Table 2. Anthocyanin content of 'Annette Hegg Brilliant Diamond' poinsettias grown under various air and root-zone temperatures.

Treatment[z]	Total anthocyanin (mg/ml extract ± SE)		
	Nov. 25	Dec. 10	
	Main stem	Main stem	Axillary shoot
Warm night	13 ± 1	818 ± 38	660 ± 107
Cool night			
17° root	7 ± 1	378 ± 110	214 ± 82
23° root	40 ± 14	1115 ± 164	---
26° root	43 ± 9	879 ± 82	---
29° root	31 ± 7	861 ± 71	1005 ± 128

[z]The air temperatures were 16.7°C in the warm night greenhouse and 11.5° in the cool night greenhouse.

(5). All plants were watered and fertilized with 200 ppm N (15 N–6.6 P–12.5 K) daily.

Warming the root zone to 26°C increased poinsettia height (Fig. 1). Plants grown at 23° had a height not significantly different from that of the 26° plants, whereas plants grown at 29° exhibited a height (growth) curve similar to that of the cool night control. It appears that under cool night conditions, some root heating promoted growth in height while higher temperatures in the root zone were somewhat inhibitory. Under warm night conditions (3), root-zone heating at any temperature above ambient retarded stem elongation. Plants grown under warm night had a final height of 72 cm. Plants were compact under cool night air temperatures at 17° or 29° root temperature, which is very desirable. Under cool night temperature, the dry weights of plant parts were maximal at a root-warming temperature of 23°, which equalled or surpassed dry weight under warm nights (Table 1).

Cool night conditions delayed anthocyanin development, but root-zone warming overcame this delay. On December 10, the cool night control plants had less anthocyanin than the warm night control plants, but plants grown under cool night conditions with root warming had similar or greater anthocyanin content (Table 2).

Warming the root zones of 'Annette Hegg Brilliant Diamond' poinsettias to 23°C under cool night conditions stimulated growth of bracts and axillary shoots and enhanced anthocyanin development. These plants compared favorably to those grown without root warming under more acceptable night air temperatures. Thus root-zone warming could make it possible to achieve salable plants with reduced night temperatures. Interactions among root warming, different genotypes, and growth regulators remain to be tested.

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The Effect of BAS 106, Ancymidol, and Chlormequat on Chrysanthemum and Poinsettia

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Abstract. **Application of 5-(4-chlorophenyl)-3,4,5,9,10 pentaaza-tetracyclo-5,4,10^{2,6} 0^{8,11} -dodeca-3-9-diene (BAS 106) by granular (1G) application to the medium surface or 50% wettable powder (50 WP) soil drench were compared with standard methods of application for (2-chloroethyl)trimethylammonium chloride (chlormequat), butanedioic acid mono-(2,2-dimethylhydrazide) (daminozide), and alpha-cyclopropyl-alpha-(p-methoxyphenyl)-5-pyrimidinemethanol (ancymidol) for their retardation of chrysanthemum and poinsettia growth. A 32 mg/pot BAS 106 (50 WP) rate caused temporary venial chlorosis of the leaves. BAS 106 (1G) at 6 mg/pot and BAS 106 (50 WP) at 8 mg/pot retarded *Chrysanthemum* X *morifolium* Ramat, 'Always Pink' as effectively as daminozide spray at 2500 mg/liter; whereas the same treatments were more effective on chrysanthemum 'Ritz' than either a 2500 mg/liter spray or 0.25 mg/pot ancymidol drench. BAS 106 (1G) topdressed at 18 mg/pot or a BAS 106 (50 WP) drench at 8 mg/pot retarded *Euphorbia pulcherrima* Willd. 'Brilliant Diamond' and 'Paul Mikkelsen' as much as a 0.5 mg/pot ancymidol drench and more than a 3000 mg/liter chlormequat drench.**

