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Effect of GA, NAA and CCC on growth and flowering of French marigold (*Tagetes patula*)

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Abstract

To standardize the optimum concentration of naphthalene acetic acid (NAA), gibberellic acid (GA) and chlormequat (CCC) for application on French marigold, a field trial was conducted with their different concentrations. Effect of these chemicals on vegetative growth and flowering of French marigold was investigated. Significant response of these treatments was recorded on various qualitative and quantitative traits. The response of NAA was not encouraging whereas CCC and GA application gave quite beneficial effect. Therefore, 400ppm GA or 600 ppm CCC may be used to increase flower yield/plant and number of flowers/plant, respectively. Adverse effect of these chemicals on growth and flowering was not recorded.

Key words: Plant growth regulators, growth, flowering characters, French marigold (*Tagetes patula* L.)

Introduction

French marigold is an important commercial flower for making garland, vein button holes, bouquets, wreath and various items of decoration as well as used for extraction of innumerable perfumes, essences and other products. Marigold is very popular amongst the gardeners and florists because of its easy culture and wide adoptability along with short duration to produce marketable flowers with wide spectrum of attractive color, shape, size and good keeping quality. In India, it is one of the most commonly grown flowers and extensively used in religious and social functions. However, it has not yet been fully commercialized in U.P., which might be due to lack of suitable agro-technique. In recent year, in order to standardize different agro-techniques for successful cultivation of ornamental crops, application of many plant growth regulators were tried to increase vegetative growth, early flowering, increased flower size and weight of flowers. Therefore, experiment was laid out to study the effect of plants growth regulators on growth and flowering of French marigold.

Material and Methods

The present investigation was carried out at Janta college, Bakewar, Etawah (U.P) in 1998-99 during winter season in a Randomized block design with three replication. Twenty-five days old seedlings were transplanted at the distance of 20cm. The spraying of naphthalene acetic acid (NAA), gibberellic acid (GA) and chlormequat (CCC) was done in February and control plots were sprayed with distilled water. The observations on the vegetative growth and flowering characters were recorded to make a critical analysis of the performance of the plant as affected by different treatment (Table 1).

Results and discussion

In the present investigation, it was observed that NAA, GA and CCC brought about marked changes in the vegetative growth and flowering of French marigold. The data on plant height revealed maximum plant height with 400 ppm GA (36.36 cm) followed by GA 200 ppm (34.63cm) and GA 100 ppm (31.56cm). All GA treatments have shown their superiority in increasing plant height over other treatments than control (29.78). It is well known that application of GA stimulate cell division or cell elongation or both resulting to comparatively more height. The results are in conformity with the finding of Singh *et al.* (1991) in African marigold. Spraying of NAA did not influence plant height significantly over control. The minimum height of (25.40cm) was recorded in plants treated with CCC 600 ppm, which was significantly lower than control because of preventing cell division of the sub apical meristem (Weaver, 1981).

Though maximum diameter of stem (1.051 cm) was observed in plants treated with NAA 200 ppm yet none of the treatments could brought about any significant change in diameter of the plants (Table 1).

The maximum number of branches were recorded in plants treated with 600 ppm CCC (18.08). All CCC treatments produced significantly more number of branches as compared to other treatments including control (Table 1). The results are in conformity with findings of Novaselova *et al.* (1985) in *Tagetes patula*. GA treatments also increased the number of branches than control. The results are in conformity with Deotale *et al.* (1995) in Chrysanthemum. Significantly more number of branches was recorded with the application of NAA 200 ppm (15.16), NAA 100ppm (13.96) and NAA 50 ppm (12.50) similar to Mukhopadhyay (1990) in carnation.

The maximum numbers of leaves were produced with the application of 600 ppm CCC (148.76) which is significantly higher than control. In general, all concentrations of CCC, NAA and GA increased the number of leaves than control (110.31) but CCC had pronounced effect over other treatments. The results are in conformity with Khimani *et al.* (1994) in *Gaillardia* and Bhattacharjee (1984) in Gladiolus.

