Chemical Growth Retardants for

Poinsettias

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Introduction

One of the recent advances in the control of plant growth has been the introduction of chemical growth retardants. These chemicals which generally reduce plant height without detrimental side effects have been of particular interest to poinsettia growers faced with the task of holding down lanky, rapidly growing plants early in the fall. Before the advent of chemical growth retardants, growers were able to use their early cuttings only for tall plants in large containers and cuttings taken late in the season (September) were used for short, small plants. The use of growth retardants now makes it possible for the grower who desires to do so, to utilize some of the earlier propagations (late July and August) for small plants, which are in greatest demand, thereby permitting him to spread his growing operations over a longer period of time if he has limited space and help.

Two chemicals are presently being tested and used to dwarf poinsettia plants. They are B-995 (N-dimethylaminosuccinamic acid)[1] and Cycocel (2-chloro ethyl trimethylammonium chloride)[2]. Cycocel is now commercially available and has been used on a trial basis by many commercial growers during the past two seasons. This report covers experimental work and results obtained at the University of Missouri greenhouses, Columbia, Missouri, in which Cycocel was used to control poinsettia growth.

Growth Habit of the Treated Plants

In addition to causing shorter internodes and consequently shorter stems, Cycocel has several other visible effects on the growth of poinsettias. Leaves of the treated plants have a darker green, more attractive color than leaves of untreated plants. Stems are thicker and sturdier and normally do not need to be staked. Since plants can be propagated earlier, these shorter plants will have more leaves than plants of the same height grown from later propagations. Flower bracts of treated plants have shorter petioles and therefore droop less and are easier to handle than those of untreated plants. See Figure 1. We have also observed that treated and untreated plants observed for 3 months after Christmas kept equally well but that treated plants generally appeared to be in slightly better condition at the end of this time.

Effects on Anthesis and Bract Expansion

Although the use of this chemical has advantages, it is important to mention some disadvantages and problems which may be associated with its use. Application of overdosages of the chemical may delay development of the bracts. Both treated and untreated plants reach anthesis (full bloom—indicated by the appearance of pollen on the anthers) at about the same time, but bract development is often slower on the treated plants; a phenomenon which seems to be accentuated by cool temperatures. This slow bract development may be accompanied by a crinkling of the bract, but this usually disappears by the time that the bracts are fully expanded. Plants grown in the University greenhouses were not lighted in most cases in order to bring them into full flower by the end of the first week in December. Although many plants had reached anthesis by the end of November, the bracts were not fully expanded until the end of the second week of December and were still salable at Christmas time.

Lighting of treated and untreated plants to October 10 delayed anthesis equally in both, but this delay in anthesis caused added delay in bract development on the treated plants which was not desirable. Frequently bracts on treated plants were still of poor quality at Christmas time, even though the true flowers had reached anthesis.

Effects on Leaves

Overtreatment, particularly in the case of Ecke White, caused chlorosis and downward curvature of the leaf with eventual leaf drop. See Figure 2. This phenomenon was of little consequence with the red varieties grown, however, and will be discussed more fully in a later section dealing with differences in varietal response.

Effects of Chemical Treatment on the Growth Pattern

In an effort to determine the portion of the stem most affected by the chemical, the number of nodes on a poinsettia plant was counted at the time of flowering and the total divided into thirds as shown in Figure 3. The length of each segment of the stem containing ⅓ of the total number of nodes was then measured. The number of nodes per plant was not affected by chemical treatments. As might be expected, the bottom stem segment constituted the length of the original cutting and therefore showed no reduction in growth. The middle segment included the nodes elongating while the cutting was getting established and was the segment being formed when the chemical was applied. The top segment was an area of rapid growth and had long internodes on the untreated plants. This was the section in which the effect of the chemical was most pronounced. In the treated plants, the length of the top stem segment was no greater than the length of the middle segment, while in untreated plants it was almost doubled in length, except in the case of late propagations, where late season elongation was prevented by the formation of a terminal flower bud.

Figure 4 shows growth curves for Barbara Ecke Supreme plants after Cycocel application. This pattern

[1]Manufactured by Naugatuck Chemical Company.
[2]Manufactured by American Cyanamid Chemical Company.

