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RESPONSE OF GA_3 ON GROWTH, FLOWERING AND QUALITY YIELD OF AFRICAN MARIGOLD (*TAGETES ERECTA* L.) CV. GIANT ORANGE

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ABSTRACT

An experiment was carried out at Experimental Research Farm, R.B.S College Bichpuri, Agra (U.P.) during *rabi* season of 2022-23 to study the response of GA_3 on growth, flowering and quality yield of African marigold (*Tagetes erecta* L.). The experiment consists of three replications and 8 treatments and laid out in a randomized block design- consisting of various concentrations of GA_3 *viz.* 0ppm, 50ppm, 100ppm, 150ppm, 200ppm, 250ppm, 300ppm and 350ppm. The results revealed that among different concentrations of GA_3 ,300ppm showed the maximum value of plant height (64.72 cm), diameter of main stem (1.32 cm), plant spread N-S and E-W (30.36 cm and 30.39 cm), number of primary branches/ plant (23.55), length of longest primary branch (27.41 cm). In the case of floral parameters 300ppm recorded minimum days taken to first flower bud initiation (34.58 days) and first flower bud break (47.92 days), and maximum length of flower (10.24 cm), diameter of flower (6.11 cm), number of flowers/plant (25.67), weight of flower/plant (238.56 g) and flower yield (15.19 t ha^{-1}).

Key words : GA_3, African marigold, Growth behavior, Flower yield.

Introduction

Marigold (*Tagetes erecta* L.) is one of the most commonly grown flowers and used extensively as loose flower for making garlands for religious and social functions. It has gained popularity among gardeners on account of its easy cultivation, wide adaptability and year around flower production. Its habit of free flowering, short duration to produce marketable flowers, and wide range of colours, shape, size and good keeping quality attracted the attention of flower growers. Plant growth regulators play an important role in vegetative propagation, inhibition of abscission, prevention of bud dormancy, growth control and promotion of flowering, prolonging the vase life of flowers and retarding senescence. Gibberellic acid helps to promote plant growth, an increased number of primary and secondary branches and increase flower quality, maintains uniformity in flower size and number which eventually ensures higher production of flowers. Keeping in view the above facts this experiment was conducted with the objective to standardize the different concentrations of GA_3 on growth and flowering of African marigold.

Materials and Methods

The experiment was conducted at Research Farm, Department of Horticulture, R.B.S College, Bichpuri, Agra (U.P.) during rabi season of 2022-23. The experimental area is situated at 27.2^0 N latitude 78.5^0 East longitudes at height of 168m above the mean sea level. The climate of experimental site is sub-tropical with large variation between summer and winter temperature. During the summer, temperature ranges from 46^{0}C to 48^{0}C or even more during May and June whereas in winter, it ranges from 1^{0}C to 22^{0}C. Mansoon generally starts from June and recedes by the end of September with an annual rainfall of 670mm. The soil of experimental field was well drained sandy loam in texture with good water holding capacity. The ph of soil was 8.1. The soil had 290.0 ha^{-1} available potassium, 28.30 ha^{-1} available phosphorus and 181 kg ha^{-1} available nitrogen and 0.32

% organic carbon. The experiment was laid out in randomized block design with three replications and 8 treatments comprising Control and different concentrations of GA_3 (50ppm, 100ppm, 150ppm, 200ppm, 250ppm, 300ppm and 350ppm). One month old healthy seedlings were transplanted at the spacing of 40-40cm. Recommended dose of 100 kg N, 100 kg P_2O_5 and 100 kg K_2O ha^{-1} were applied as basal through urea, diammonium phosphate and muriate of potash, respectively. Hand sprayer was used to spray GA_3 uniformly. The various observations on growth, flowering and yield characters *viz*.; plant height, number of primary branches, length of longest primary branch, diameter of main stem, plant spread N-S and E-W, number of flowers per plant, length of flower, weight of flower per plant and flower yield were recorded and the data was statistically analyzed.

Results and Discussion

Growth study

The study revealed an increase in almost all the vegetative growth and flowering parameters with the application of GA_3 (Table 1). Plant height was significantly increased by successive increase in concentration of GA_3. The maximum plant height (64.72 cm) was recorded with T_6 treatment (300ppm GA_3) followed by T_7. The result reveals that the higher concentration of GA_3 is most effective in multiplication of cells as well as elongation of young tissues whereas the lower concentration was less desirable. These results are in close conformity with the findings of Kanwar and Khandelwal (2013) and Sarkar *et al.* (2018). The number of primary branches per plant increased with successive increase in GA_3 concentration. The maximum number of primary branches (23.55) per plant was observed with treatment T_6 (300ppm GA_3) and the least number of primary branches (15.67) was recorded in the control treatment. Foliar application of GA_3 also exert significant impact on length of primary branches and GA_3 @ 300 ppm produced conspicuously longer primary branches over all other lower concentrations of GA_3 and control. The results are in accordance with the report of Acharya *et al.* (2021) and Kumar *et al.* (2023) in marigold. The marigold plants sprayed with GA_3 300 ppm (T_6) had the significantly maximum plant spread in both directions N-S and E-W (30.36 cm and 30.39 cm). GA_3 at optimum dose (300 ppm) enhanced the metabolic activities of the plant and influenced the uptake of water and nutrients, therefore, the plant spread might have increased. Similar observations were also reported by Ramdevputra *et al.* (2009) and Kumar *et al.* (2016). Similar trend was observed in case of diameter of main stem of marigold and foliar application of 300 ppm GA_3 appreciably increased diameter of main stem (1.32 cm) over all other treatments and control. The minimum stem diameter (0.91 cm) was recorded in control treatment. The findings of present study are in close conformity with finding of Pandey and Chandra (2008) and Shivprakash *et al.* (2011).

