


 research  
bulletin

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## RESPONSE OF DWARF CARNATION 'SNOWMASS' TO GROWTH RETARDANT APPLICATION

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Spray applications of 2.5, 5, 7.5, 10, 15 and 20 ppm a.i. of Sumagic™, 3 and 10 ppm a.i. of Bonzi™ or 2500 and 3500 ppm a.i. of Cycocel™ significantly inhibited the height of Colorado Majestic Mountain™ dwarf carnation 'Snowmass' when applied 10, 21, 35 or 63 days following the pinch. The best treatment for achieving a dwarf carnation height ranging from 6 to 7 inches was 15 ppm a.i. of Sumagic applied when lateral shoots were 2 to 4 inches long. Applications of 3 or 10 ppm a.i. Bonzi and 2500 or 3500 ppm a.i. of Cycocel significantly retarded plant height but not to the desired degree.

### Introduction

The naturally dwarf *Dianthus caryophyllus*, Colorado Majestic Mountain™ (CMM) carnations were introduced by Colorado State University as a flowering pot plant in 1987 (5). Even though the CMM carnation are genetically dwarf, experiments have been conducted to determine if growth retardants will "tone" plants providing shorter, more compact products, that meet the requirements of a mini pot plant with a height range of 6 to 7 inches (4). A preliminary study using CMM 'Lindsey', determined that Sumagic (uniconazole), effectively controlled plant height when applied at specific concentration and stages of plant growth (15). Sumagic has been shown to be an effective growth retardant for inhibiting the height of many bedding (3,10,14) and pot plant species including *Euphorbia pulcherrima* (1), *Dendrothema morifolium* (2,18) and *Eustoma grandiflorum* (17). Bonzi (paclobutrazol), another plant growth regulator has been reported to retard stem elongation of several plant species (3,6,12). From 1978 to 1980 Japanese researchers (11,19) obtained satisfactory dwarfing responses, when Cycocel (chlormequat chloride) was applied to the dwarf carnation 'Picadilly'. Messinger and Holcomb (13) reported that the growth of potted dianthus cultivars 'Snowfire', 'Indian Carpet', and 'Persian Carpet' was

successfully retarded by using plant retarding chemicals A-Rest, BAS 106, SD 8339 and Cycocel.

The objective of this experiment was to determine the optimum dose of Sumagic needed to obtain a CMM 'Snowmass' carnation 6 to 7 inches in the height and, secondarily, to observe plant responses to Cycocel and Bonzi during winter growing conditions.

### Materials and Methods

Rooted cuttings were planted in 4" azalea pots containing 1 soil, 3 sphagnum peat, 2 No. 6 perlite (v:v:v) medium, spaced on a 3.5 ft x 22 ft bench at a density of 4 plants ft<sup>-2</sup> on January, 1988, and grown in temperature conditions previously described (15). They were watered with a continuous feed program (8). Two weeks after planting, the upper six nodes were removed (pinched) leaving three to four leaf pair on the remaining plant. Following the pinch, plants were divided into 43 groups of six plants each for a single application of growth retardants. Each group of plants was sprayed with 2.5, 5, 7.5, 15 or 20 ppm a.i. Sumagic (Valent USA, Walnut Creek, CA), 3 and 10 ppm a.i. Bonzi (Sandoz Crop Protection Corp., Des Plaines, IL) or 2500 and 3500 ppm a.i. Cycocel (American Cyanamid Co., Wayne, NJ) 10, 21, 35 or 63 days following the pinch (Fig. 1). The treatment groups were arranged on a single bench in order of concentration and application date with control groups placed at each end and in the middle of the