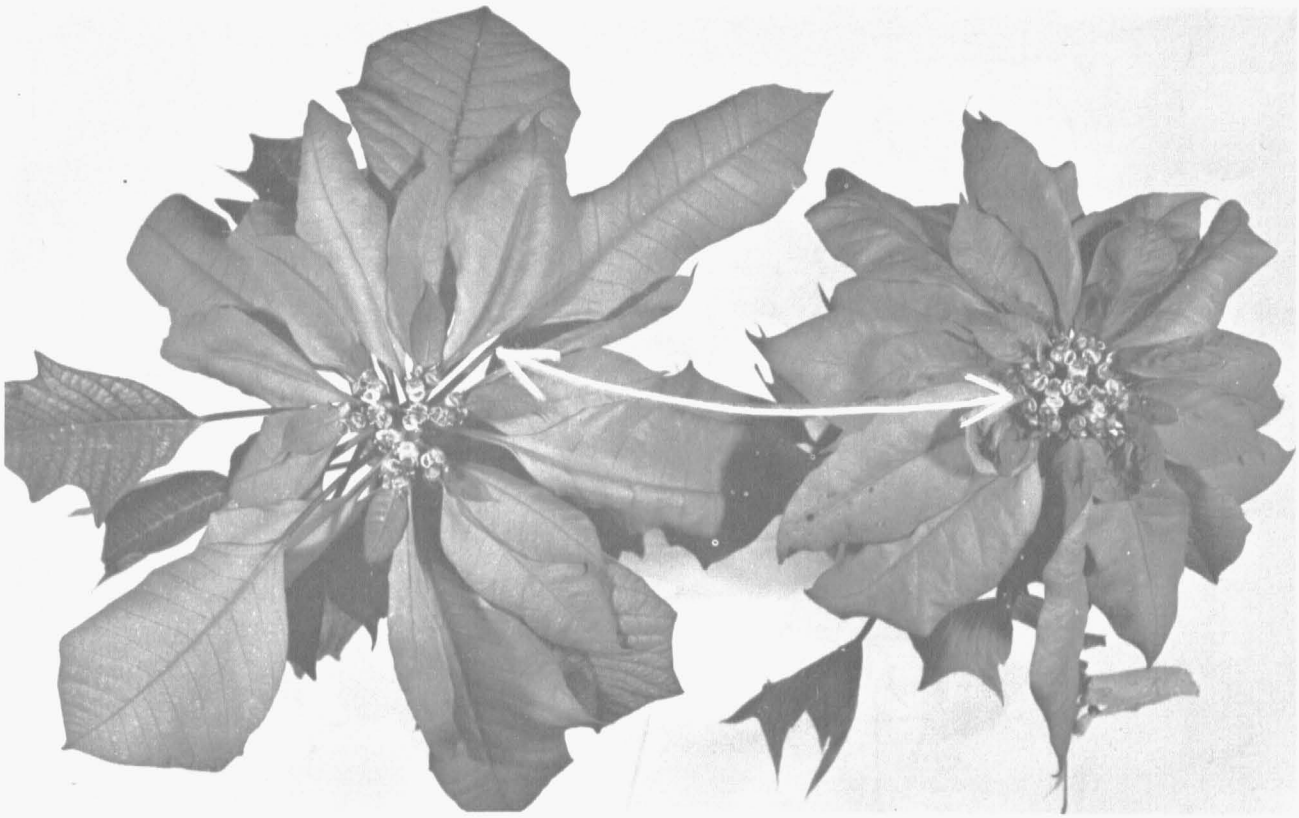
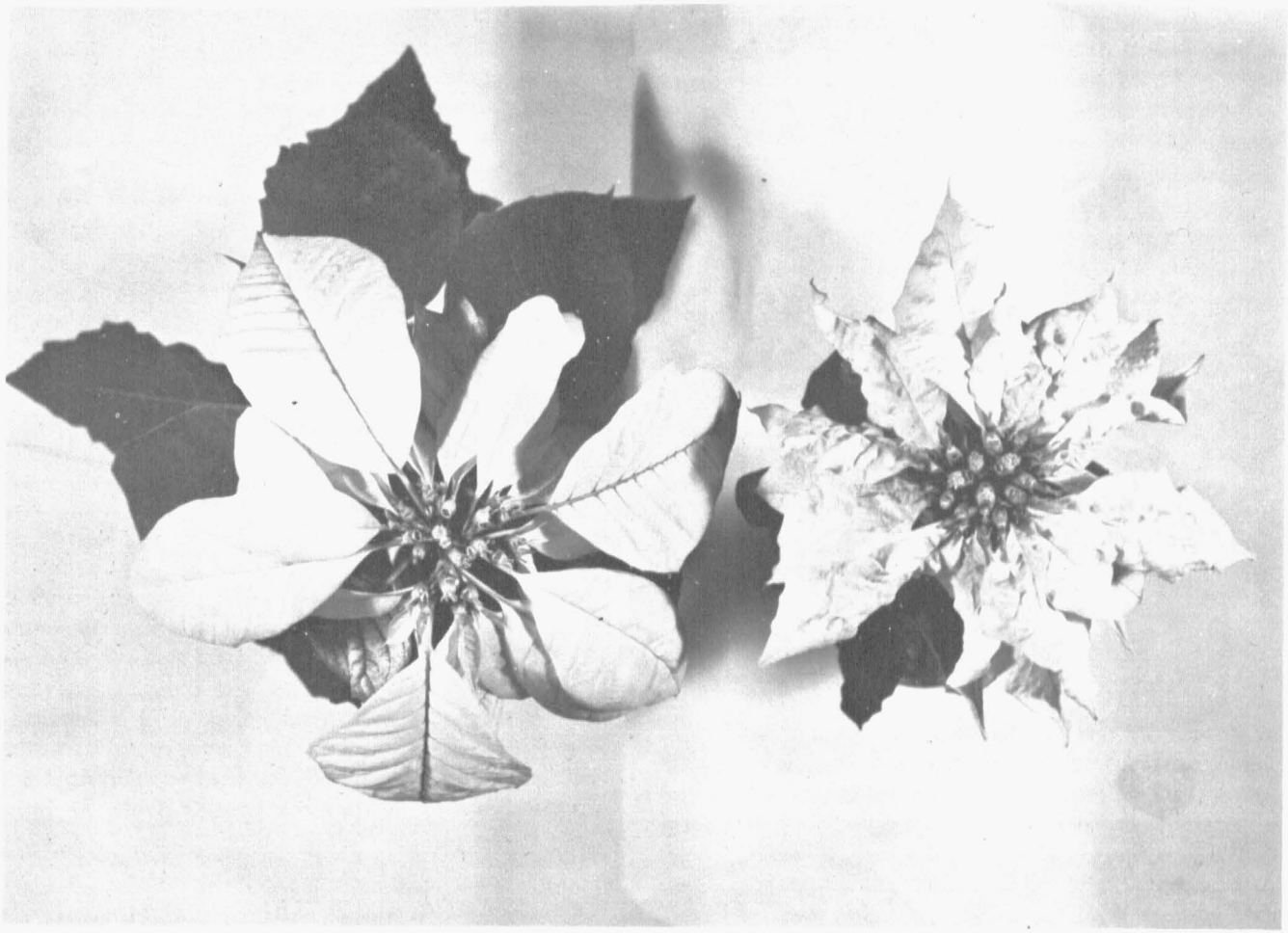


