branches per plant (7.53 and 7.63) were recorded with seed soaked + foliar spray application (M_3). Whereas, minimum number of

branches (6.22 and 6.41) were recorded with seed soaked application (M_1) at 60 and 90 DAS, respectively.

Effect of concentration of PGRs

At 30 DAS the maximum number of branches (4.23) were obtained due to application of CCC @ 300 ppm (P_6), which was found at par with P_5 and P_4. The minimum number of branches (2.94) were recorded with an application of GA_3 @ 50 ppm (P_1). At 60 and 90 DAS, significantly maximum number of branches per plant (8.08 and 8.14) were recorded with CCC @ 300 ppm (P_6). Whereas, minimum number of branches (6.10 and 6.24) with GA_3 @ 50 ppm (P_1), respectively.

Interaction effect

At 30 DAS, interaction effect in between the methods of application and concentration of PGRs was found statistically significant. Significantly maximum number of branches per plant (5.00) were recorded due to an application of CCC @ 300 ppm when applied as seed soaked treatment combination (M_1P_6), which was found at par with treatment combinations M_3P_6, M_1P_5, M_3P_5, M_1P_4 and M_3P_4. Whereas, the minimum number of branches per plant (2.80) were obtained, when the GA_3 @ 50 ppm was applied as foliar spray treatment combination (M_2P_1). At 60 and 90 DAS significantly maximum number of branches (9.09 and 9.67) when CCC was applied @ 300 ppm as seed soaked + foliar spray treatment combination (M_3P_6), while it was recorded minimum (5.86 and 6.01) when GA3 was applied @ 50 ppm as seed soaked (M_1P_1) treatment combination (Table 3).

More number of branches per plant might be due to the fact that suppression of apical dominance by the application of growth retardant CCC which diverts the polar transport of auxin towards the basal buds there by leads to increased branching. These results were in conformation with Haokip *et al*. (2016) [1], Yugandhar *et al*. (2017) [9], Kurmi *et al*. (2019) [4] in coriander.

Table 2: Effect of different plant growth regulators and methods of application on plant height of coriander

Treatments	Plant height (cm)		
	30 DAS	60 DAS	90 DAS
Methods of application of PGRs (M)			
M_1 (Seed soaked)	10.31	36.68	54.75
M_2 (Foliar spray)	10.03	38.20	57.70
M_3 (Seed soaked + foliar spray)	10.62	39.58	59.25
'F' test	Sig	Sig	Sig
SE(m)±	0.12	0.56	0.68
CD at 5%	0.36	1.62	1.96
Concentration of PGRs (P)			
P_1 (GA_3 - 50 ppm)	9.96	45.72	64.67
P_2 (GA_3 - 75 ppm)	11.70	47.70	67.63
P_3 (GA_3 - 100 ppm)	13.50	49.50	70.42
P_4 (CCC - 200 ppm)	9.74	29.30	48.31
P_5 (CCC - 250 ppm)	8.51	28.80	47.23
P_6 (CCC - 300 ppm)	8.52	28.00	45.17
'F' test	Sig	Sig	Sig
SE(m)±	0.17	0.80	0.96
CD at 5%	0.51	2.30	2.78
Interaction (M X P)			
M_1P_1	10.12	41.49	55.55
M_1P_2	12.16	43.83	61.29
M_1P_3	14.60	44.27	64.60
M_1P_4	9.30	31.04	50.53
M_1P_5	7.99	30.18	49.70
M_1P_6	7.71	29.30	46.84
M_2P_1	9.49	44.79	65.66
M_2P_2	10.21	48.06	67.20
M_2P_3	11.39	50.50	71.55
M_2P_4	10.21	29.18	48.49
M_2P_5	9.49	28.95	47.82
M_2P_6	9.41	27.73	45.49
M_3P_1	10.27	50.87	72.80
M_3P_2	12.73	51.09	74.40
M_3P_3	14.56	53.57	75.11
M_3P_4	9.70	27.66	45.90
M_3P_5	8.04	27.33	44.17
M_3P_6	8.43	27.00	43.15
'F' test	Sig	Sig	Sig
SE(m)±	0.30	1.38	1.67
CD at 5%	0.88	3.98	4.81

Table 3: Effect of different plant growth regulators and methods of application on number of branches per plant of coriander