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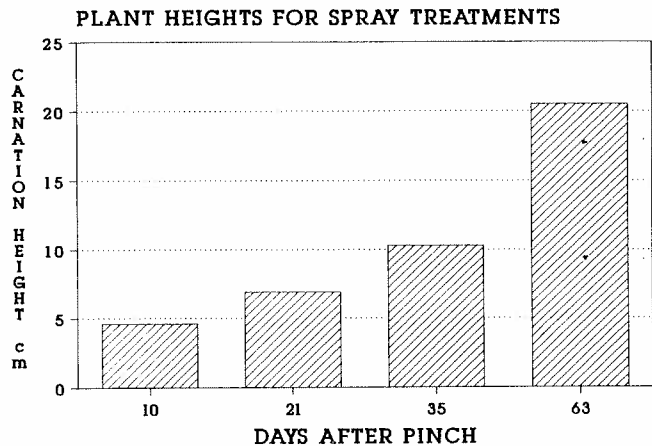
bench. The carnation plants were sprayed until thoroughly covered with growth retardant solution. Control plants were sprayed with a tap water. Lateral shoot lengths of individual plants were recorded on each treatment date. Final plant height, flower diameter and time to flowering were determined 90 days following the pinch, when at least one flower was fully open and two buds were showing color.

Data for each chemical were analyzed separately as a two factor (concentration-by-date) randomized design, although the arrangement of pots on the bench was systematic for ease of treatment application. Statistical computations were

performed using the subprogram MANOVA in the statistics package SPSS<sup>x</sup> (16). Treatment groups were individually compared to the control using the Least Significant Difference (LSD) method. When the concentration by period interaction was significant, concentrations were also compared within each application period using LSD.

**Results**

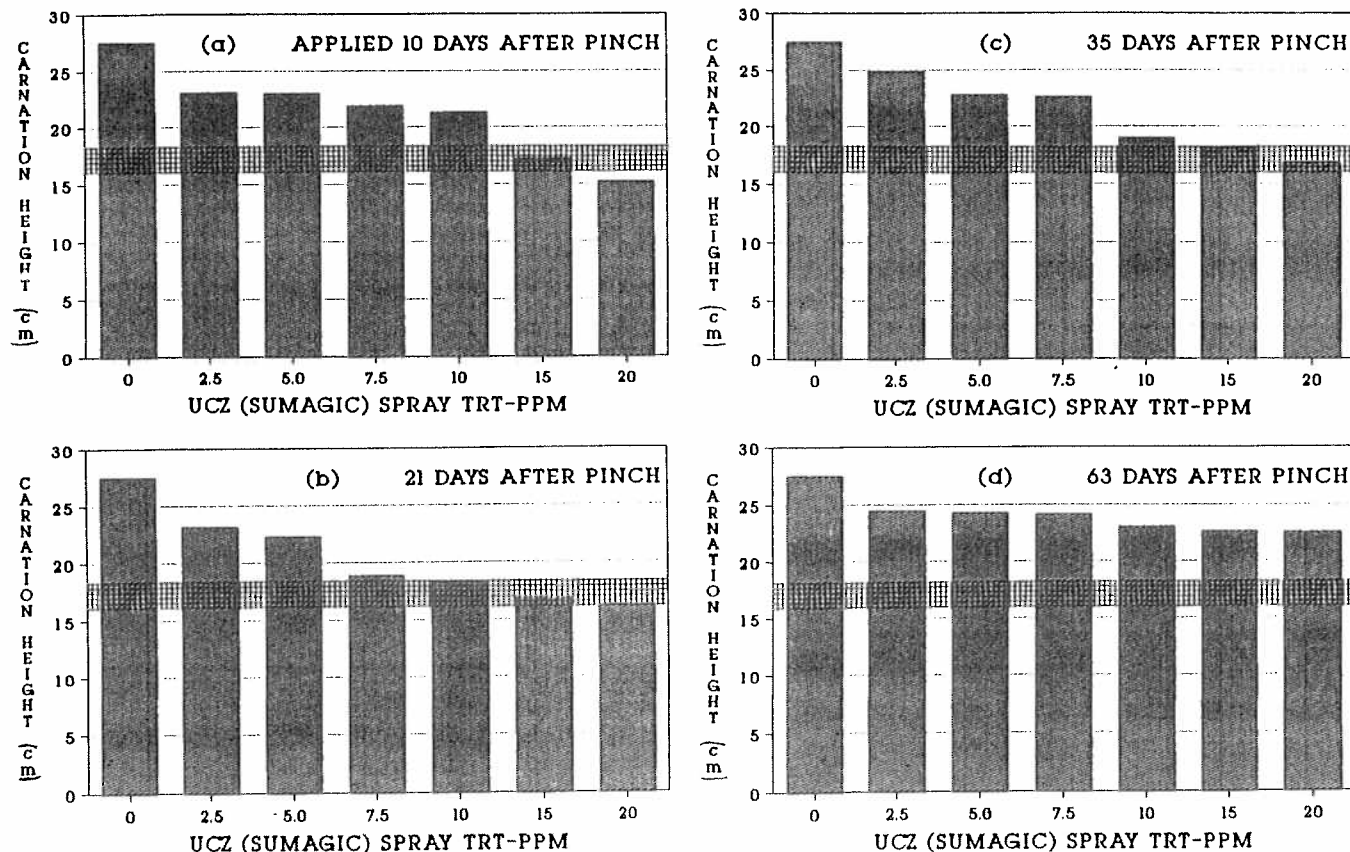
Spray application of 2.5, 5, 7.5, 10, 15 and 20 ppm a.i. Sumagic significantly inhibited stem elongation of dwarf carnation when applied from 10 to 63 days following the pinch.