Fig. 1. Cycocel treatment results in a shorter plant with a more compact head, attractive to most retail customers. Total diameter of the inflorescence is reduced slightly, however, because of shortening of the petioles of each individual bract (arrow). Variety, Barbara Ecke Supreme. Left, untreated plant. Right, plant treated with Cycocel soil drench.



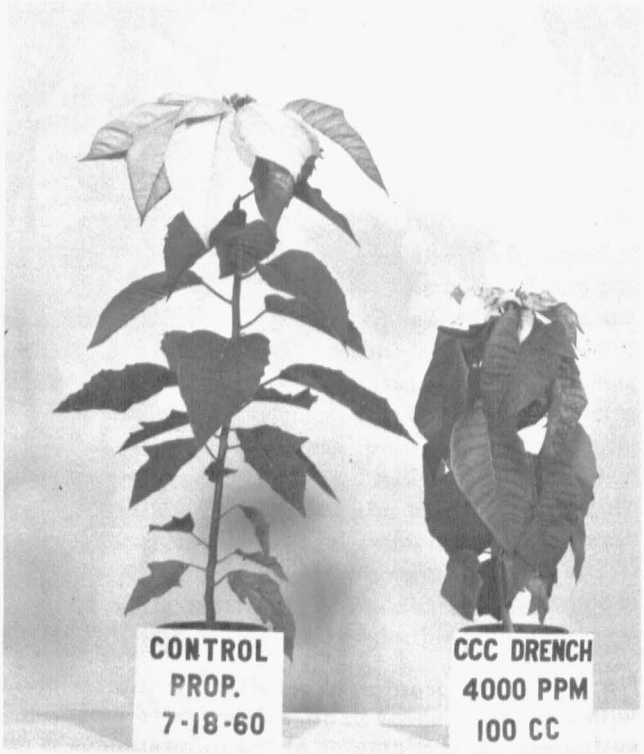


Fig. 2. Overdosages of Cycocel may result in severe plant injury, particularly on Ecke White variety, as shown by severe crinkling of the bracts, epinastic curvature (turning downward) of the leaves, and chlorosis. Untreated bract and plant on upper and lower left.

