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Impact of pre-soaking and foliar application of plant growth regulators on growth and seed yield of coriander *(Coriandrum sativum* L.)

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ABSTRACT

A field experiment was conducted during Rabi 2013-14 at Research Farm, Horticultural College and Research Institute, Dr. Y.S.R. Horticultural University, Anantharajupet, Andhra Pradesh to study the impact of pre-soaking and foliar application of plant growth regulators on growth and yield of coriander (Coriandrum sativum L.). The experiment consists of seven treatments viz., T_1-GA_3 50 ppm, T_2-$GA_3$75 ppm, T_3-NAA 10 ppm, T_4-NAA 25 ppm, T_5-cycocel 100 ppm, T_6-cycocel 250 ppm and T_7-control (water spray) as pre-soaking and foliar application at 30 and 60 DAS in a Randomized block design with three replications. Among different PGRs applied, spraying of GA_3 75 ppm resulted in highest plant height and germination percentage. However, number of primary branches, secondary branches plant^{-1}, number of umbels plant^{-1}, number of umbellets umbel^{-1}, number of seeds umbel^{-1} and seed yield were recorded maximum with 250 ppm cycocel. GA_3 75 ppm took least number of days to 50 per cent flowering and maturity.

***Keywords* :** Coriander, cycocel,GA_3, NAA, plant growth regulators, yield

Coriander (*Coriandrum sativum* L.) is an annual spice and condiments herb that is mostly used for pleasant aromatic odour. The aroma and taste in coriander are due to the presence of essential oil, which is used for flavouring 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 and A, while seeds are rich in carbohydrates and protein content. Coriander is an important seed spices in Andhra Pradesh during *Rabi* season for grain purpose under rain fed vertisols. The crop has to survive under residual soil moisture throughout the cropping period and generally experiences terminal moisture stress which results in poor yields, which is the major constraint in production of coriander in Andhra Pradesh (*Sarada et al.* 2008). Plant growth regulators have great potential in increasing agricultural production and helps in removing many of the barriers imposed by genetics and environment. PGR's play an important role in mitigating the stress and increasing the flower set. Exogenous application of PGR's has been reported to improve the growth and yield of various crops (Bharud *et al.*1988). It is well known that all the PGR's regulate the physiological functions or processes of plant. Information regarding the use of plant growth regulators suitable for rain fed vertisols in Andhra Pradesh is very meagre. Keeping this in view, the present field experiment was conducted to study the effect of plant growth regulators on growth and seed yield of coriander.

MATERIALS AND METHODS

Present field experiment was conducted during *Rabi* 2013-14 at Research Farm, Horticultural College and Research Institute, Dr. Y.S.R. Horticultural University, Anantharajupet, Andhra Pradesh to see the impact of different plant growth regulators on growth and yield of coriander cv.Sudha. The soil texture of the experimental field was sandy clay loam with 7.4 pH, low in available nitrogen (150.70 kg ha^{-1}), medium in available phosphorus (29.28 kg ha^{-1}) and high in available potassium (316.15 kg ha^{-1}). The experiment consists of seven treatments including control (water spray), two concentrations of GA_3 (50 and 75 ppm), two concentrations of NAA (10 and 25 ppm) and two concentrations of cycocel (100 and 250 ppm) as pre-soaking and foliar spray at 30 and 60 DAS replicated thrice in a randomised block design. Seeds were sown in the plot of 2 x 2m at spacing of 30 x 10 cm. The crop was fertilized with 12 t of FYM along with NPK @ 45: 40: 30 kg ha^{-1} as basal. Another 15 kg N ha^{-1} was top dressed at 60 DAS. Growth regulators were applied as pre-soaking, foliar spray at 30 and 60 DAS as per the treatments and untreated control plots were sprayed with water. Need based cultural and plant protection operations were taken up to harvest good crop. Five plant samples from each replication in each treatment were selected at random to record data on morphological, yield and quality attributing characters. The experimental data was analysed statistically by the method of analysis of variance as out lined by Panse and Sukhatme (1995).

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Table 1: Effect of plant growth regulators on morphological characters of coriander

Treatment	Plant height (cm)			No. of primary branches plant^{-1}			No. of secondary branches plant^{-1}			Germination (%)
	30 DAS	60 DAS	At Harvest	30 DAS	60 DAS	At Harvest	30 DAS	60 DAS	At Harvest	
GA_3 50 ppm	32.47	67.12	75.11	3.33	6.33	6.47	3.47	12.33	15.33	95.00
GA_3 75 ppm	35.43	69.22	78.09	3.67	6.67	6.87	3.87	12.73	15.47	96.29
NAA 10 ppm	28.77	63.25	71.37	2.87	5.73	5.93	2.93	11.27	13.67	89.33
NAA 25 ppm	30.97	65.05	73.09	3.13	6.00	6.07	3.20	11.87	14.80	90.55
Cycocel 100 ppm	25.35	57.79	66.23	3.53	6.60	6.87	3.73	12.67	15.47	92.22
Cycocel 250 ppm	24.57	54.71	62.34	3.93	7.00	7.13	4.13	13.40	16.13	93.22
Control	26.31	60.46	68.02	2.47	5.40	5.60	2.67	10.40	12.93	88.33
LSD(0.05)	**0.56**	**1.02**	**0.65**	**0.20**	**0.30**	**0.25**	**0.20**	**0.65**	**0.63**	**0.22**

