Journal of Spices and Aromatic Crops
Vol. 15 (2) : 118–122 (2006)

Indian Society for Spices

Effect of plant growth regulators on vegetative growth and seed yield of coriander (*Coriandrum sativum* L.) cv. RCr – 435

Piyush Verma[1] & N L Sen

Department of Horticulture
Rajasthan College of Agriculture
Maharana Pratap University of Agriculture and Technology
Udaipur- 313 001, Rajasthan, India.
E-mail: abpiyush@yahoo.co.in

Received 08 August 2005; Revised 06 June 2006; Accepted 04 July 2006

Abstract

A field experiment consisting of nine levels of plant growth regulators (indole acetic acid, naphthalene acetic acid and gibberellic acid, each at 10, 25 and 50 ppm concentration) and three modes of application (soaking of seeds, spraying 20 days after sowing and soaking + spraying) was conducted at Udaipur, Rajasthan, to study their effect on growth and yield of coriander (*Coriandrum sativum*). The results revealed that application of gibberellic acid 50 ppm by soaking + spraying resulted in maximum number of nodes on main shoot (7.60), number of branches plant^{-1} (9.51), number of umbels plant^{-1} (25.36), biological yield (1.274 q ha^{-1}) and seed yield (0.432 q ha^{-1}).

Keywords: coriander, *Coriandrum sativum*, growth, plant growth regulators, yield.

Abbreviations: DAS: Days after sowing, GA_3: Gibberellic acid, IAA: Indole acetic acid, NAA: Naphthalene acetic acid, PGR: Plant growth regulator.

Though India is the largest producer of coriander (*Coriandrum sativum* L.) in the world, the productivity of the crop is low in the country. PGRs have great potential in increasing agricultural production and help in removing many of the barriers imposed by genetics and environment (Nickell 1982; Mishra 1989). Exogenous application of PGRs has been reported to improve the growth and yield of various crops (Fisher & Pyshtaeva 1974; Bharud *et al*. 1988; El-Keltawi *et al*. 2000). The present investigation was conducted with the objective to improve vegetative growth and seed yield of coriander by the use of PGRs.

The field experiment was conducted for two consecutive years during November to April 2000–01 and 2001–02 at Horticulture Farm, Department of Horticulture, Rajasthan College of Agriculture, Udaipur, Rajasthan. The maximum and minimum temperatures fluctuated between 24.2–35.5°C and 4.0–17.8°C, respectively, during 2000–01 and the RH varied from 38% to 91% and 10% to 57% at 07:35 and 14:35 hrs, respectively. During 2001–02, the maximum and minimum temperatures varied from 22.2–37.9°C and 3.9–19.3°C, respectively, and RH varied from 63%–68% at 07:35 and 24%–49% at 14:35 hrs.

[1]Present address: Agri Research Department, Lucid Colloids Ltd., B – 5/7; Basni Phase – I, Jodhpur – 342 005, Rajasthan, India.

The variety of coriander used in the experiments was RCr-435. Three PGRs namely, IAA, NAA and GA_3, each at three concentrations (10, 20 and 50 ppm), thus making nine levels of PGRs, were used. Each level was applied through three different modes of application namely, pre-plant soaking, spraying at 20 DAS and pre-plant soaking + spraying at 20 DAS. Eight hours of soaking duration was given in soaking treatment. An absolute control was also maintained. All the 28 treatment combinations were replicated thrice. Seeds were sown during the first week of November (both the years) in beds of 3 m^2 area at a spacing of 30 cm x 10 cm (row to row x plant to plant). Sowing and other cultural operations were done using recommended practices.

Vegetative growth was measured by recording number of branches $plant^{-1}$ and number of nodes on main shoot of 10 randomly selected plants from each plot. Yield and yield attributes were assessed by recording number of umbels $plant^{-1}$, biological yield and seed yield. The biological and seed yields were recorded by weighing sun-dried plants along with umbels and by weighing seeds, respectively. The experiment was laid out in factorial randomized block design. Data were analyzed statistically by applying the technique of Cochran & Cox (1950). Pooled analysis was done over two years of experimentation. The significance was tested by 'F' test comprising the calculated variance ratio (F value) with those of probability for appropriate degrees of freedom.

Vegetative growth

Maximum number of nodes on main shoot (7.60) and branches (9.51) were recorded in GA_3 50 ppm treatment. Pre-plant soaking + spraying at 20 DAS mode of application of PGR was superior with respect to nodes on main shoot (7.18) and number of branches $plant^{-1}$ (9.36). Interaction of GA_3 50 ppm when applied through pre-plant soaking and spraying at 20 DAS was significantly better (8.15 nodes on main shoot and 10.33 branches $plant^{-1}$, respectively) than all other treatments (Table 1). Treated plots showed 38.5% and 31.1% increment over control in number of nodes on main shoot and number of branches $plant^{-1}$, respectively.