**Figure 1:** Plant height of dwarf carnation 'Snowmass' at time of growth retardant application.



**Figure 2:** Response of dwarf carnation 'Snowmass' to spray applications of 2.5, 5, 7.5, 10, 15 and 20 ppm a.i. Sumagic 3 weeks after pinching the plants.



**Figure 3:** Flowering height of dwarf carnation 'Snowmass' treated with six different Sumagic concentrations on (a) 10, (b) 21, (c) 35, (d) 63 days following the pinch. [Shaded Band] DESIGNED PLANT HEIGHT

Sumagic treatments of 2.5, 5, 7.5 and 10 ppm a.i. applied 10 days after the pinch did not restrict plant height enough. However, plants treated with 15 and 20 ppm a.i. Sumagic obtained the planned height of 6 to 7 inches (Fig. 3a). Plants treated with 20 ppm a.i. of Sumagic were significantly shorter than those treated with 15 ppm a.i.

Plants sprayed with 2.5, 5 and 7.5 ppm a.i. Sumagic solution during the second application period, were taller than 7 inches, but those treated with the other concentration were in the planned height range of 6 to 7 inches (Fig. 3b). There were no significant height differences in the plants treated with 10 and 15 ppm a.i. Sumagic solution. Plants sprayed with 20 ppm a.i. Sumagic solution were one inch shorter than the 10 ppm a.i. treated plants.

Only plants treated with 15 and 20 ppm a.i. Sumagic solution in the third treatment period, 35 days following the pinch, developed a desirable plant height (Fig. 3c). Plants treated with 20 ppm a.i. Sumagic solution were 6 to 7 inches tall but did not differ in the height from the 15 ppm treated plants. All plants treated with Sumagic solution 63 days following the pinch were taller than planned (Fig. 3d). Single application of 3 or 10 ppm a.i. Bonzi significantly inhibited the height of 'Snowmass' compared to the control plants during four application dates (Fig. 4). Plants treated with 10 ppm a.i. Bonzi solution during the first three application periods were significantly shorter than plants treated with 3 ppm a.i. The final average height of treated plants

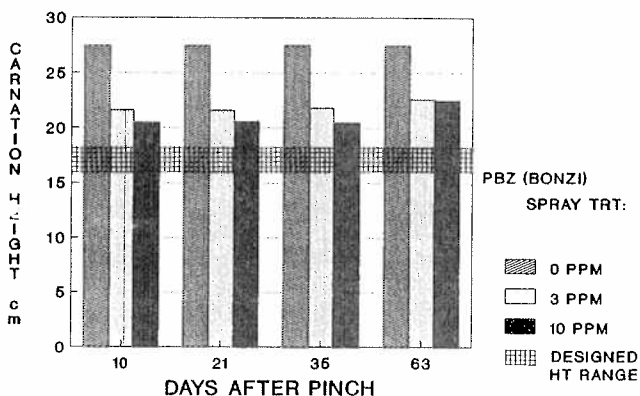


Figure 4: Final height of dwarf carnation 'Snowmass' sprayed with 3 or 10 ppm Bonzi 10, 21, 35 and 63 days following the pinch.