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

Treatments	No. of umbels plant^{-1}	No. of umbellets umbel^{-1}	Seeds umbel^{-1}	Seed yield	Seed yield (g plant^{-1})	Days to maturity (q ha^{-1})	Days to 50 % flowering
GA_3 50 ppm	24.00	5.87	30.93	7.21	15.58	86.33	41.67
GA_3 75 ppm	25.93	6.07	33.00	8.02	16.99	85.00	40.33
NAA 10 ppm	22.07	5.53	25.53	6.30	13.49	88.67	44.00
NAA 25 ppm	23.00	5.73	27.20	6.80	14.68	87.67	43.00
Cycocel 100 ppm	26.60	6.00	32.53	7.83	16.64	91.00	46.67
Cycocel 250 ppm	28.00	6.33	34.73	9.02	18.46	90.00	45.33
Control	16.93	5.27	23.47	5.33	11.29	92.33	47.33
LSD(0.05)	**1.38**	**0.20**	**1.68**	**0.92**	**1.44**	**2.14**	**1.82**

RESULTS AND DISCUSSION

Morphological characters

Morphological characters such as plant height, number of primary branches plant^{-1}, number of secondary branches/plant, days taken for 50 per cent flowering and maturity showed significant variation with different concentrations of growth regulators (Table 1). Among various treatments GA_3 at 75 ppm recorded the highest plant height at 30 DAS (35.43 cm), 60 DAS (69.22 cm) and at harvest (78.09 cm). The increase in plant height might be due to effect on increased cell elongation and rapid cell division in the growing portion leading to increased length of internodes. These results were in conformity with the findings of Bairva *et al*. (2012) in fenugreek, Singh *et al.* (2012) in coriander and Rohamare *et al*. (2013) in cumin. Number of primary and secondary branches plant^{-1} was maximum with the application of cycocel 250 ppm at 30 DAS (3.93 and 4.13, respectively), 60 DAS (7.00 and 13.40, respectively) and at harvest (7.13 and 16.13, respectively). The increase in number of primary and secondary 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. The results were in conformation with Bairva *et al*. (2012) in fenugreek, Singh *et al.* (2012) in coriander and Rohamare *et al*. (2013) in ajwain. Maximum germination percentage was recorded with the pre-soaking of GA_3 75 ppm (96.29). The increase in seed germination might be due to synthesis of α- amylase and other hydrolytic enzymes by the GA_3 during germination. These enzymes in turn will stimulates conversion of storage polymers in to sucrose or mobile amino acids or amides to facilitate translocation via phloem into the young root and shoots. The results were in conformation with the findings of Kumar and Sundareswaran (2011) in coriander and Shetty and Rana (2012) in ajwain.

Yield and yield attributing characters

The yield and yield attributing characters, such as number of umbels plant^{-1}, number of umbellets umbel^{-1}, number of seeds umbel^{-1}, seed yield plant^{-1} and seed yield ha^{-1} were also showed significant variation among the different concentrations of $GA_{3,}$ NAA and cycocel (Table 2). Application of Cycocel 250 ppm was found to be the best for various yield attributing characters such as number of umbels plant^{-1} (28.00), number of umbellets umbel^{-1} (6.33), number of seeds umbel^{-1} (34.73). Obviously the projected seed yield plant^{-1} and ha^{-1} was found maximum with cycocel 250 ppm (9.02 g and 18.46q respectively). The increase in seed yield ha^{-1} might be due to increase in yield attributes such as number of umbels plant^{-1}, number of umbellets umbel^{-1}, number of seeds umbel^{-1}, seed yield plant^{-1} and increase in growth parameters like number of branches (primary and secondary) plant^{-1}. The above results were in conformity with the findings of Menaria and Maliwal (2007) in fennel, Sarada *et al* (2008), Kumar and Sundareswaran (2011) in coriander and Shetty and Rana [9] in ajwain. Days to 50 per cent flowering and maturity decreased gradually with an increasing level of GA_3 of 50 ppm to 75 ppm which indicated GA_3 involvement in transition of vegetative apices to floral apices. According to Lang (1965) GA_3 could substitute for the proper environmental conditions which initiate early flowering (40.33 days) and maturity (85.00 days). Similar findings were reported by Singh *et al.* (2012) in coriander.

From the above study it can be concluded that higher concentrations of both cycocel 250 ppm and GA_3 75 ppm were significantly influencing the growth parameters, seed yield and yield attributing characters.

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