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EFFECT OF GROWTH PROMOTING CHEMICALS ON GROWTH, FLOWERING AND SEEDS ATTRIBUTES IN MARIGOLD

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ABSTRACT

An investigation was carried out during 2011-2012 at Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh to evaluate the effect of various growth promoting chemicals on growth, flowering and seed attributes in African marigold cv. Pusa Narangi Gainda. Four levels each of gibberellic acid (GA_3) at 50, 100, 150 and 200 ppm and kinetin (50, 100, 150 and 200 ppm) along with control (distilled water) were applied as foliar application at 30 days after transplanting. Experiment was laid out in a randomized block design with three replications. Results revealed that, maximum fresh weight of leaf (0.58 g) was produced with 100 ppm of GA_3 and it was significantlysuperior to all the treatments. Maximum dry weight of leaf (0.13 g) was recorded with GA_3 at 100 ppm which was at par with GA_3 at 200 ppm. The maximum plant spread (40.82 cm), plant height (55.77 cm), diameter of flower (5.54 cm), number (145.47) and weight of seeds/peduncle (0.69 g) and weight of 100 seeds (0.76 g) were recorded with GA_3 200 ppm. GA_3 150 ppm resulted in maximum duration of flowering (61.89 days). Application of kinetin 200 ppm resulted in maximum stem diameter (1.49 cm), fresh weight of flower (4.01 g), early seed ripening (56.25 days) and seed yield (21.92 g per plant).

Key words: Marigold, GA_3, kinetin, flower, seed, Pusa Narangi Gainda.

INTRODUCTION

Marigold is an important flower crop and constitute as one of the five most commonly cultivated and used flower in urban and rural India. They are extensively used for making garlands, beautification and other purposes i.e. pigment and oil extraction and therapeutic uses. Apart from these uses marigold is a widely grown plant in gardens and pots. It is highly suitable as a bedding plant, in an herbaceous border and is also ideal for newly planted shrubberies to provide colour and fill the space. Flowers remain fresh for 4-5 days at room temperature and are used for religious offerings and social functions (Singh, 2006). The carotenoid extracted from petals are added to poultry feed for intensification of yellow colour of egg yolk. Lutein which is the major constituent of xanthophylls is used for colouring food stuffs. Purified extract of marigold petals containing lutein dipalmitate is marketed as an ophthalmologic agent under the name adaptinol. The marigold flower meal that remains after removal of lutein and it is believed to contain a polysaccharides component having ability to protect the hydrophobic substances from oxidation (Singh and Karki, 2004). The use of plant growth regulators has been found to be great importance in the commercial cultivation of many ornamental plants. Earlier worker found beneficial effect of growth promoting chemicals in marigold (Singh, 2004a, b and Swaroop *et al.*, 2007). Application of gibberellic acid found effective in tuberose (Sharma and Singh (2012) and in improving flowering characters in gladiolus (Neetu *et al.*, 2013). Therefore, present experiment was undertaken to find out response of GA_3 and kinetin on growth, flowering and seed yield in marigold.

MATERIALS AND METHODS

A field experiment was conducted using marigold cv. Pusa Narangi Gainda at Horticulture Unit, Department of Horticulture, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh during 2011-2012.Field of experimental site lies approximately in the centre of North-Gangetic alluvial plain, on the left bank of river Ganga which was homogeneously fertile with uniform textural makeup. Varanasi city is situated at $25^0 10^{'}$ North latitude and $83^0 03^{'}$ East longitudes. The altitude of the location is 123.23 meter above the mean sea level. Four levels of gibberellic acid (GA_3) at 50, 100, 150 and 200 ppm and kinetin at 50, 100, 150 and 200 ppm along with a control (distilled water) were taken in this investigation. The experiment was laid out in a randomized block design with three replications. Seed sowing was done in second week of October and one month old seedlings were transplanted at 60 cm row to row distance and 45 cm from plant to plant distance. Plot size was kept 2.4 × 1.8 m to accommodate 16 plants in each plot. Different concentrations of GA_3 and kinetin were

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sprayed to the plants at 30 days after transplanting to run-off stage. Control plants were sprayed with distilled water in same manner. Observations on various growth, flowering and seed attributes were recorded. Results thus obtained, were subjected to statistical analysis.