Flowering study

The foliar treatment of GA_3 300ppm took significantly minimum period (34.58 days) for first flower bud initiation and first flower bud break (47.92 days) followed by 350 ppm and 250 ppm GA_3 application, whereas maximum days were taken in control treatment. This improvement might be attributed to the increase in endogenous levels of gibberellins which by virtue of its characteristics of hastening the flowering might have advanced the date of anthesis. Similar results have also been reported by Palei *et al.* (2016) and Patil *et al.* (2016) in marigold. Significantly maximum flower length (10.24 cm) and

Table 1 : Effect of GA_3 on vegetative growth of African marigold.

Treatment	Plant height (cm)	Number of primary branches	Length of longest primary branch (cm)	Plant spread (N-S) (cm)	Plant spread (E-W) (cm)	Stem diameter (cm)
GA_3 50ppm	55.65	18.33	21.72	25.90	24.35	1.07
GA_3 100ppm	57.02	19.88	23.84	26.03	26.05	1.11
GA_3 150ppm	58.50	19.89	23.84	26.11	26.35	1.11
GA_3 200ppm	59.69	20.77	23.91	26.14	26.63	1.12
GA_3 250ppm	61.44	20.88	24.32	27.98	28.92	1.14
GA_3 300ppm	64.72	23.55	27.41	30.36	30.39	1.32
GA_3 350ppm	64.35	21.33	25.52	28.96	28.96	1.15
Control	51.23	15.67	19.95	23.70	21.81	0.91
S.Em	0.60	0.75	0.48	0.73	0.62	0.05
CD at 5%	1.48	1.86	1.20	1.83	1.54	0.12

Table 2 : Effect of GA_3 on flowering parameters and yield of African marigold.

Treatment	Days to first flower bud initiation	Days to first flower bud break	Length of flower (cm)	Diameter of flower (cm)	Weight of flowers plant^{-1} (g)	Number of flowers plant^{-1}	Flower yield plot^{-1} (kg)	Flower yield (t ha^{-1})
GA_3 50ppm	38.58	60.67	9.41	4.91	208.00	19.00	4.50	10.81
GA_3 100ppm	38.25	58.42	9.53	5.14	209.67	19.00	4.67	11.20
GA_3 150ppm	38.25	56.25	9.60	5.15	209.67	19.67	4.88	11.70
GA_3 200ppm	38.00	53.75	9.67	5.21	220.78	20.67	5.05	12.11
GA_3 250ppm	35.17	51.67	9.67	5.26	224.11	21.00	5.67	13.60
GA_3 300ppm	34.58	47.92	10.24	6.11	238.56	25.67	6.33	15.19
GA_3 350ppm	34.75	48.00	9.70	5.31	233.56	22.67	5.70	13.67
Control	42.08	61.42	8.37	4.08	197.44	18.33	3.99	9.56
S.Em	0.57	0.82	0.17	0.24	1.16	0.86	0.23	0.61
CD at 5%	1.42	2.05	0.42	0.60	2.89	2.14	0.58	1.52

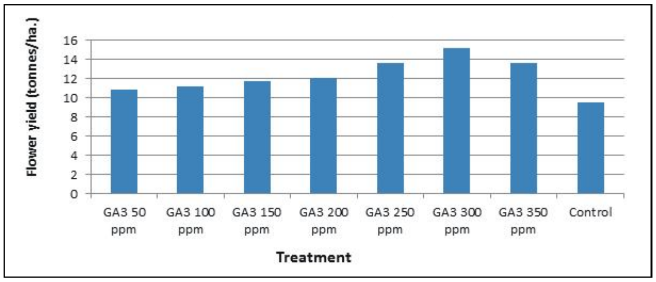

Fig. 1 : Effect of GA_3 on flower yield of African marigold cv. Giant Orange (tonnes/ha).

flower diameter (6.11 cm) were recorded with foliar spray of GA_3 300ppm. The increment in flower length and flower diameter might be due to cell elongation in the flower. Similar findings were also noted by Pandey and Chandra (2008). GA_3 treatments have a significant effect on the number of flowers plant^{-1}. The maximum number of flowers (25.67) per plant were recorded with application of GA_3 300ppm closely followed by 350 ppm, whereas minimum number of flowers plant^{-1} (18.33) was recorded with control. The enhancement in number of flowers per plant may be attributed to an increased plant height and number of branches per plant as influenced by the GA_3 treatments. These results are in conformity with the findings of Badge *et al.* (2014).

Yield study

Data regarding yield parameter has been recorded and shown in Table 2 and Fig. 1. Significantly maximum flower yield plot^{-1} (6.33 kg) and flower yield ha^{-1} (15.19 t) and weight of flower (238.56 g) were recorded with foliar treatment of GA_3 300ppm followed with the application of 350 ppm GA_3. However, minimum flower yield plot^{-1} and ha^{-1} (3.99 kg and 9.56 t, respectively) and weight of flower (197.44 g) were registered with the control treatment. This increase in the yield of African marigold plot^{-1} and hectare^{-1} may be attributed to the fact that GA_3 treated plants remained physiologically more active to build up sufficient food stocks, which in turn, promoted better plant growth and a greater number of flowers, leading to higher yields. These results are in close conformity with the findings of Palei *et al.* (2016) and Kalaimani *et al.* (2017) in marigold.

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