EFFECT OF GIBBERELLIC ACID ON GROWTH, FLOWERING AND CONSTITUENTS OF CHRYSANTHEMUM FRUTESCENS

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Abstract

In the present study, the effect of gibberellic acid (GA_3) on vegetative growth and flowering of C. f r u t e s c e n s L. is investigated. The plants were sprayed with GA_3 at either 250, 500 or 1000ppm, three times throughout the early stages of growth. The treatment with GA_3 increased the height and diameter of plant, the number of shoots per plant and the length of shoots. GA_3 accelerated flowering and decreased the number of inflorescence per plant. The fresh and dry weight of foliage and roots increased in response to GA_3 but the fresh weight of inflorescence decreased. The chlorophyll and carotenoides increased by GA_3 application.

1. Introduction

C h r y s a n t h e m u m f r u t e s c e n s L., commonly known as Marguerite or Paris Daisy, is a perennial flowering plant mostly used in various landscape purposes, for cut flower production and as a potted plant. Gibberellic acid influences plant growth in many ways; it promotes stem elongation and consequently enhances growth, modifies the light requirements of many plants, influences flower and bud initiation and flower characters. Previous reports have indicated that gibberellic acid has a remarkable effect on C h r y s a n t h e m u m m o r i f o l i u m (Poole and Ying, 1965; Kher et al., 1972; Shanmugam and Muthuswamy, 1974; Zimmer and Bahneman, 1980). The species under study received little attention although it grows well under egyptian climate. Therefore, the present study was initiated to investigate the response of C h r y s a n t h e m u m f r u t e s c e n s to gibberellic acid in order to improve its cultivation for cut flowers production.

2. Material and Methods

The experiments were carried out at the nursery of floriculture, faculty of agriculture, Cairo University, throughout the period from 1982 to 1984. Tip cuttings of chrysanthemum were taken at an average length of 10 - 15 cm planted in a mixture of peat moss and sand 1:1 by volume, and kept under mist until rooting. Rooted cuttings were transplanted in 25-cm pots filled with the same soil mixture. The plants were kept to grow in nursery under natural environmental conditions. All plants were supplied with 2g per plant superphosphate mixed to the soil before planting, and with 7g per plant ammonium nitrate applied monthly. The treatments with gibberellic acid started after one month from transplanting at fortnight intervals, the total number of applications was three. Gibberellic acid was used in a liquid form sprayed to the foliage of plants, three concentrations

were used : 250, 500 and 1000 ppm. The lay-out of experiments was complete randomized block, each treatment included 18 plants and was replicated three times. Data were statistically analysed by "F" test and "Duncan Multiple Range Test" at 5% level. Data were recorded on the following characters: plant height, plant diameter, number of shoots per plant, length of shoots, fresh and dry weight of foliage and roots, number of days from planting to flower opening, number of inflorescence per plant, fresh and dry weight of inflorescence. Chlorophyll and carotenoides were determined (mg/g) according to saric et al., (1967).

3. Results

3.1 The effect of GA_3 on vegetative growth

3.1.1 Plant height

The application of GA_3 increased the plant height in both seasons of the experiment (Table 1). Moreover, the increase in plant height was positively correlated to the increasing rate of gibberellic acid.

3.1.2 Plant diameter

The plant diameter increased in response to GA_3 at all rates in the first season, whereas the results of the second season indicated that the effectiveness of GA_3 depended on its concentration (Table 1). A reduction in plant diameter was observed during the second season compared to the first one.

3.1.3 Number of shoots per plant

The treatment with gibberellic acid at the three rates increased the number of shoots per plant in the two seasons (Table 1). The number of shoots was relatively higher in the second season compared to the first one.

3.1.4 Length of shoots

The results of both the first and second seasons (Table 1) showed that GA_3 increased the length of shoots and that the increase was greater by increasing GA_3 concentration.

3.1.5 Fresh weight of faliage and roots

The average fresh weight of foliage and roots increased in response to GA_3 (Table 2), the highest rate was more effective than the lower rates.

