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EFFECT OF PLANTING DATE AND GROWTH REGULATORS ON POINSETTIA HEIGHT[1,2]

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Abstract. **Poinsettia (Euphorbia pulcherrima Willd.) cultivars 'Gutbier's V-14 Glory' and 'Annette Hegg Diva' were planted on 3 dates in the summer of 1981 and 1982 and grown with capillary mat irrigation in a polypropylene shade house. Single or multiple applications of chlormequat, ancymidol, and paclobutrazol were used to attain a plant height of 12 ± 1 inches. No treatment was effective when the plants were pruned to 5 nodes prior to August 15. If plants were pruned prior to September 3, only ancymidol at 1.3 and 2.6 X 10^{-5} oz/pot and paclobutrazol at 1.3 X 10^{-5} oz were effective. Plants pruned by September 15 could be maintained at the ideal height with multiple applications of chlormequat or single applications of ancymidol and paclobutrazol.**

Production of potted poinsettias has increased significantly in Florida during the past decade, with estimates of 2.5 million units grown in 1983. Since the development of the self-branching 'Annette Hegg' and 'Mikkelsen' cultivars in the 1960's (6) and the introduction of 'Gutbier's V-14 Glory' in the late 1970's (14), many growers plant a single cutting in a 5 to 6.5-inch pot, selectively prune to 5-6 nodes, and apply a growth regulator to maintain a plant:pot height ratio of 2:1. Plants grown in shade houses in central and south Florida and pruned around September 15 generally require only 1 or 2 applications of a growth regulator to attain the proper plant:pot ratio (12, 14). Chlormequat (Cycocel), applied as a foliar spray or soil drench, is used most frequently to retard poinsettia plant growth (3, 4, 5, 7, 8, 10). Ancymidol (A-Rest) is useful as a soil drench but is phytotoxic as a foliar spray (3, 8, 11, 13, 16). Paclobutrazol (Bonzi) is one of a new class of chemicals to be evaluated on poinsettias and has shown greater activity as a soil application than a foliar spray. This chemical is very active at low concentrations and requires only one treatment (2, 9, 15).

With the increased number of plants grown on individual farms in Florida, it has become unfeasible to pot all the plants the last of August and prune them on September 15. To circumvent this problem, some plants are potted beginning in early August and pruned as early as August 15, which is at least 6 weeks prior to the minimum nycto-period for floral bud initiation (1). These additional 4 weeks of vegetative photoperiods necessitate the use of multiple applications of growth regulators, which often are phytotoxic to the foliage and detrimental to bract development (8, 10). Limited use of growth regulators on these early-pruned plants contributes to the production of tall plants with weak stems, small bracts, and reduced marketability. Some growers who practice this early production have switched from the Annette Hegg cultivars to 'Gutbier's V-10 Amy,' which has short internodes and early bract development. Generally, a single application of a growth retardant is sufficient to maintain the ideal plant:pot ratio with 'Amy'. Unfortunately, 'Amy' has several undesirable characteristics, such as poor leaf and bract color, weak stems, small bracts, and poor leaf retention under low-light conditions (11). A cultivar with the short internodes of 'Amy' but with stronger stems and better leaf retention and color is needed. Until that genotype is developed, the proper use of growth retardants will be essential to the production of short, compact poinsettia plants in Florida. The purpose of this study was to evaluate several growth regulators applied to poinsettia plants propagated at different times in central Florida and to determine if compact plants could be produced from early planting and pruning dates.

