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Effect of Growth Regulators on Vegetative, Flowering and Flower Yield Parameters in African Marigold cv Culcatta Orange

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ABSTRACT

An experiment was carried out during winter season of 2015 in Department of Floriculture and Landscape Architecture, University of Horticultural Sciences, Bagalkot, during the year 2015-16. The experiment was conducted in randomized block design with 5 treatments or growth regulators of different concentrations along with one control as water spray. Gibberellic acid (G_1- GA_3 at 200 ppm), NAA (G_2- at 60 ppm), Cycocel (G_3- CCC at 1000 ppm) and TIBA at 1000 ppm (G_4) replicated thrice to evaluate the effect of these plant growth regulators on growth, flowering and yield characters in African marigold. The observed vegetative traits like plant height, numbers of primary and secondary branches per plant and plant spread and different flowering as well as yield attributing traits like early flower bud initiation, opening of first flower and maximum duration of flowering and and flower yield per plant were found to be maximum from the treatment Gibberellic Acid @ 200 ppm as compared to other treatments.

Key words: *GA_3-Gibberellic acid, NAA- Alpha - Naphthalene acetic acid, CCC-Cycocel or 2-chloro ethyl trimethyl ammonium chloride and TIBA-2, 3, 5 triiodobenzoic acid.*

INTRODUCTION

Marigold (*Tagetes erecta* L.) is an important commercial flower in India belongs to family Asteraceae (Compositae). It is very popular due to easy to grow and wider adaptability. In India, African marigold flowers are sold in the market as loose for making garland. Flowers are traditionally used for offering in temple, churches and used in festival for beautification of landscape. It is highly suitable for making flower beds in herbaceous border and also found ideal for newly planted shrubberies to provide colour and fill the gap in landscape. Both leaves and flowers possess medicinal values. Growth regulators find their extensive use in ornamental crops for modifying their developmental process. Plant growth regulators play an important role in flower production, which in small amount promotes or inhibits or quantitatively modifies growth and development. Gibberellic acid increased to be very effective in manipulating growth and flowering in marigold[7]. The experiment was carried out to assess the optimum concentration of various growth regulators to cause beneficial effect on growth and flowering behaviour of marigold.

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MATERIAL AND METHODS

The present experiment was conducted at the in the experimental field of Department of Floriculture and Landscape Architecture, University of Horticultural Sciences, Bagalkot, during the year 2015-16. The experiment was laid out in randomized block design (R.B.D.). All treatments were randomly allocated among the plot and replicated five times. Four growth regulators namely gibberellic acid (G_1- GA_3 at 200 ppm), NAA (G_2- at 60 ppm), cycocel (G_3-CCC at 1000 ppm) and TIBA at 1000 ppm (G_4) were taken. These four growth regulators along with one control (G_0-water spray), were taken for both the growth regulators. The marigold cultivar Calcutta Orange seedlings used for the experiment were collected from C.S. Biradar nursery, Ghataprabha.

One month old, healthy, uniform seedlings were used for transplanting. Seedlings were planted at a spacing of 60 x 45 cm and light irrigation was given soon after transplanting. The operation of transplanting was carried out in the afternoon followed by a light irrigation to allow for proper establishment of seedlings. Well decomposed FYM @ 20 tonnes per hectare was applied at the time of land preparation. The recommended dose of fertilizer 225:60:60 kg NPK/ha[3] (Anon, 2012). Seven and ten days after transplanting the gap filling was done twice with fresh seedling, in order to maintain 100 per cent plant population in each plot. Hence for whole experimental site necessitated 3L of growth regulator spray of mentioned concentration which are prepared out of respective stocks and diluted for 3L volume with distilled water. Only control treatment plot was water sprayed. The spraying was done in the morning hours with the help of hand sprayer.

Three spraying were done, first spray one week after transplanting, second spray 15 days after first spray and third spry 15 days after second spray.

Observations were recorded at 45 and 90 days after transplanting. The various growth parameters like height of plant (cm), number of primary branches per plant, number of primary branches per plant and plant spread (cm^2) were recorded for observation. The flowering parameters like emergence of first flower bud, commencement of first flowering (days) and the yield parameter flower yield per plant (g) were also recorded.

RESULTS AND DISCUSSION

Growth parameters:

All the parameters at 90 DAT were influenced significantly due to various plant growth regulators, whereas for 45 DAT were nonsignificant except for the plant spread, which is significant **(Table 1)**. Plants sprayed with GA_3 a4 200 ppm (G_1), was found to be significantly highest for plant height at 90 DAT (64.52 cm), plant spread at both 45 (589.90 cm) and 90 DAT (5058.73 cm). This indicates that GA_3 has a role in increasing plant height and plant spread, where similar results were also observed by Verma and Arha[11], Devadanam *et al*[6]., Sunita *et al*[8]., Amitkumar *et al*[2]., Amitkumar *et al*[1]., and Mithileshkumar *et al*[7]., in African marigold. The increased plant height and plant spread with the application of GA_3 may be due to enhanced cell division and cell enlargement.

