ISSN-1923-7766 (Online)
Int. J. Expt. Agric. 2(1):17-20(January 2011)

EFFECT OF GA_3, CCC AND MH ON VEGETATIVE GROWTH, FLOWER YIELD AND QUALITY OF CHRYSANTHEMUM

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Accepted for publication on 15 December 2010

ABSTRACT

Sharifuzzaman SM, Ara KA, Rahman MH, Kabir K, Talukdar MB (2011) Effect of GA_3, CCC and MH on vegetative growth, flower yield and quality of chrysanthemum. *Int. J. Expt. Agric.* 2(1), 17-20.

The experiment was conducted to evaluate the three different concentrations of gibberellic acid (GA_3), cycocel (CCC) and maleic hydrazide (MH) on the vegetative growth, yield and quality of chrysanthemum. Four weeks old seedlings were transplanted in pot where aqueous solution containing 3 concentrations of GA_3 (50, 100, 150 ppm), CCC (400, 600, 800 ppm) and MH (250, 500, 750 ppm) were applied along with a carrier (control). GA_3 treated plants showed significant increase in plant spread, leave number and leave length. Irrespective of concentration, GA_3 also produced the higher number of sucker and flowers and CCC produced less. GA_3 also caused faster initiation of flowering and ACC and MH delayed it. Length of flower stalk significantly increased with GA_3. Use of CCC showed an increasing vase life of flowers. In this study, foliar application of 150 ppm GA_3 was the best for obtaining better growth of plants, maximum number of cut blooms with longer stalk as well as bigger flower size.

Key words: *GA_3, CCC, MH, vegetative growth, yield, quality, chrysanthemum*

INTRODUCTION

Chrysanthemum (Chrysos, golden; anthos, flower) is a popular flower crop of commercial importance. It belongs to the family Composite and has been commonly grown in gardens for more than 2500 years (Bose *et al.* 2003). It is grown commercially for cut-flowers for vases and for loose flowers for social and religious offerings, garland making and interior decorations at ceremonies. The agro-ecological conditions of Bangladesh are favorable for the culture and survival of chrysanthemum. For this, the flower growers of Bangladesh are very much interested in cultivating chrysanthemum instead of the traditional flower crops that usually do not give much return to them. As a result, recently chrysanthemum is becoming attractive to the growers as well as users, as it has great potential for local and export market.

The plant growth regulators generally modify the physiological processes of plants and ultimately affect the yield and quality of blooms. Several plant growth regulators have been widely used in many ornamental crops and their efficacy have been demonstrated for nursery production, ornamental foliage plant and/or several other flower crops (Sanap *et al.* 2000). The uses of gibberellic acid, cycocel and maleic hydrazide have been reported to be remarkably successful in quality bloom production with several flower and ornamental crops. Keeping all the above facts in view, this investigation was carried out to evaluate the effects of GA_3, CCC, MH, on the growth, yield and quality of chrysanthemum.

MATERIALS AND METHODS

The experiment was conducted at the Farm of the Landscape, Ornamental and Floriculture Division of Horticulture Research Centre, BARI at Joydebpur, Gazipur during the period from July 2010 to December 2010. Four weeks seedlings of CM-019 were transplanted in pot for the study. The pots were filled with a mixture of media that consists of one part coarse sand, one part garden soil, one part cocodust, one part cowdung, a quarter part of wood ashes and two table spoonfuls of bone meal. Subsequently 10 g TSP and 8 g MP per pot were applied. Urea @ 2, 3 and 3 g per pot was applied at 20, 30 and 40 days after transplanting respectively. The pots were kept under 100% sunlight condition. The experiment was carried out in completely randomized design (CRD) with 3 replications. The plants were sprayed with aqueous solution of gibberellic acid @ 50, 100, 150 ppm; cycocel @ 400, 600, 800 ppm and maleic hydrazide @ 250, 500, 750 ppm. Thus, three growth regulators and three concentrations each of the regulators along with control formed the 10 treatments variables. The growth regulators were sprayed on plant in the morning started after one month of transplanting at fortnightly interval. All the cultural operations were done as per the need of the crop. Ridomil 2g/L and Malathion 2ml/L of water was sprayed once fortnight to the plants as protective measures against diseases and insect attack. The data were recorded on plant spread, number of leaves, number of suckers produced per plant, days to flower initiation, number of flowers per plant, flower size, length of flower stalk and vase life of flowers. The recorded data were statistically analyzed and treatment means were separated by Duncan’s Multiple Range Test (DMRT) according to Steel and Torrie (1960).