Earlier work on PGRs on coriander (Pareek 1996), bhindi (Singh *et al*. 1999), brinjal (Sorte *et al*. 2001) and mustard (Hayat *et al*. 2001) supported the present findings. Better growth is the result of various enhanced physiological activities in the plant. PGRs have been reported to enhance physiological activities like cell division, cell elongation, photosynthesis and translocation of nutrients and photosynthates (Paleg 1965; Mohammed 1975; Saxena 1989) in different crops. In the present experiment also PGR treated plants resulted in higher number of nodes on main shoot and number of branches $plant^{-1}$ that could be attributed to enhanced physiological activities.

Yield and yield attributes

Number of umbels $plant^{-1}$, biological yield and seed yield were maximum with GA_3 50 ppm treatment (25.36, 1.274 q ha^{-1} and 0.432 q ha^{-1}, respectively) and followed by pre-plant soaking + spraying at 20 DAS treatment (25.76, 1.275 q ha^{-1} and 0.418 q ha^{-1}, respectively). Interaction effect also showed significant variation in number of umbels $plant^{-1}$, biological yield and seed yield and were maximum (31.75, 1.432 q ha^{-1} and 0.495 q ha^{-1}, respectively) in the treatment GA_3 50 ppm applied through pre-plant soaking + spraying at 20 DAS. Treatment application doubled (100% increment over control) the number of umbels $plant^{-1}$ over control while there was 30.2% and 39.2% increment in biological yield and seed yield, respectively over control (Table 2). Involvement of growth regulating substances with sink efficiency in influencing the yield potential has been reported by Evans *et al*. (1972). This may be one of the reasons that under the influence of PGRs better efficacy of sink resulted in higher yield. Improved vegetative growth due to PGR application has also direct influence on seed yield of coriander because higher the number of branches more will be seed yield. The present results are similar to that of Amrutavalli

Table 1. Effect of PGRs and mode of their application on vegetative growth of coriander var. RCr-435

Treatment	No. of nodes on main shoot				No. of branches plant^{-1}			
	Pre-plant soaking	Spraying 20 DAS	Pre-plant soaking + Spraying 20 DAS	Mean	Pre-plant soaking	Spraying 20 DAS	Pre-plant soaking + Spraying 20 DAS	Mean
IAA 10 ppm	4.97	5.23	5.60	5.27	7.28	7.75	8.47	7.83
IAA 20 ppm	5.12	6.98	7.32	6.47	7.25	9.05	9.77	8.69
IAA 50 ppm	5.93	7.47	7.28	6.89	8.23	9.18	10.08	9.17
NAA 10 ppm	5.20	5.53	5.90	5.54	6.75	7.57	8.08	7.45
NAA 20 ppm	5.23	6.18	7.75	6.39	7.12	7.67	9.22	8.00
NAA 50 ppm	6.15	6.35	7.93	6.81	7.18	8.07	9.82	8.36
GA_3 10 ppm	5.72	6.40	7.08	6.40	7.02	7.72	8.52	7.75
GA_3 20 ppm	6.50	7.43	7.63	7.19	8.52	8.87	10.03	9.14
GA_3 50 ppm	6.80	7.85	8.15	7.60	8.63	9.57	10.33	9.51
Mean	5.74	6.60	7.18		7.56	8.38	9.36	
Control vs Treatment								
Control			4.70				6.43	
Treated			6.51				8.43	
'F' test			Significant				Significant	
	SEm±		CD (1%)		SEm±		CD (1%)	
PGR	0.070		0.259		0.104		0.387	
MOA	0.040		0.150		0.060		0.223	
PGR x MOA	0.121		0.449		0.181		0.670	

DAS=Days after sowing; PGR=Plant growth regulator; MOA=Method of application

Table 2. Effect of PGRs and mode of their application on yield attributes and yield of coriander var. RCr-435