Figure 5: Final height of dwarf carnation treated with 3 and 10 ppm a.i. Bonzi 21 days following the pinch.

ranged from 8 to 9 inches compared to 11 inches for the control plants, all undesirable heights, (Fig. 5).

Dwarf carnations treated with 2500 and 3500 ppm a.i. Cycocel during the four application periods were shorter than the untreated plants (Fig. 6). The most effective concentration of Cycocel for developing a 6 to 7-inch pot carnation was 3500 ppm a.i. applied 35 days after the pinch. Cycocel treated plants responded differently than those treated with Sumagic or Bonzi. Cycocel effectively inhibited the height of the first flush of 'Snowmass' flowering stems, but the developing reproductive shoots bypassed them a few weeks later (Fig. 7).

No phytotoxic damage was observed on the Sumagic and Bonzi treated dwarf carnations. The youngest leaves of Cycocel treated plants developed light yellow leaf margins following application, which was not evident when flowers opened. Flower diameter and number of nodes on all treated plants did not differ from the control plants. The foliage of the treated plants was visually darker than the untreated.

### Conclusion

To achieve a height ranging from 6 to 7 inches on the mini

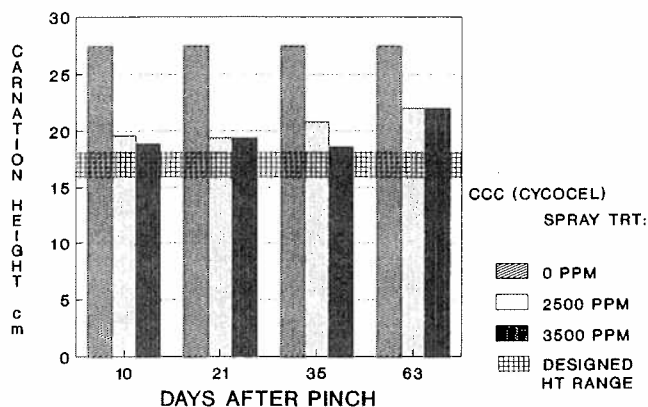


Figure 6: Final height of dwarf carnation 'Snowmass' treated with 2500 and 3500 ppm a.i. Cycocel 10, 21, 35 and 63 days following the pinch.

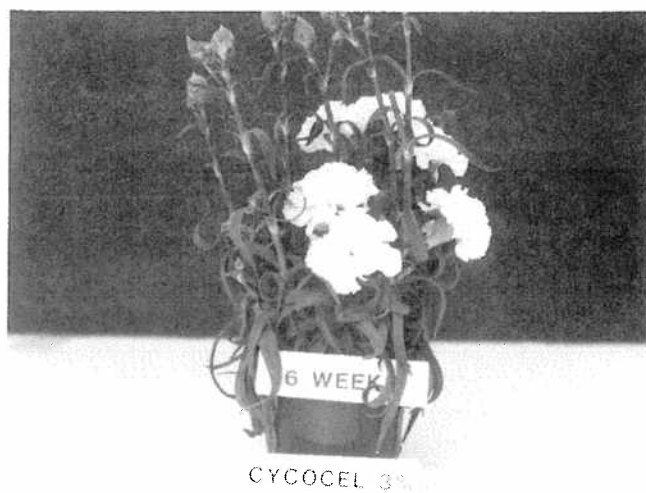


Figure 7: Example of bypassing flowering stems by developing reproductive shoots on plants sprayed with 3500 ppm a.i. Cycocel 63 days following the pinch.

pot carnation 'Snowmass' during winter growing conditions, plants should be sprayed with 15 ppm a.i. Sumagic solution within 10 to 35 days following the pinch, or when the plants have lateral shoots 2 to 4 inches in length.

Cycocel at 3500 ppm a.i. appeared to sufficiently retard carnation growth, but application should be repeated to inhibit elongation of developing secondary shoots. To achieve desirable retardation in the height of 'Snowmass', Bonzi concentration greater than 10 ppm a.i. must be used. Further studies are being conducted to determine the optimum amount of Bonzi and frequency of Cycocel application for desirable dwarf carnations.

### Acknowledgements

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