3.1.6 Dry weight of foliage and roots

The application of GA_3 increased the dry weight (Table 2), the maximum weight was recorded for plant treated with GA_3 at 1000 ppm.

3.2 The effect of GA_3 on flowering

3.2.1 Number of days from planting to flower opening

The application of GA_3 shortened the time to flowering (Table 3). In the first season flowering was advanced by 8 to 14 days, and in the second season it was advanced by 30 to 33 days.

3.2.2 Number of inflorescence

The number of inflorescence per plant was slightly affected in the first season, but decreased in response to GA_3 treatment in the second one.

3.2.3 Fresh weight of inflorescence

The treatment with GA_3 at various rates decreased the fresh weight of inflorescence (Table 3).

3.2.4 Dry weight of inflorescence

The dry weight of inflorescence was not affected by most of the treatments applied (Table 3).

3.3 The effect of GA_3 on plant constituents

3.3.1 Chlorophyll content

Chlorophyll A, B and total chlorophyll increased by GA_3 application at the three concentrations.

3.3.2 Carotenoides content

The treatment with GA_3 increased the carotenoides, the three concentrations were equally effective.

4. Discussion

The growth and flowering of C. f r u t e s c e n s is influenced by gibberellic acid. Treated plants were taller than untreated ones which probably resulted from a promoting effect of gibberellin on cell enlargement or cell division. Moreover, treated plants produced a greater number of shoots which might be attributed to the role of gibberellin in reducing the apical dominance. An acceleration of flowering occured by GA_3 application, which might be explained by the role of gibberellin in regulating the activity of sub-apical meristem and the induction of flowering in many plants. However, the analysis of gibberellins during flower induction stage has shown that the transition to this stage is accompanied by an increase in one or more of the gibberellins (Lang, 1960). The number of inflorescence of C. f r u t e s c e n s decreased in response to GA_3. It seems that the effect of gibberellic acid on the number of flowers varies according to plant species. GA_3 reduced the number of

inflorescence of C. m o r i f o l i u m (Poole and Ying, 1965). On the other hand, GA_3 increased the number of flowers of gerbera (Baz, 1970); carnation (Ali, 1976); and dahlia (Bhattacharjee et al., 1976).

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Table 1 - Effect of gibberellic acid on vegetative growth.
Mean separation within each column by Duncan Multiple Range Test at 5% level.

Treatment	Plant height cm		Plant diameter cm		No. of shoots/plant cm		Shoot length cm	
	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
Control	35.7b	34.0c	35.0b	26.8b	4.0c	11.1c	23.1c	20.1b
GA_3 250 ppm	84.8a	56.1b	66.1b	27.6b	7.7b	12.5b	59.0b	45.0a
GA_3 500 ppm	88.7a	62.7ab	65.7a	26.5b	8.8ab	16.4	63.7ab	48.5a
GA_3 1000ppm	91.2a	72.1a	69.4a	28.2a	9.3a	13.7a	69.5a	50.0a

Table 2 - Effect of gibberellic acid on total fresh and dry weight of foliage and root.

Treatment	Total fresh weight of foliage and root (g)		Total dry weight of foliage and root (g)	
	1st season	2nd season	1st season	2nd season
Control	209.0d	273.0c	78.0c	102.5b
GA_3 250 ppm	488.0b	307.0a	149.0b	132.2a
GA_3 500 ppm	621.0c	322.3a	94.0c	136.0a
GA_3 1000 ppm	813.0a	315.5a	236.0a	126.6a

Table 3 - Effect of gibberellic acid on flowering.

Treatment	No. of days from planting to flower opening		No. of inflorescence plant		Fresh Weight of inflorescence (mg)		Dry weight of inflorescence (mg)	
	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
Control	103.0	128.0	134.9ab	190.0a	504.5a	540.3a	211.3bc	118.8a
GA_3 250ppm	89.0	98.0	142.9a	163.3b	477.8b	495.8b	244.3b	118.5a
GA_3 500 ppm	95.0	95.0	144.1a	133.4c	476.8b	511.8ab	212.3b	127.0a
GA_3 1000ppm	90.0	98.0	124.0b	134.1c	427.6c	513.6ab	201.5c	120.6a