RESULTS AND DISCUSSION

Growth parameters

Significant variations due to application of GA_3 and kinetin at various concentrations were recorded in fresh weight of leaf. Maximum fresh weight of leaf was recorded at GA_3 100 ppm (0.58 g), which was significantly superior to all the treatments (Table 1). Whereas, the minimum fresh weight of leaf was recorded with 50 ppm GA_3. Maximum dry weight of leaf (0.13g) was recorded at GA_3 200 ppm and GA_3 100 ppm. This treatment was statistically *at par* with all the treatments except control (distilled water) and GA_3 50 ppm. The maximum plant spread was exhibited with GA_3 200 ppm (40.82 cm), it was statistically *at par* with all the treatments except control (distilled water). It was observed that all the vegetative growth characters were influenced by GA_3 at 300 ppm (Ramdevputra *et al.,* 2009). Higher dose of kinetin i.e. 200 ppm resulted in maximum stem diameter (1.49 cm), which was significantly superior to all the treatments except GA_3 150, 200 ppm and kinetin 100, 150 ppm. Minimum stem diameter was recorded with GA_3 50 ppm (0.77 cm). Maximum plant height was recorded with GA_3 200 ppm (55.77 cm). This treatment was statistically *at par* with all the treatments except control (distilled water) and GA_3 50 ppm treatments. These results are in close conformity with the observations made by Singh (2004a, b). Results were also in congruence with findings of earlier workers who found beneficial effect of GA_3 in marigold (Swaroop *et al.,* 2007) and in calendula (Tyagi *et al.,* 2008). Improved plant growth of gladiolus due to application of GA_3 was also observed by Neetu *et al.* (2013) and they found that maximum number of leaves/plant was registered in gladiolus cv. Gunjan at 200 ppm GA_3.

Table 1: Effect of growth promoting chemicals on growth in marigold cv. Pusa Narangi Gainda

Treatment	Fresh weight of leaf (g)	Dry weight of leaf (g)	Spread of plant (cm)	Stem diameter (cm)	Plant height (cm)
Control	0.34	0.07	31.59	0.79	44.72
GA_3 50 ppm	0.26	0.05	32.67	0.77	48.76
GA_3 100 ppm	0.58	0.13	32.50	0.83	50.38
GA_3 150 ppm	0.39	0.08	38.17	0.95	52.82
GA_3 200 ppm	0.46	0.13	40.82	1.38	55.77
Kinetin 50 ppm	0.32	0.12	39.64	0.79	50.38
Kinetin 100 ppm	0.45	0.11	38.42	0.99	52.82
Kinetin 150 ppm	0.45	0.12	39.32	1.17	52.46
Kinetin 200 ppm	0.48	0.12	39.62	1.49	53.89
C.D.(P=0.05)	0.06	0.05	7.01	0.56	5.54

Flowering parameters

Pronounced effects of various chemicals were observed on different flowering parameters (Table 2). Maximum duration of flowering was recorded at GA_3 150 ppm (61.89 days), which was statistically significant to all the treatments except GA_3 100 and 200 ppm. Minimum duration of flowering was observed with kinetin 200 ppm. Higher dose of GA_3 i.e. 200 ppm resulted in maximum diameter of flower (5.54 cm). Minimum flower diameter (4.01 cm) was recorded with control (distilled water). Ramdevputra *et al.* (2009) recorded maximum flowering span with 200 ppm GA_3 application. Kumar *et al.* (2010) observed that flowering in marigold improved due to application of GA_3. Results indicated that GA_3 at 50,100 and 200 ppm significantly increased number of flower per plant, weight and size of flower and flower yield per plant over control. Maximum fresh weight of one flower was observed at kinetin 200 ppm (4.01 g). This treatment was statistically *at par* with all the treatments except control (distilled water) and kinetin 50 ppm. Minimum fresh weight of one flower recorded at control (distilled water). Maximum dry weight of one flower (g) recorded at kinetin 200 ppm; whereas minimum at control. Syamal *et al.* (1990) observed maximum number of flowers per plant and seed production with 200 ppm GA_3. In another trial GA_3 at 200 ppm resulted in the greatest number of flowers per plant, flower diameter, fresh weight of flower, flower dry weight and flower yield (Tyagi *et al.,* 2008). Neetu *et al.* (20013) found that early spike emergence was noticed in cv. Sabnum when sprayed at 300 ppm GA_3. In general, they observed that higher size of first and fifth floret was recorded with cv. J.V. Gold at 200 ppm GA_3. GA_3 at

300 ppm also exerted maximum length of spike, whereas maximum number of florets/spike was recorded with cv. Snow Princess when GA3 was applied at 100-200 ppm.