RESULTS AND DISCUSSION

The Table 1 showed that the different plant characteristics exhibited differences among the ten treatments under study. In general, GA_3 treated plants showed significant improvement in plant spread compared to other treatment variables (Table 1). The maximum spreading of plant (24.0 cm) was observed when plants were treated with GA_3 @ 150 ppm which was closely followed by the application of GA_3 @ 100 ppm. The minimum plant spread (11.8 cm) was recorded in plants treated with CCC @ 800 ppm. Foliar application of GA_3 might have influence on cell division and cell elongation that resulting in enhanced vegetative growth of plants. In contrast, CCC may act as growth retardants and thereby inhibited biochemical processes resulting in less spreading of plants. The findings are in agreement with those of Mittal (1967) in dahlia and Verma *et al*. (1995) in chrysanthemum. The variation in number of leaf production was pronounced by the application of different growth regulators. However, the highest number of leaves (60) was produced by the application of GA_3 @ 150 ppm as foliar spray (Table 1). This was closely followed by the other concentration of GA_3 @ 100 ppm. The effects of the GA_3 treatments were observed at par but significantly superior to the rest of the treatments. All the concentrations of CCC were at par recording minimum number of leaves. This is similar with the findings of Talukdar and Paswan (1988), who observed more number of leaves by the application of GA_3 and less number of leaves by foliar application of CCC. The leaf length was also significantly increased with the application of GA_3 at different concentrations, of which GA_3 @ 150 gave the longest leaf length (8.35 cm). Leaf length highly reduced even in respect of control with the use of CCC growth regulators irrespective of concentrations. These findings confirmed that GA_3 acted as growth promoter and that of CCC as growth retardants on different plant characters of chrysanthemum.

Table 1. Effect of GA_3, CCC and MH on plant characteristics in chrysanthemum

Treatment (ppm)	Plant spread (cm)	Number of leaves	Leaf length (cm)
GA_3-50	17.9 b	43 bc	6.00b
GA_3-100	20.0 ab	50 b	7.00ab
GA_3-150	24.0 a	60 a	8.35a
CCC-400	17.5 b	39 c	4.90cd
CCC-600	13.5 c	23 e	3.63d
CCC-800	11.8 cd	22 e	3.47d
MH-250	14.0 c	25 de	5.89bc
MH-500	15.8 bc	38 c	5.74bc
MH-750	16.0 bc	40 c	5.80bc
Control	12.0 cd	33 d	4.20c
CV (%)	15.25	16.00	14.92

T_1-50 ppm GA_3, T_2-100 ppm GA_3,T_3-150 ppm GA_3, T_4-400 ppm CCC, T_5-600 ppm CCC, T_6-800 ppm CCC, T_7-250 ppm MH, T_8-500 ppm MH, T_9-750 ppm MH and T_{10}-Control

The higher number of suckers (20) per plant was produced when pots were treated with GA_3 @ 150 ppm followed by GA_3 @ 100 ppm (18), whereas, application of CCC at three different concentrations produced lower number of suckers (Fig. 1). Use of CCC @ 600 and 800 ppm produced the lowest number of suckers, which was much less than control treatment. This is in agreement with the findings of Reddy *et al*. (1997). The higher number of sucker production by using GA_3 might be due to increase the number and size of leaves as a results of higher translocation of the photosynthates and eventually that would have been used for the production of propagules (suckers).

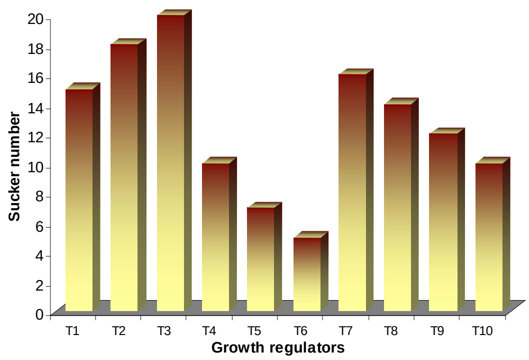

Fig 1. Effect of growth regulators on the production of sukers in chrysanthemum

T_1-50 ppm GA_3, T_2-100 ppm GA_3,T_3-150 ppm GA_3, T_4-400 ppm CCC, T_5-600 ppm CCC, T_6-800 ppm CCC, T_7-250 ppm MH, T_8-500 ppm MH, T_9-750 ppm MH, T_{10}-Control

In general, GA_3 at different concentrations produced the higher number of flowers (Fig. 2). The highest number of flower (40) was recorded with 150 ppm GA_3, which was significantly superior to those observed by spraying 100 ppm GA_3 and 50 ppm GA_3.

Application of 800 ppm CCC produced minimum number of flowers (25) per plant, which was at par with 600 ppm CCC (27) and 400 ppm CCC (31). This was in line with the findings of Shanmuganm and Muthuswamy (1974) in chrysanthemum. The increase in number of flowers for GA_3 treated plants might be due to increase in number of leaves and leaf area compared to control and other treatments. This might have resulted in the production and accumulation of more photosynthates that were diverted to the sink (flower) and give increased number of flowers.

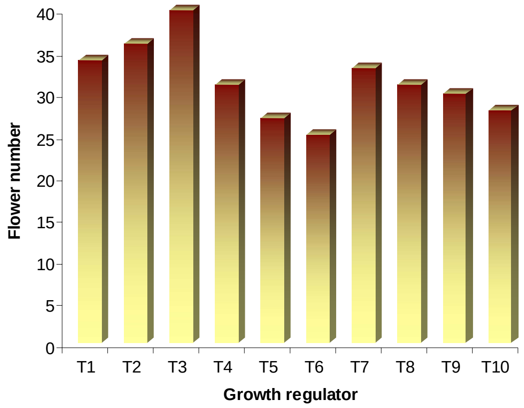

Fig. 2. Effect of GA_3, CCC and MH on flower production of chrysanthemum

T_1-50 ppm GA_3, T_2-100 ppm GA_3,T_3-150 ppm GA_3, T_4-400 ppm CCC, T_5-600 ppm CCC, T_6- 800 ppm CCC, T_7-250 ppm MH, T_8-500 ppm MH, T_9-750 ppm MH and T_{10}-Control.