Materials and Methods

General. Single poinsettia cuttings of cultivars 'Annette Hegg Diva' and 'Gutbier's V-14 Glory,' which were established in Oasis blocks, were planted in 6-inch diameter plastic pots (RT600). Medium consisted of a mixture of Florida Peace River peat, coarse white builders' sand, coarse vermiculite, and perlite (5:3:3:1 by volume). Amendments, per cubic yard of medium, were 13.2 lb. Osmocote 18-2.6-10 (N, P, K), 2.1 lb. 6-2.6-5 dry fertilizer (30% organic), 16 lb. dolomite, 6 lb. hydrated lime, 6.0 lb. superphosphate, and 2.0 lb. Micromax (a minor element mixture). Initial pH was 6.2. Each pot was drenched once with 6 fl. oz of a etridiazole 35W-benomyl 50W mixture (0.5 lb. + 0.5 lb./100 gal) combined with 2.0 lb./100 gal of a soluble 20-8.7-16.6 fertilizer. Plants were grown with natural photoperiods on capillary mat beds in a shade house covered with black polypropylene (25% shade). Water was distributed on the Vattex capillary mat with 2 Chapin twin-wall tubes (4-inch hole spacing) spaced 12 inches apart down the length of the bed. The mat and tubes were covered with 1.25 mil white-on-black polyethylene mulch with the white side up. Plants were set 3 across on the 3.3-ft wide beds, with the center row staggered from the outer two. Pots were spaced on 16-inch centers and the polyethylene under each pot was cut and discarded. The capillary mat was irrigated every 4 hr in an amount to thoroughly wet the mat with minimum runoff. Supplemental nutrition was provided with 3 weekly applications of a soluble 20-8.7-16.6 fertilizer (2 lb./100 gal) starting the second week in November. Soil drenches and foliar sprays of the growth regulators were applied in 5.1 fl. oz and 0.7 fl. oz doses per pot, respectively. Included in the foliar spray solutions was 0.05% Tween-20 surfactant. Disease and insects were controlled by weekly sprays. Plants were arranged in a split-plot design with planting date the main plots and growth regulators the subplots. An experimental unit consisted of 3 plants and was replicated 3 times. Plant height above the pot rim, plant diameter, number of laterals which had colored bracts, diameter of terminal inflorescence, and number of colored bracts per inflorescence were recorded, but only plant heights will be reported in this paper.

1981. Three planting dates were utilized. The first set of rooted cuttings was planted on July 31, pruned (5 nodes) on August 14, and treated with growth regulators (where applicable) on September 11, 25, and October 1. The second group of cuttings was planted on August 14, pruned on August 28, and treated with growth regulators on September 25, October 7, and 23. The third set was planted on August 28, pruned on September 11, and treated with growth regu-

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[2]Appreciation is expressed to ICI-Americas for partial support of this research. Trade names are included for the benefit of the reader and do not infer any endorsement or recommendation by the author.

lators on October 7, 23, and November 4. Chemical treatments, with application method, number of applications, and solution concentrations are listed in Tables 1 and 2. Data on the plants were recorded on December 14.

1982. Three planting dates were evaluated. The first group was planted on August 4, pruned (5 nodes) on August 20, and treated with growth regulators (where required) on September 10, 17, and 24 and October 1, 8, and 15. The second set was planted on August 18, pruned on September 3, and treated with growth regulators on September 28 and October 5, 12, 19, and 26. The third unit was planted on September 1, pruned on September 17, and treated with growth regulators on October 8, 15, and 22. Chemical treatments and application number and method are itemized in Table 3. Plants were evaluated on December 7.

Results and Discussion

1981. The first month of this experiment was a typical August in central Florida, with daylengths greater than 13 hr, high day temperatures (90° ± 3°F), warm nights (80° ± 4°F), and daily rainfall. All these factors contributed to the rapid vegetative growth observed in the first planting of both cultivars. Control plants of 'Glory' and 'Diva' finished at heights of 18.9 and 18.3 inches, respectively (Table 1). All plants finished shorter than expected due to an early cold front that moved through the area the third week of September and caused floral bud initiation earlier than normal. Since the ideal plant:pot ratio was established at 2:1, the goal of this experiment was to produce plants 12 ± 1 inches above the pot rim. Although some of the growth regulators significantly retarded plant height, none produced plants less than 15.4 inches high in the first planting. The most effective treatments were a single drench application of 0.88 x 10^{-5} oz a.i. of paclobutrazol or 3 spray applications of 2000 ppm chlormequat. The latter treatment exhibited the typical foliar chlorosis associated with this chemical (7). The chlorosis was persistent and evident as slight yellow margins on the mature leaves at final evaluation in December.

In the second planting the control plants of 'Glory' and 'Diva' were 2.0 and 2.8 inches shorter, respectively, than in the first planting. None of the growth regulators produced 'Glory' plants less than 14 inches although all but the plants treated with chlormequat drenches were significantly shorter than the control plants. 'Diva' responded more favorably to the growth regulators and 2 of the treatments produced plants within the ideal height range. Three 2000 ppm chlormequat sprays or one 1.3 x 10^{-5} oz a.i. ancymidol drench were most effective. Again, the chlormequat caused persistent foliar chlorosis. Plants treated with ancymidol and paclobutrazol had darker green foliage and earlier bract coloring than the control plants.