Chrysanthemum. On May 21, 1981, one rooted cutting of 'Always Pink' chrysanthemum was planted to each 12-cm pot containing a 1 sphagnum peatmoss :1 vermiculite mix (by volume) amended with 4.5 kg single superphosphate, 474 g gypsum, 162 g potassium nitrate, 90 g epsom salt, and 36 g fritted trace elements/m^3 (Expt. 1). The night temperature was maintained at 18°C, with day temperature ventilation at 21° ± 2°. Plants were irrigated 2 to 3 times daily with a fertilizer solution containing 200 mg/liter N from a 20N–8.4P–14.9K fertilizer. On June 16 (2 weeks after pinching), all but 2 breaks were removed from each plant. On June 18, the following treatments were applied: BAS 106 (1G) (BASF Wyandotte Corp. Parsippany, N.J.) was topdressed at 2, 6, and 18 mg ai/pot. BAS 106 (50 WP) was applied as a soil drench at 0, 2, 8, and 32 mg a.i./pot in 100 ml of solution. These treatments were compared with daminozide spray at 2500 mg/liter. The design was completely random with 6 plants per treatment. Final data, taken July 15, 1981, included average height per plant, length of longest stem, and number of nodes on the longest stem.

BAS 106 (50 WP) caused foliar injury to chrysanthemum at 32 mg/pot. The injury was characterized by a temporary yellowing of the veins one week after application. All growth retardants reduced chrysanthemum height compared to the control except for BAS 106 (1G) at 2 mg/pot (Table 1). Increased concentration of BAS 106 (1G or 50 WP) caused greater restriction in plant height. Daminozide-treated plants were 29% shorter than the control and BAS 106 at 6 mg/pot retarded growth similarily. The number of nodes per stem was greater at low levels of BAS 106 than the control, but there is no apparent explanation for this effect.

In a second experiment, rooted cuttings of 'Always Pink' and 'Ritz' chrysanthemum were

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Table 1. Effect of 2 BAS 106 formulations, daminozide, and ancymidol on stem length and number of nodes of 'Always Pink' and 'Ritz' chrysanthemums.

		Always Pink				Ritz	
		Experiment 1		Experiment 2		Experiment 2	
Treatment	Rate	Stem length (cm)	No. nodes	Stem length (cm)	No. nodes	Stem length (cm)	No. nodes
Control		25.3 a[z]	22.7 c	42.3 a	24.2 ab	50.0 a	18.5 a
Daminozide	2500 mg/liter	17.9 cd	24.0 abc	34.0 d	25.6 a	38.7 b	18.0 a
BAS 106 1% G	2 mg/pot	24.0 a	25.3 ab	39.3 b	25.8 a	29.5 cd	17.2 a
	6 mg/pot	19.0 bc	23.7 bc	33.9 d	24.8 ab	21.7 e	16.0 a
	18 mg/pot	15.0 ef	23.5 bc	26.9 e	25.6 a	14.5 f	15.0 a
BAS 106 50% WP	2 mg/pot	20.6 b	25.8 a	37.0 c	25.5 a	31.5 c	15.8 a
	8 mg/pot	16.0 de	23.2 c	33.2 d	23.5 b	22.7 d	16.5 a
	32 mg/pot	12.9 f	22.7 c	27.9 e	24.8 ab	12.7 f	15.5 a
Ancymidol	0.25 mg/pot	---	---	39.0 b	25.2 a	34.2 bc	18.0 a

[z]Mean separation within columns by Waller-Duncan K-Ratio *t* test with K ratio 100.

planted into 12-cm pots on June 6, 1981. Environmental conditions were the same as for Expt. 1. 'Always Pink' was pinched and then pruned to 2 break per plant on July 14; 'Ritz' was pinched but not pruned. Treatments, applied July 16, were the same as those in Expt. 1 with the addition of an ancymidol drench at 0.25 mg/pot. The experimental design was randomized complete block design with 3 replications for 'Always Pink' and 4 replications for 'Ritz.' Final data were taken September 16.

BAS 106 at 32 mg/pot caused the same type of injury observed in Expt. 1. Increased concentration of BAS 106 caused greater restriction in plant height. Daminozide-treated 'Always Pink' were 19% shorter than the control and BAS 106 at 6 mg/pot retarded growth similarily. With 'Ritz', all plants in BAS 106 treatments were significantly shorter than those treated with daminozide. This cultivar difference is similar to the cultivar response that has been reported for other growth retardants (2). BAS 106 was more effective in restricting height of chrysanthemum than ancymidol at 0.25 mg/pot for both 'Always Pink' and 'Ritz'.