Irrespective of concentrations, GA_3 significantly reduced the number of days to initiation of flowering (Table 2). The plants sprayed with 50 ppm GA_3 took 48 days to flower initiation, where as, it took 70 days with 750 ppm MH. Among the growth regulators GA_3 caused faster initiation of flowering and ACC and MH delayed it in respect of control. Flower size was not significantly affected by the application of growth regulators at different concentrations (Table 2). However, it was recorded highest (5.40 cm) when plants were sprayed with 150 ppm GA_3 whereas; lowest size (4.50 cm) was obtained with the application of 500 ppm MH. This was in line with the findings of Talukdar and Paswan (1988) in chrysanthemum. Here, food reserves may have been diverted to only a fewer sinks that enhanced to produce bigger flowers. Length of flower stalk significantly increased when plant was treated with GA_3 regardless of different concentrations (Table 2). The application of 150 ppm GA_3 produced maximum length of flower stalk (14.0 cm), which was identical with those produced by 100 and 50 ppm GA_3.

This was in line with the findings of Biswas *et al.* (1983) and Misra *et al.* (1993). This might be due to the fact that giberellic acid promotes cell division and cell elongation resulting in longer stalks. The growth regulators CCC and MH at different concentrations gave the shorter stalk compared to control.

Table 2. Effect of GA_3, CCC and MH on floral characteristics in chrysanthemum

Treatment (ppm)	Days to flowering	Flower size (cm)	Stalk length (cm)
GA_3-50	48e	5.20	13.40a
GA_3-100	53d	5.30	13.70a
GA_3-150	55cd	5.40	14.00a
CCC-400	58c	5.00	6.00d
CCC-600	60bc	5.10	7.00cd
CCC-800	62b	5.15	7.00cd
MH-250	65ab	4.80	8.00bcd
MH-500	68a	4.50	7.00cd
MH-750	70a	4.60	9.00bc
Control	57c	4.90	11.00b
CV (%)	13.64	07.50	12.41

T_1-50 ppm GA_3, T_2-100 ppm GA_3,T_3-150 ppm GA_3, T_4-400 ppm CCC, T_5-600 ppm CCC, T_6-800 ppm CCC, T_7-250 ppm MH, T_8-500 ppm MH, T_9-750 ppm MH and T_{10}-Control

Use of growth regulators showed an increasing vase life of flowers in respect of control (Fig. 3). The maximum vase life of flowers was recorded for the treatment 800 ppm CCC (15 days), which was at par with 13 days vase life obtained by spraying 600 ppm CCC. This is in line with the findings of Talukdar and Paswan (1988) in chrysanthemum. This might be due to the fact that CCC acted as growth retardants that may reduce the cell size and stomatal opening and thereby reduce the area for transpiration for which it maintained better water balance.

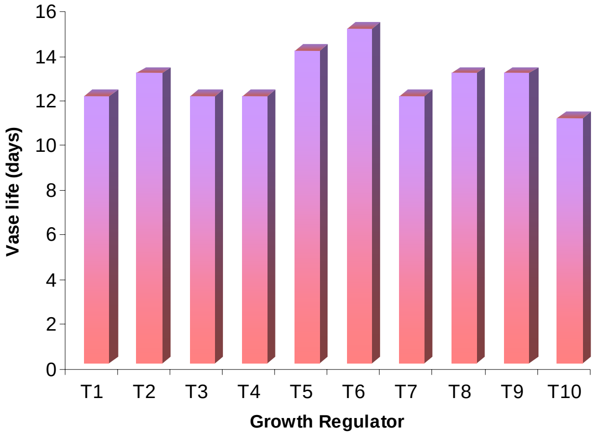

Fig 3. Effect of GA_3, CCC and MH on vase life of chrysanthemum

T_1-50 ppm GA_3, T_2-100 ppm GA_3,T_3-150 ppm GA_3, T_4-400 ppm CCC, T_5-600 ppm CCC, T_6-800 ppm CCC, T_7-250 ppm MH, T_8-500 ppm MH, T_9-750 ppm MH and T_{10}-Control

CONCLUSION

The present investigation was carried out to ascertain the effect of GA_3, CCC and MH on growth, yield and quality flower production of chrysanthemum. The experimental findings revealed that GA_3 @ 150 ppm performed better than other concentrations, where as, CCC at all concentrations had some adverse effect on the plant growth and flower yield performances. But in case of vase life elongation, CCC performed best than other growth regulator treatment. Therefore, it was concluded that GA_3 acted as growth promoter and that of CCC as growth retardants on growth, yield and quality of chrysanthemum.

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