Plants drenched with water in the third planting were 14.4 and 15.1 inches high for 'Glory' and 'Diva,' respectively. All plants of 'Glory' from this planting date were less than 13 inches high except those treated with two 3000 ppm drenches of chlormequat. 'Diva' plants responded similarly to the growth regulators but the 1.3 x 10^{-5} oz a.i. ancymidol and 0.88 x 10^{-5} oz paclobutrazol drenches produced plants shorter than ideal. These plants had exceptionally dark green leaves, small bracts, and would not be marketable. Both cultivars produced significantly shorter plants as the planting date extended later in the year. A significant interaction of planting date and growth regulator was evident with 'Diva' but not with 'Glory.' At the conclusion of this season it was obvious that the growth regulator treatments used were not effective in the first 2 plantings but were adequate in the third planting.

1982. This year was more typical for the growing area and the warm nights (above 70°F) persisted into October. Plant heights reflected these warm conditions and the control plants in the first planting were 5-6 inches taller than in 1981 (Table 2). Although the number of applications of chlormequat applied either as foliar sprays or soil drenches and the concentrations of ancymidol and paclobutrazol were doubled compared to 1981, no treatment produced 'Glory' plants less than 15.4 inches or 'Diva' plants less than 14.5 inches. The most effective treatment was a single drench of 1.8 x 10^{-5} oz a.i. paclobutrazol. In the second planting 3 of the growth regulator treatments produced plants 13 inches high or less. These treatments were soil drenches of ancymidol at 1.3 x 10^{-5} and 2.6 x 10^{-5} and paclobutrazol at 1.3 x 10^{-5} oz/pot. The 'Glory' plants treated with paclobutrazol were a little shorter than desired but the 'Diva' plants were at the ideal height. The control plants of 'Glory' and 'Diva' were 6.7 and 5.0 inches shorter, respectively, in the second planting than in the first.

In the last planting the control plants almost attained the ideal height without the application of a growth regulator. Plants of 'Glory' and 'Diva' were between 4.7 and 4.8 inches shorter than in the second planting. All of the growth regulator treatments produced plants less than 13 inches high. Plants of both cultivars treated with the 0.44 x 10^{-5} oz paclobutrazol drench were slightly shorter (0.1-0.2 inches) than ideal and the 'Diva' plants which received a 0.88 x 10^{-5} oz ancymidol drench were too short also. During this year a single application of chlormequat might

Table 1. Effect of planting date and growth regulators on height of poinsettia 'V-14 Glory' and 'Annette Hegg Diva' (1981).

Chemical	Application method[z]	Number of applications	Solution concn (ppm)	oz. a.i. chemical per plant (X 10^{-5})	'V-14 Glory' Planting date July 1	'V-14 Glory' Planting date August 14	'V-14 Glory' Planting date August 28	'Annette Hegg Diva' Planting date July 31	'Annette Hegg Diva' Planting date August 14	'Annette Hegg Diva' Planting date August 28
					Plant height at maturity (inches)					
Water	drench	1	—	—	18.3 c[y]	16.3 b	14.4 c	18.9 d[y]	16.1 c	15.1 d
Chlormequat	drench	2	3000	3175	18.3 c	15.5 ab	13.6 bc	17.6 bcd	15.6 c	13.2 c
Chlormequat	drench	3	3000	4762	17.5 bc	15.4 ab	12.9 abc	17.0 abc	14.5 bc	12.6 bc
Chlormequat	spray	2	2000	282	16.6 ab	14.5 a	12.8 abc	15.8 a	14.3 bc	12.6 bc
Chlormequat	spray	3	2000	423	15.5 a	14.1 a	12.2 ab	15.4 a	13.0 ab	12.2 bc
Ancymidol	drench	1	1.67	0.88	17.4 bc	14.5 a	12.0 ab	16.1 ab	13.3 ab	11.3 ab
Ancymidol	drench	1	2.50	1.3	16.2 ab	14.2 a	11.6 a	15.6 a	11.6 a	10.0 ab
Paclobutrazol	drench	1	1.67	0.88	15.4 a	14.2 a	11.5 a	15.4 a	13.1 ab	10.0 a
Mean of plant dates					16.9 c[x]	14.8 b	12.6 a	16.5 c[x]	13.9 b	12.1 a

[z]Soil drench at 5.1 fl. oz/pot and foliar spray at 0.7 fl. oz/plant.
[y]Mean separation within columns by Duncan's multiple range test, 1% level.
[x]Mean separation of planting dates within columns by Duncan's multiple range test, 1% level.

