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Effect of GA_3 and ethrel along with pinching on yield of Marigold (*Tagetes erecta* L.) cv. Pusa narangi gainda

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Abstract
The present experiment "Effect of GA_3 and Ethrel along with pinching on yield of Marigold (*Tagetes erecta* L.) cv. Pusa Narangi Gainda" was conducted out at Indira Gandhi Krishi Vishwavidyalaya, Raipur, during rabi 2017-18. The experiment was conducted in Randomised Block Design comprising 7 treatments of 3 levels of GA_3 (200, 300, 400 ppm), 3 levels of Ethrel (400, 500, 600 ppm) and replicated in three times. The maximum number of (63.26) flowers per plant, highest flower diameter (6.667 cm.), maximum flower weight (6.03g) and highest yield/plant/ha (226.54 q/ha) were obtained at GA_3 400 ppm+ pinching. Hence, on the basis of result obtained from the present investigation it can be concluded that foliar application of GA_3 400 ppm at 15 DAT and 30 DAT was found to play a major role in increasing yield and yield attributive characteristics of marigold (*Tagetes erecta* L.) cv. Pusa Narangi Gainda.

Keywords: Marigold, GA_3, Ethrel, yield

Introduction
Marigold one of the most popular amongst cultivators, gardeners and flower merchants due to its wide adaptability, easy and short duration cultivation, good keeping quality and provides higher returns. It is native of Central and South America, especially Mexico. They are widely used for garden display and for religious and social functions. They are excellent landscape plants for bedding purpose, herbaceous border and also grown in pots. They are marketed as loose flower, also as cut flower and used for garland making purpose. For the control of nematodes especially in vegetable crop marigold is grown as trap crop. They are a important source of carotenoids which is used as poultry ration to impart yellow colour to egg yolk. The physiological processes of marigold can be altered with in a plant by using growth regulators PGR's are used to improve floral quality and yield. Gibberellins are growth enhancing substance. It plays role in stem elongation, germination, early flowering, vernalisation treatment, dormancy breaking, yield improvement etc. Being a growth retardant Ethrel Causes dwarfness in plants, reduces growth rate and regulate senescence activity of flowers.

Materials and Methods
The experiment was done during winter season 2017- 18 at Horticultural Research cum Instructional Farm, Department of Floriculture and Landscape Architecture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh. The investigation was put under Randomised Block Design with three replications in plot size 2.0 m × 1.6 m. The seeds were shown on 16 October 2017. Well grown healthy seedlings was transplanted to the main field 25-30 days after sowing of seeds. Transplanting was done in the evening at a spacing of 40cm × 40cm. A recommended dose of fertilizers *viz.* NPK 100:50:25 per hectare was applied through Urea, Single Super Phosphate (SSP) and Murate of Potash (MOP). At transplanting full dose of phosphorus and potash and half dose of nitrogen was applied to all treatment plots and rest half dose of nitrogen was applied 30 DAT as top dressing. Light irrigation was done immediatelyj after transplanting and subsequently when needed. There were 7 treatments which includes three levels of Gibberellic acid (200, 300 and 400 ppm), Ethrel (400, 500 and 600 ppm) along with one control (water spray).PGR sprays at 15 DAT and 30 DAT whereas, 30 DAT pinching will be done before PGR spray at 30 DAT. Pinching is common to all the treatments. Harvesting of flowers were done during cool hours in morning and evening.

Result and Discussion

Number of flowers per plant

The maximum number of (63.26) flowers per plant were obtained at GA_3 400 ppm+ pinching, followed by GA_3 300 ppm+ pinching. Ethrel causes least flower per plant (43.23) under Ethrel 600ppm+ pinching. The large number of lateral production at early stage of growth leads to the enhancement in number of flowers per plant. It might be due to getting sufficient time to accumulate carbohydrate for sufficient and proper flower bud differentiation resulted in enhanced reproductive efficiency. Similar results were also reported by Kumar *et al*. (2012) [4], Palei *et al.* (2016) [6].

Flower diameter (cm)

The highest flower diameter (6.667 cm.) was obtained atGA_3 400 ppm+ pinching, followed by GA_3 300 ppm+ pinching. Lowest diameter (4.600 cm) was observed in Ethrel 600ppm + pinching. The role of GA3 in improving the bud size may be ascribed to the translocation of metabolites at the site of bud development. Increase in flower diameter might be due to cell elongation in the flower. Gibberellins are also known to increase the sink strength of actively growing parts. These results are in close conformity with the study of Mishra (2017) [5] and Rajhansa (2014) [7].

Flower weight (g)

The maximum flower weight (6.03g) was obtained atGA_3 400 ppm+ pinching, followed by GA_3 300 ppm+ pinching. Least flower weight (3.8g) was observed in Ethrel 400 ppm+ pinching. The increase in weight of flowers per plant with GA3 might be due the production of more number of flowers and bigger sized flowers. These results are in close conformity with the study of Mishra (2017) [5]

Flower yield/plant/ha

The highest yield/plant/ha (226.54 q/ha) was obtained atGA_3 400 ppm+ pinching, followed by GA_3 300 ppm+ pinching, respectively as compared to (105.41 q/hec) in control. In ethrel least flower yield/plant/ha was observed in Ethrel 600ppm+ pinching. This increase in yield per plant under GA3 over the other treatments may be attributed to the fact that GA3 treated plants remained physiologically more active to build up sufficient food stocks, which in turn, promoted better plant growth and ultimately more number of flowers, leading to higher yields. Similar results were also reported by Kanwar *et al.* (2013) [3] and Badge *et al.* (2014) [1]

Table 1: The number of plant treatments per flowers and diameter weight

Treatment No.	Treatments	Number of flowers per plant	Flower diameter(cm)	Flower weight (g)	Flower Yield/plant/ha
T1	GA_3 200 ppm + pinching	51.30	5.533	4.40	149.83
T2	GA_3 300 ppm + pinching	53.43	5.900	5.00	176.52
T3	GA_3 400 ppm + pinching	63.26	6.667	6.03	226.54
T4	Ethrel 400ppm+ pinching	45.13	5.267	3.80	125.41
T5	Ethrel 500 ppm + pinching	43.23	4.900	4.46	122.17
T6	Ethrel 600 ppm + pinching	43.23	4.600	4.43	119.14
T7	(Control)+pinching	42.66	5.333	3.93	105.41
	SE (m) ±	1.512	0.146	0.25	4.103
	CD at 5%	4.71	0.455	0.70	12.78

Conclusion

On the basis of the result obtained from this experiment it is relevant to say that spray of GA_3 400 ppm at 15 DAT and 30DAT along with pinching was very effective with respect to the yield character of marigold (*Tagetes erecta* L.) cv. Pusa Narangi Gainda.

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