Table 2: Effect of growth promoting chemicals on flowering in marigold cv. Pusa Narangi Gainda

Treatment	Duration of flowering (days)	Diameter of flower (cm)	Flowers/plant	Fresh weight of flower (g)	Dry weight of flower (g)
Control	35.96	4.01	19.95	3.13	0.94
GA_3 50 ppm	39.96	5.03	22.55	3.46	0.99
GA_3 100 ppm	47.93	5.41	24.11	3.68	1.10
GA_3 150 ppm	61.89	5.53	25.67	3.71	1.03
GA_3 200 ppm	54.45	5.54	23.33	3.78	1.07
Kinetin 50 ppm	33.53	5.23	22.67	3.32	1.01
Kinetin 100 ppm	35.58	5.34	24.62	3.88	1.08
Kinetin 150 ppm	40.60	5.40	23.22	3.95	1.09
Kinetin 200 ppm	29.83	5.48	30.67	4.01	1.23
C.D.(P=0.05)	18.27	0.95	6.21	0.61	0.16

Seed attributes

Various growth promoting chemicals exerted significant effect on seed attributes in marigold (Table 3). Minimum duration of days to seed ripening was recorded with kinetin at 200 ppm and it was significantly earlier than all the treatments except GA_3 200 ppm, kinetin 100 and 150 ppm, whereas seed ripening was delayed with control. The maximum number of seeds per peduncle was scored with GA_3 200 ppm (145.47 seeds) and it was significant to all the treatments except kinetin 150 and 200 ppm. Minimum number of seeds per peduncle was noticed with control. Maximum weight of seeds per peduncle was with GA_3 and kinetin at 200 ppm. Control (distilled water) yielded minimum weight of seed per peduncle. Maximum weight of 100 seeds observed with GA_3 200 ppm (0.76 g). Minimum weight of 100 seeds observed with control. Kinetin 200 ppm registered maximum seed yield per plant yield, however lower seed yield per plant was observed with control. Syamal *et al.* (1990) noticed maximum seed production with 200 ppm GA_3. Singh (2004) reported that application GA_3 increased the number of seeds per flower, 100-seed weight and seed yield per plant. Present findings also substantiated with the observations of Swaroop *et al.* (2007). In case of tuberose, bulb yield was improved with application of GA_3 in comparison to control (Sharma *et al.*, 2012).

Table 3: Effect of growth promoting chemicals on seed attributes in marigold cv. Pusa Narangi Gainda

Treatment	Days to seed ripening	Seeds/ peduncle	Weight of seeds/ peduncle (g)	Weight of 100 seeds (g)	Seed yield/plant (g)
Control	77.95	91.63	0.59	0.53	12.28
GA_3 50 ppm	75.31	105.25	0.61	0.55	14.03
GA_3 100 ppm	77.73	104.96	0.68	0.61	15.74
GA_3 150 ppm	71.69	109.62	0.63	0.63	16.73
GA_3 200 ppm	66.82	145.47	0.69	0.76	16.65
Kinetin 50 ppm	73.13	101.33	0.62	0.62	14.41
Kinetin 100 ppm	61.60	110.25	0.62	0.64	15.55
Kinetin 150 ppm	68.78	113.56	0.68	0.66	15.88
Kinetin 200 ppm	56.25	119.64	0.69	0.69	21.92
C.D.(P=0.05)	6.96	32.18	0.08	0.14	5.17

From the results, it can be concluded that the application of GA_3 at 100-200 ppm was found beneficial to improve plant growth and flowering in marigold whereas kinetin at 200 ppm gave pronounced effect on weight of flower and seed yield.

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