Table 1. Effect of NAA, GA and CCC on vegetative growth and flowering of French marigold

Treatments	Height of plant (cm)	Diameter of main stem(cm)	Number of branches /plant	No. of leaves /plant	First flowering (days)	Diameter of flowers (cm)	Fresh weight of flowers(g)	No. of flowers /plant	Flower yield/ plant(g)
NAA (50)	29.76	0.998	12.55	129.03	68.83	3.82	1.42	63.30	91.40
NAA (100)	29.73	1.010	13.96	134.37	69.16	3.87	1.43	65.60	101.26
NAA (200)	29.30	1.051	15.16	139.61	70.83	3.91	1.44	69.20	101.95
GA (100)	31.56	1.046	15.43	141.36	63.66	4.12	1.45	73.66	102.74
GA (200)	34.63	1.040	14.34	137.26	66.16	4.18	1.55	71.11	108.02
GA (400)	36.36	1.036	13.10	135.03	66.50	4.30	1.62	70.99	127.71
CCC (200)	28.41	1.000	15.55	143.80	68.10	4.43	1.49	74.62	106.58
CCC (400)	28.13	1.033	16.81	145.53	71.33	4.46	1.58	75.95	112.88
CCC (600)	25.40	1.045	18.08	148.76	72.00	4.54	1.59	78.83	117.55
Control	29.78	0.988	12.76	110.31	80.00	3.61	1.54	60.34	93.36
CD (p=0.05)	1.53	NS	0.61	1.28	6.37	0.17	0.09	1.30	6.00

Concentration of plant growth regulators is given in parenthesis

The number of days taken by plants for first flowering ranged between 63.66 and 80.00 days. It has been observed that control plants took more number of days for first flowering as compared to treated plants. The minimum number of days (63.66) for first flowering was taken by plants sprayed with 100 ppm GA followed by 200 ppm GA (66.16) and GA 400 ppm (66.50).The results are similar to Mittal (1967) in Dahalia.

The average diameters of flowers in all treated plants were significantly more than control (Table 1). The maximum diameter of flower was recorded in plants treated with 600 ppm CCC (4.54 cm). EL Shafie and Hassan (1978) in *Gerbera jamesoii* has reported similar results. The spraying of GA and NAA treatments also produced increased diameter of flowers than control (3.61cm) because, these growth regulators causes mobilization of assimilates in the plants resulting increased flower diameter (Nakata, 1955).

It is evident from the results that NAA and GA treatments could increase the average weight of flowers. However, 600 ppm CCC (1.587g) and 400 ppm GA (1.58g) sprayed plants were at par with the control (1.54g).These results are in contrast with the findings of Talukdar and Paswan (1996) in Chrysanthemum and Singh *et al.* (1991) in African marigold. It has also been noticed that plants treated with NAA and lower concentration of GA did not shows any effect on fresh weight of flowers as compared to control (1.55g).

Although, all the plants treated with growth regulators recorded increased number of flowers per plant and CCC show superiority over other treatments. The maximum number of flowers per plant were recorded with the application of 600 ppm CCC (78.33) followed by 400 ppm CCC (75.94) which is highly significant than control (60.34). Similar results were recorded by Novoselova *et al.* (1985) in *Tagetes patula*. GA applications were also significantly increased number of flowers/plants. This finding is in conformity with Shyamal *et al.* (1990) in marigold and aster. NAA concentrations have also proved the beneficial effects on number of flowers/plants. The increase in number of flowers per plant by these growth regulators might be the effect of translocation of assimilates which mobilized towards floral region as it has been reported in case of NAA application.

The maximum flower yield per plant was recorded in plants treated with 400 ppm GA (127.71 g) followed by 600 ppm CCC (117.55 g) and 400 ppm CCC (112.88g). All the treatments produced significant increase in flower yield than control (93.36g) except NAA 50 ppm.

Present study revealed that growth and flowering responses of NAA were not encouraging whereas CCC and GA application gave quite beneficial effect. GA (400 ppm) or CCC (600 ppm) may be used for increased flower yield/plant and number of flowers/plant, respectively.

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