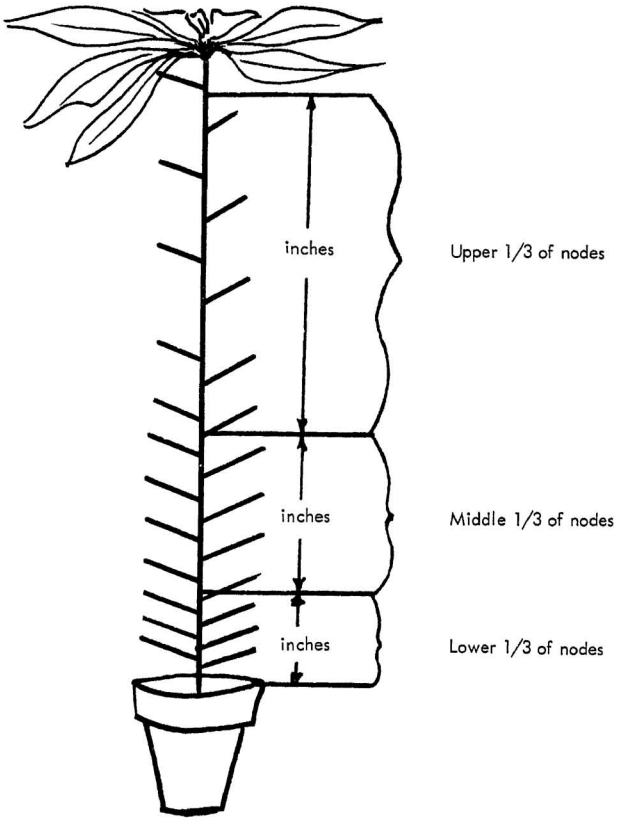
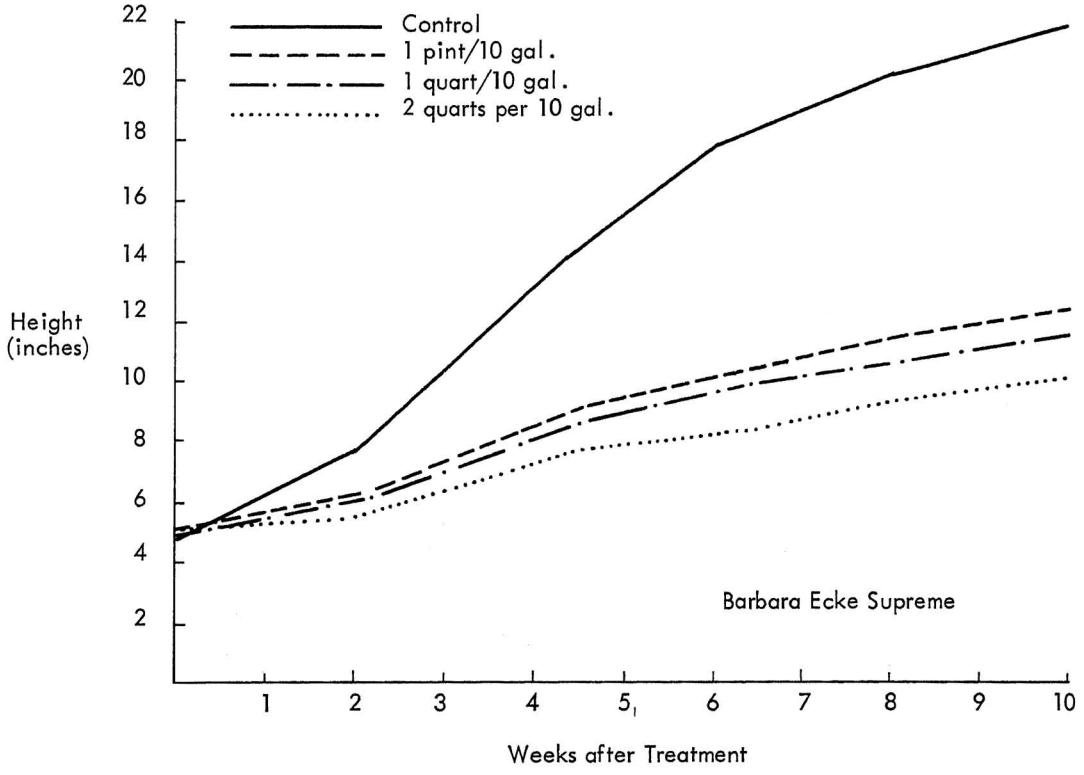


Fig. 3. Diagram showing method of determining the average length of the internodes in three equal nodal areas of the poinsettia stem.