Whereas in case of number of primary (23.13) and secondary (54.45) branches per plant on 90 DAT were found to be highest and significantly different in plants sprayed with cycocel at 1000 ppm but plants sprayed with with GA_3 at 200 ppm (22.60 and 53.25 for number of primary and secondary branches per plant on 90 DAT respectively). This can be due to reduced cell elongation by cycocel might have increased primary and secondary branches per plant, however with GA_3, this might be due to its role in increased cell division might have increased the number of primary and secondary branches per plant. Similar results were observed and reported by Amitkumar *et al*[2]., Mithileshkumar *et al*[7]., and Suvalaxmi *et al*[9]., in African marigold.

Table 1: Effect of growth regulators on growth parameters of marigold

Treatments	Plant height (cm)		Number of primary braches per plant		Number of secondary branches per plant		Plant spread (cm)	
	45 DAT	90 DAT	45 DAT	90 DAT	45 DAT	90 DAT	45 DAT	90 DAT
G_0	31.52	59.94	8.02	20.08	19.67	47.79	493.55	2649.84
G_1	35.04	64.52	9.75	22.60	22.45	53.25	589.90	5058.73
G_2	33.06	61.88	9.56	22.34	20.98	51.95	549.92	3387.41
G_3	32.49	59.34	10.17	23.13	23.13	54.45	558.20	3594.50
G_4	32.10	58.70	8.36	21.26	19.73	49.65	444.92	2922.99
SE.m±	0.63	0.64	0.30	0.32	0.91	0.63	2.94	3.86
CD at 5 %	NS	1.93	NS	0.97	NS	1.87	8.79	11.54

However, lowest observations were recorded for two treatments, the plants which are sprayed with water (control-G_0) for plant height at 45 DAT (31.52 cm), number of primary branches per plant at 45 DAT (8.02), 90 DAT (20.08), number of secondary branches per plant at 45 DAT (19.67) and plant spread at 90 DAT (2649.84 cm) and the plants which are sprayed with TIBA at 1000 ppm (G_4) for plant height at 90 DAT (58.70 cm), number of secondary branches per plant at 90 DAT (49.65) and plant spread at 45 DAT (444.92 cm). This indicated that TIBA has no or less role in growth parameters of marigold as it was evident with control and TIBA with lowest records.

Flowering and flower yield paramters:

Flowering and flower yield parameters were found to be significantly different for all the growth regulators in the study (**Table 2**). Earliest/ first bud initiation and flowering was observed with the spary of GA_3 at 200 ppm (41.40 and 57.69 days respectively). Gibberellins reduces juvenile period and with the termination of juvenile phase, the shoot apical meristem instead of producing leaves and branches start producing buds. Similar finding was also reported by Dahiya and Rana[4]. GA_3 was found most effective in extending the flowering duration (92.57 days). It might be due to advanced stage of flowering in marigold. Tyagi and Kumar[10], Sunita *et al*[8]., Amitkumar *et al*[2]., Amitkumar *et al*[1]., and Mithileshkumar *et al*[7]., in African marigold and Dalai *et al*[5]., in Chrysanthemum, reported similar results.

Maximum number of flowers yield per plant was recorded with application of GA_3 at 200 ppm (397.25 g) sprayed plants. The enhancement in flower yield per plant might be due to the production of large number of laterals at early stage of growth (which was evident in table 1 with highest plant spread at 90 DAT for plants sprayed with GA_3 at 200 ppm) which had sufficient time to accumulate carbohydrate for proper flower bud differentiation due to enhanced reproductive efficiency and photosynthesis restrictive plant type. The result was in close conformity with Verma and Arha[11] and Sunita *et al*[8]., Amithkumar *et al*[1]., Mithileshkumar *et al*[7]., and Suvalaxmi *et al*[9]., in African marigold and Devadanam *et al*[6]., in tuberose.