Treatment	No. of umbels plant^{-1}				Biological yield (q ha^{-1})				Seed yield (q ha^{-1})			
	Pre-plant soaking	Spraying 20 DAS	Pre-plant soaking + Spraying 20 DAS	Mean	Pre-plant soaking	Spraying 20 DAS	Pre-plant soaking + Spraying 20 DAS	Mean	Pre-plant soaking	Spraying 20 DAS	Pre-plant soaking + Spraying 20 DAS	Mean
IAA 10 ppm	16.32	17.20	19.70	17.74	0.967	1.083	1.139	1.063	0.258	0.351	0.361	0.332
IAA 20 ppm	16.44	23.22	29.33	22.97	1.082	1.214	1.372	1.222	0.308	0.397	0.446	0.384
IAA 50 ppm	17.82	24.06	31.40	24.13	1.122	1.292	1.403	1.269	0.357	0.404	0.479	0.414
NAA 10 ppm	15.02	16.70	18.60	16.74	0.939	1.055	1.100	1.032	0.267	0.334	0.364	0.322
NAA 20 ppm	15.24	21.40	23.35	20.23	0.944	1.134	1.207	1.095	0.268	0.380	0.408	0.352
NAA 50 ppm	16.47	22.55	27.57	22.22	1.080	1.158	1.345	1.194	0.348	0.378	0.427	0.385
GA_3 10 ppm	16.30	19.53	20.34	18.71	0.975	1.092	1.106	1.058	0.288	0.359	0.357	0.335
GA_3 20 ppm	17.82	21.97	30.09	23.29	1.051	1.249	1.373	1.225	0.315	0.396	0.423	0.378
GA_3 50 ppm	19.00	25.32	31.75	25.36	1.097	1.278	1.432	1.274	0.360	0.441	0.495	0.432
Mean	16.73	21.34	25.76		1.029	1.173	1.275		0.311	0.382	0.418	
Control vs Treatment												
Control	10.60				0.890				0.265			
Treated	21.28				1.159				0.370			
'F' test	Significant				Significant				Significant			
	SEm±		CD (1%)		SEm±		CD (1%)		SEm±		CD (1%)	
PGR	0.166		0.466		0.0070		0.0187		0.0020		0.0053	
MOA	0.096		0.269		0.0040		0.0107		0.0010		0.0027	
PGR x MOA	0.288		1.067		1.0130		0.0340		0.0040		0.0105	

DAS=Days after sowing; PGR=Plant growth regulator; MOA=Method of application

(1979) who also reported higher yield attributes and yield in coriander under the influence of PGRs.

The present study indicated that application of GA_3 @ 50 ppm through pre-plant soaking + spraying at 20 DAS proved the best treatment to increase the growth (number of nodes on main shoot and branches plant^{-1}), yield attributes and yield (number of umbels plant^{-1}, biological yield and seed yield) of coriander cv. RCr-435.

Acknowledgements

The authors are thankful to the Dean, Rajasthan College of Agriculture, Udaipur, for providing necessary facilities.

References

Amrutavalli 1979 Gibberellic acid (GA_3) induced enhancement in flowering in Bulgarian coriander (*Coriandrum sativum* L.) in relation to changes in carbohydrate metabolism. Curr. Sci. 48 : 5–6.

Bharud R W, Deore B P & Patil V A 1988 Effects of growth substances on the growth and yield of methi. J. Maharashtra Agril. Univ. 13 : 340–341.

Cochran W G & Cox G M 1950 Experimental Design. John Wiley Inc., New York.

El-Keltawi N E, Barham I H, El-Naggar A I & Rekaby A F 2000 Investigations on the responses of cumin plants to certain horticultural agro-chemicals. I. Influence of gibberellic acid (GA_3) on foliage growth, fruit yield, essential oil and chemical compositions. Egyptian J. Hort. 27 : 439–458.

Evans L T, Bingham J & Roskames M A 1972 The pattern of grain set within ears of wheat. Australian J. Biol. Sci. 25 : 1–8.

Fisher A M & Pyshtaleva O T 1974 Gibberellin as a mean of improving the nutritional value of green vegetables. Trudy NII Kraev. Patol. Kazssr. 26 : 180–182.

Hayat S, Ahmed A, Mobin M, Fasiduddin Q & Atam Z M 2001 Carbonic anhydrase, photosynthesis and seed yield in mustard plants treated with phytohormones. Photosynthetica 39 : 111–114.

Mishra S D 1989 Growth regulators in crop production-I. A brief overview. In : Saxena H K & Srivastava R D L (Eds.). Proceedings, National Seminar on Plant Physiology-Imperatives for Nineties, 22–24 January 1989, Kanpur (pp. 63–68). Indian Society for Plant Physiology, New Delhi.

Mohammed H M 1975 Effect of GA_3, calcium, kinetin and ethylene on growth and cell wall composition of pea epicotyls. Plant Physiol. 56 : 622–625.

Nickell L G 1982 Plant Growth Regulators - Agricultural Uses. Springer-Verlag, Berlin.

Paleg L G 1965 Physiological effect of gibberellins. Ann. Rev. Plant Physiol. 18 : 291–322.

Pareek N K 1996 Response of coriander (*Coriandrum sativum* L.) to nitrogen and plant growth regulators. M Sc Thesis, Rajasthan Agricultural Universtiy, Bikaner.

Saxena O P 1989 Role of PGRs in plant productivity studies. In: Proceedings, National Seminar on Strategies in Physiological Regulation of Plant Productivity, December 1989, Bombay (pp. 13–17). Indian Society of Plant Physiology, New Delhi.

Singh R K, Singh G P & Singh V K 1999 Effect of plant growth regulator and green fruit picking on seed production of bhindi [*Abelmoschus esculentus* (L.) Moench]. J. Appl. Biol. 9 : 31–34.

Sorte P N, Damke M M, Rafeekhar M, Gorammagar H B & Bobade P M 2001 Influence of GA and IAA on growth, yield and fruit quality of different varieties of brinjal. J. Soil Crops 11 : 128–131.