For 'Always Pink', BAS 106 (50 WP) drench at 8 mg/pot provided about the same retardation as BAS 106 (1G) topdressed at 6 mg/pot; therefore, the drench and granular topdressed methods of BAS 106 application were equally effective. These results with BAS 106 are similar to those reported by Nell et al. (4) when comparing granular and drench methods of ancymidol on chrysanthemum.

The number of nodes per stem was not reduced significantly by BAS 106 compared to the untreated control plants. Differences in internode length do not indicate whether the major effect of BAS 106 is on cell elongation or cell division.

Poinsettia. One rooted cutting of 'Brilliant Diamond' poinsettia was planted to each 16-cm pot on September 16, while 3 rooted cuttings of 'Paul Mikkelsen' were planted to each 16-cm pot on September 17. The growing mix was the same as that used in Expt. 1. The fertilization program was Osmocote 14N–6.2P–11.6K at the rate of 8.3 kg/m^3. Night break lighting at 3.6 μE m^{-2} s^{-1} was used from planting until September 30. 'Brilliant Diamond' was pinched on September 21, leaving 4 healthy leaves on each cutting, while 'Paul Mikkelsen' was not pinched. BAS 106 treatments were applied at the rates previously described. A chlormequat drench was made at 3000 mg/liter with 168 ml of solution applied per pot. An ancymidol drench was applied at 0.5 mg/pot. BAS 106 was applied on September 23, and chlormequat and ancymidol were applied on September 24. There were 6 pots per treatment in a completely randomized design. Data were taken December 10–13 for the nonpinched plants and December 15 and 16 for pinched plants.

BAS 106 caused some foliar injury to poinsettia at the highest rate. As with chrysanthemums, the injury became evident within a week but after one week began to diminish until little injury was visible at harvest.

All growth retardants restricted height compared to the nontreated plants (Table 2). The 'Brilliant Diamond' and 'Paul Mikkelsen' plants treated with ancymidol were shorter than those treated with chlormequat. Wilfret et al. (7) reported that ancymidol was more effective than chlormequat. Each increase in BAS 106 concentration caused a greater height reduction. Wilfret et al. (7) reported that ancymidol as a granular incorporation to be more effective than as a drench; however, plants with BAS 106 (1G) topdressed at 2 mg/pot were significantly taller than BAS 106 drenched at 2 mg/pot. BAS 106 (1G) at 18 mg/pot and BAS 106 (50 WP) at 8 mg/pot retarded poinsettias to a similar extent as an ancymidol drench.

Chlormequat and ancymidol treatments reduced bract size as much or more than most BAS 106 treatments. Only BAS 106 (50 WP) at 32 mg/pot reduced bract size more. The reduction in bract size by the growth retardants was not great enough to reduce the quality of the finished poinsettia.

The number of nodes on 'Paul Mikkelsen' plants was significantly reduced by BAS at the highest rates. This is in contrast to the effect of BAS 106 on chrysanthemums.

Table 2. Effect of 2 BAS formulations, ancymidol, and chlormequat on plant height, bract diameter, and number of nodes of 'Brilliant Diamond' and 'Paul Mikkelsen' poinsettia.

		'Brilliant Diamond'		'Paul Mikkelsen'		
Treatment	Rate	Plant ht (cm)	Bract diam (cm)	Plant ht (cm)	Bract diam (cm)	No. nodes
Control		27.2 a[z]	20.0 ab	29.5 a	21.1 ab	13.1 a
Chlormequat	3000 mg/liter	19.8 c	17.3 c	26.4 b	20.1 ab	12.7 a
Ancymidol	0.5 mg/pot	14.7 d	17.4 c	19.1 cd	19.4 ab	12.3 ab
BAS 106 (1% G)	2 mg/pot	26.5 a	20.7 ab	27.2 ab	22.1 a	12.7 a
	6 mg/pot	22.0 b	20.5 ab	20.5 c	21.9 a	12.3 ab
	18 mg/pot	14.9 d	19.4 b	17.3 de	20.0 ab	11.4 b
BAS 106 (50 % WP)	2 mg/pot	22.7 b	21.5 a	21.1 c	22.3 a	12.2 ab
	8 mg/pot	15.8 d	19.8 b	15.1 e	18.6 b	9.8 c
	32 mg/pot	10.5 e	15.4 d	12.4 f	10.0 c	8.6 d

[z]Mean separation within columns by Waller-Duncans K-Ratio *t* test with K Ratio 100.

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