Table 2. Effect of plant date and growth regulators on height of poinsettia 'Gutbier's V-14 Glory' and 'Annette Hegg Diva' (1982).

Planting date	Chemical	Application method[z]	Number of applications	Solution concn (ppm)	oz a.i. chemical per plant (X 10^{-5})	Plant height at maturity (inches) Glory	Diva
August 4	Water	drench	1	—	—	25.0 d[y]	24.8 f
	Chloromequat	drench	4	3000	6350	21.3 bc	19.6 cde
	Chloromequat	drench	6	3000	9525	19.6 b	19.2 cd
	Chloromequat	spray	4	2000	564	22.2 c	22.1 e
	Chloromequat	spray	6	2000	847	20.1 b	19.6 cde
	Ancymidol	drench	1	3.33	1.8	19.7 b	18.0 bc
	Ancymidol	drench	1	5.00	2.6	17.0 a	16.2 ab
	Paclobutrazol	drench	1	3.33	1.8	15.4 a	14.5 a
	Paclobutrazol	spray	1	50.0	3.6	22.1 c	21.2 de
August 18	Water	drench	1	—	—	18.3 e	19.4 c
	Chlormequat	drench	3	3000	4762	13.7 cd	13.5 ab
	Chlormequat	drench	5	3000	7937	13.3 bc	13.3 a
	Chlormequat	spray	3	2000	423	15.4 d	16.1 b
	Chlormequat	spray	5	2000	705	14.4 cd	13.5 ab
	Ancymidol	drench	1	2.5	1.3	13.0 bc	12.5 a
	Ancymidol	drench	1	4.17	2.6	11.6 ab	11.8 a
	Paclobutrazol	drench	1	2.5	1.3	10.6 a	12.2 a
	Paclobutrazol	spray	1	50.0	3.6	15.5 d	16.0 b
September 1	Water	drench	1	—	—	13.6 b	14.6 b
	Chlormequat	drench	2	3000	3175	11.2 a	11.8 a
	Chlormequat	drench	3	3000	4762	11.2 a	11.3 a
	Chlormequat	spray	2	2000	282	11.8 ab	11.3 a
	Chlormequat	spray	3	2000	423	11.2 a	11.1 a
	Ancymidol	drench	1	0.83	0.44	12.0 ab	11.8 a
	Ancymidol	drench	1	1.67	0.88	11.1 a	10.5 a
	Paclobutrazol	drench	1	0.83	0.44	10.8 a	10.9 a
	Paclobutrazol	spray	1	50.0	3.6	12.1 ab	11.7 a

[z]Soil drench at 5.1 fl. oz/pot and foliar spray at 0.7 fl. oz/plant.
[y]Mean separation within cultivar and planting date by Duncan's multiple range test, 1% level.

have been sufficient to maintain the plants at 13 inches or less in the third planting. As in 1981, plant heights were significantly reduced as the planting and pruning dates were delayed. Both cultivars displayed a significant interaction between planting date and growth regulator.

Analyses of the data from these 2 yr indicate that environmental conditions play a significant role in the need for a chemical growth regulator on poinsettias in Florida. Since structures in which poinsettias grow in Florida are generally not equipped to lower significantly the air temperature to retard internode elongation, growers must utilize growth regulators. Unfortunately, effectiveness of these chemicals may not be of practical significance if poinsettia plants are pruned before August 15 and grown under conditions of these experiments. If plants are pruned prior to September 1, only the more expensive ancymidol or the experimental paclobutrazol would retard plant growth to the ideal height. Additional applications of chlormequat beyond the 5 used in this study during the second planting might be useful, but probably would not be cost efficient. Growers who plan to use chlormequat for maintenance of plant height of 'Glory' or any of the 'Annette Hegg' cultivars should plan to prune these plants between the first and fifteenth of September. Earlier pruning may lead to the production of tall, weak plants of reduced marketability.

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