Treatments	Number of branches		
	30 DAS	60 DAS	90 DAS
Methods of application of PGRs (M)			
M_1 (Seed soaked)	4.05	6.22	6.41
M_2 (Foliar spray)	2.80	6.73	7.01
M_3 (Seed soaked + foliar spray)	4.05	7.53	7.63
'F' test	Sig	Sig	Sig
SE(m)±	0.09	0.11	0.12
CD at 5%	0.27	0.33	0.34
Concentration of PGRs (P)			
P_1 (GA_3 - 50 ppm)	2.94	6.10	6.24
P_2 (GA_3 - 75 ppm)	3.20	6.22	6.37
P_3 (GA_3 - 100 ppm)	3.44	6.46	6.60
P_4 (CCC - 200 ppm)	3.91	6.94	7.31
P_5 (CCC - 250 ppm)	4.08	7.17	7.46
P_6 (CCC - 300 ppm)	4.23	8.08	8.14
'F' test	Sig	Sig	Sig
SE(m)±	0.13	0.16	0.17
CD at 5%	0.38	0.47	0.49
Interaction (M X P)			
M_1P_1	2.96	5.86	6.01
M_1P_2	3.36	6.03	6.22
M_1P_3	3.73	6.13	6.28
M_1P_4	4.46	6.20	6.47
M_1P_5	4.80	6.27	6.55
M_1P_6	5.00	6.81	6.95
M_2P_1	2.80	6.06	6.29
M_2P_2	2.90	6.16	6.32
M_2P_3	2.83	6.20	6.35
M_2P_4	2.86	7.09	7.64
M_2P_5	2.66	7.35	7.67
M_2P_6	2.73	7.51	7.77
M_3P_1	3.06	6.36	6.42
M_3P_2	3.33	6.46	6.56
M_3P_3	3.76	7.03	7.17
M_3P_4	4.40	7.53	7.80
M_3P_5	4.76	7.88	8.14
M_3P_6	4.96	9.09	9.69
'F' test	Sig	Sig	Sig
SE(m)±	0.23	0.28	0.29
CD at 5%	0.66	0.83	0.85

Conclusion

Methods of application of plant growth regulators (PGRs) as seed soaked + foliar spray (M_3) revealed significantly maximum results in terms of plant growth. As regards to concentration of PGRs, GA_3 @ 100 ppm (P_3) revealed significantly maximum results for the plant height (cm) and CCC @ 300 ppm (P_6) revealed significantly maximum number of branches per plant. The treatment combination M_3P_3 - GA_3 @ 100 ppm as seed soaking + foliar spray showed significant interaction effect with plant height and M_3p_6 – CCC @ 300 ppm as seed soaking + foliar spray showed significant interaction for number of branches per plant.

Reference

1. Haokip CM, Sharangi AB, Debbarma K, Ranjita Devi AK, Karthik CS. Role of plant growth regulators on the growth and yield of coriander (*Coriandrum sativum* L.). Journal of Crop and Weed 2016;12(3):33.
2. Hnamte V, Chatterjee R, Tania C. Growth, flowering, fruit setting and maturity behavior of coriander (*Coriandrum sativum* L.) with organics including bio fertilizers and inorganics. The Bioscan 2013;8:791-93.
3. Kumar S, Malik TP, Mor VS, Pawan Kumar. Effect of gibberellic acid on seed quality of coriander (*Coriandrum sativum* L.). Journal of Pharmacognosy and Phytochemistry 2018;27(5):830-832.
4. Kurmi AK, Naruka IS, Kushwah SS, Chouhan GS. Effect of PGRs on growth, yield and quality of coriander (*Coriandrum sativum* L.) cv NRCSS-Acr-1. International Journal of Current Microbiology and Applied Sciences 2019;8(5). ISSN: 2319-7706
5. Nickell LG. Plant Growth Regulators. Springer-Verlag Berlin Heidelerg, New York 1982, P1-3.
6. Panse VG, Sukhatme PV. Statistical Methods for Agricultural Workers. Indian Council of Agricultural Research, New Delhi 108 1985.
7. Panda MR, Chatterjee R, Pariari A, Chattopadhyay PK, Sharangi AB, Alam K. Effect of growth regulators on growth, yield and quality of coriander. Indian Journal of Horticulture 2007;64(3):369-371.
8. Singh D, Singh PP, Naruka IS, Rathore SS, Shaktawat RS. Effect of plant growth regulators on growth and yield of coriander. Indian J Hort 2012;69(1):91-93.
9. Yugandhar V, Reddy PSS, Sivaram GT, Ramesh E. Impact of pre-soaking and foliar application of plant growth regulators on growth and seed yield of coriander (*Coriandrum sativum* L.). Journal of Crop and Weed 2017;13(1):100-102.