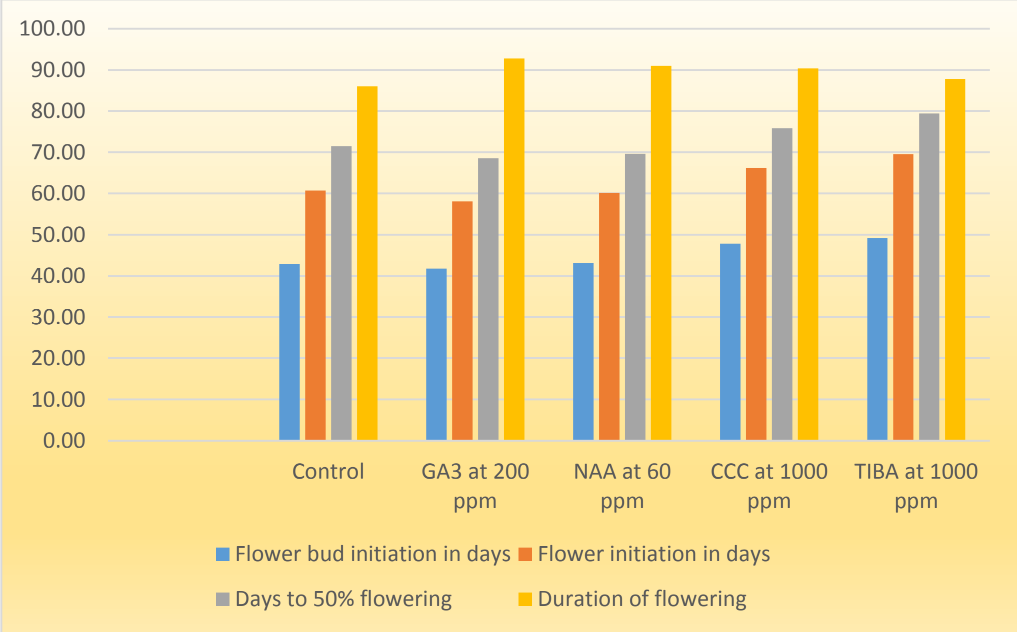

Fig. 1: Effect of growth regulators on flowering parameters

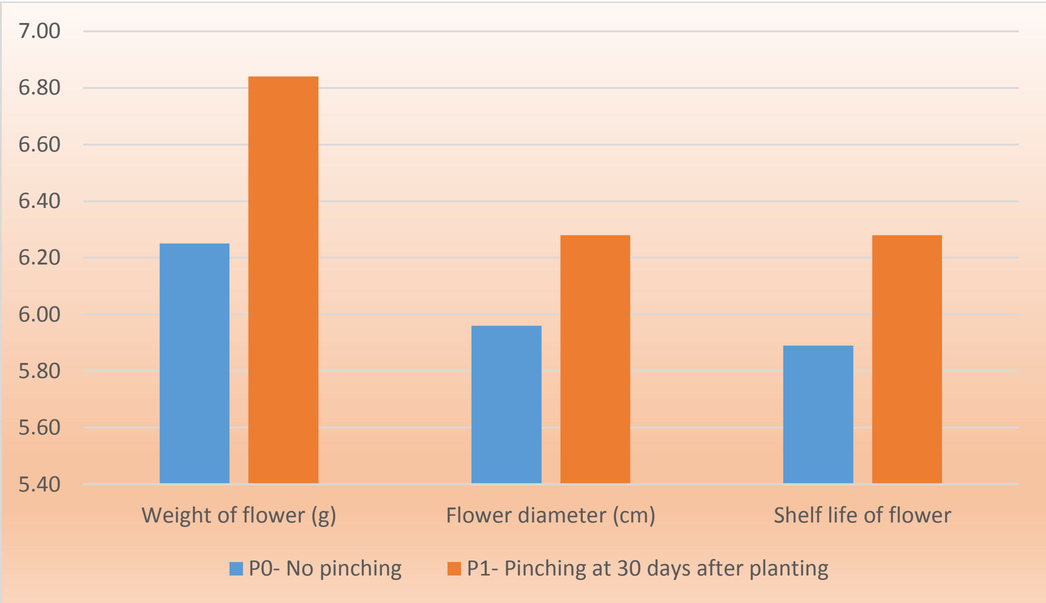

Fig. 2: Effect of growth regulators and pinching on flower quality parameters

Table 2: Effect of growth regulators on yield parameters of marigold

Treatments	Flower bud initiation (days)	Flower initiation (days)	Duration of flowering (days)	Flower yield per plant (g)
G_0	42.40	60.29	**85.64**	**165.50**
G_1	41.40	57.69	92.57	397.25
G_2	42.44	59.56	90.75	347.75
G_3	47.66	66.02	90.39	240.50
G_4	**49.31**	**69.52**	88.01	187.50
SE.m±	0.07	0.07	0.07	172.85
CD at 5 %	0.20	0.20	0.20	517.38

Late flower bud initiation and flowering was observed with the spary of TIBA at 1000 ppm (49.31 and 69.52 days respectively) and plants which were sprayed with water (control-G_0) recorded lowest flowering duration (85.64 days) and hence also with the flower yield per plant (165.50 g). This indicated that, TIBA has no role in even flowering parameeters of marigold.

CONCLUSION

From the above experiment it was revealed that different vegetative characters like height, numbers of primary and secondary branches per plant and plant spread were maximum on the plant treated with GA_3 @ 200 ppm. Similarly, different flowering and yield attributing characters like early flower bud initiation, opening of first flower and maximum duration of flowering, flower yield per plant were found to be maximum from GA_3 treated plant at a concentration of 200 ppm as compared to other treatments. Thus it was concluded that sparying with GA_3 at 200 ppm will result in better growth and yield in african marigold.

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