Fig. 4. Comparative heights of poinsettia plants treated with three Cycocel concentrations measured at biweekly intervals after treatment. Variety Barbara Ecke Supreme. Propagated August 6, 1962.



was typical for all red varieties grown. Slow growth occurred during the first 2 weeks since the plants had not yet become well established. However, at the end of this period, rapid growth occurred in the untreated plants while there was only a slight increase in growth rate in the treated plants. This is the time when rapid expansion of the upper third nodes occurs and the time of maximum chemical effect. This rapid growth rate is reduced later by flower bud initiation and development and finally terminates at the time of anthesis.

Application Methods

One of the first considerations in developing effective and economical ways to use a new chemical is to determine the best method of application. Since Cycocel is available in an 11.8% liquid formulation it lends itself to use either as a spray or liquid drench. Cycocel sprays have been found ineffective on poinsettias so a liquid soil drench appears to be the best method of applying the chemical.

Treatment of the Stock Plant

If dwarfing effects were transmitted to terminal stem tissue, treating stock plants might be a desirable method of application. However, Widmer[3] reported that cutting production was reduced from 111 cuttings on untreated stock plants to 77 on treated plants. We also observed that treated plants produced fewer branches more slowly after pinching than untreated plants. The cuttings, however, in our tests rooted equally well from both sources and the final height of the plants grown from treated stock was shorter than those of the controls. The reduction in growth, however, was only about ½ that obtained on cuttings from untreated stock plants propagated at the same time and treated with a drench application in the small pot.

Treatment of Unrooted Cuttings

Cycocel was not applied to unrooted cuttings in our research, but Widmer[4] has reported that rooting was not hindered by this method and stem elongation was limited. He states, however, that plant response was not sufficiently uniform to make this a practical method for commercial use.

Treatment of Rooted Cuttings

We found plants could be dwarfed successfully when rooted cuttings were soaked in Cycocel solutions. However, the operation often resulted in broken roots and was a possible means of inoculating healthy cuttings with pathogenic organisms. This, coupled with a lack of uniformity in overall results, made us discard the use of this method.

[3]Widmer, R. E. Short poinsettias wih CCC. Minn. St. Flor. Bul., April 1, 1962, pp. 1-7.
[4]*Loc. cit.*

Use of Liquid Soil Drenches

In the small pot. Our most successful results with Cycocel have been obtained when the chemical was applied directly to the soil of an established plant. An equal amount of dwarfing was found to occur when a given dosage was applied in either one or two applications about a month apart. A further discussion of concentration will be given, but at the concentrations used, we did not find any tendency of the plants to grow out of the effect of treatment after they were shifted into the final pans. Presently, 2 fluid ounces or ¼ cup of the diluted Cycocel solution is applied once to the 3″ pot. If the pot is too full of soil, it may be necessary to apply this quantity in two portions.

Treatment directly in the pans. Our work has not been extensive in treatment of the plants directly after panning. Lindstrom[5, 6], however, has worked extensively with this application method with good results. The amounts shown in Table 1 are suggested for application to pots of varying sizes by the American Cyanamid Company as a result of co-operative trials at over 100 commercial greenhouses and experiment stations throughout the country.

TABLE 1. QUANTITIES OF DILUTE CYCOCEL SOLUTION TO BE APPLIED PER POT, AS SUGGESTED BY THE MANUFACTURER.

Pot Diameter	Amount of Solution (1 qt. to 10 gal.) per pot	1 Quart of Cycocel treats
in.	Fl. oz.	No. of pots
2¼-3	2	640
4	3	425
5	4	300
6	6	200
8	8	150

Our treatments of panned plants were carried out on plants grown in 8-inch pans. Use of the 1 quart per 10 gallons of water concentration of Cycocel at the dosage rate shown above reduced plant height 9 inches as compared to the controls. These plants were panned October 3 and treated on October 5. Lower concentrations were also used but the dwarfing which occurred was not enough to produce the most desirable plants.

[5]Lindstrom, R. S. 1961. CCC alters growth. Florists' Review *128* (3322): 17-18, 35.
[6]Lindstrom, R. S. 1962. Poinsettia response to CCC. Florists' Review *129* (3354): 17-18, 44.

Plants propagated in August under our conditions are generally too tall by the time they are panned to receive maximum benefit from the chemical.

Best Propagation Dates for Plants to be Chemically Treated

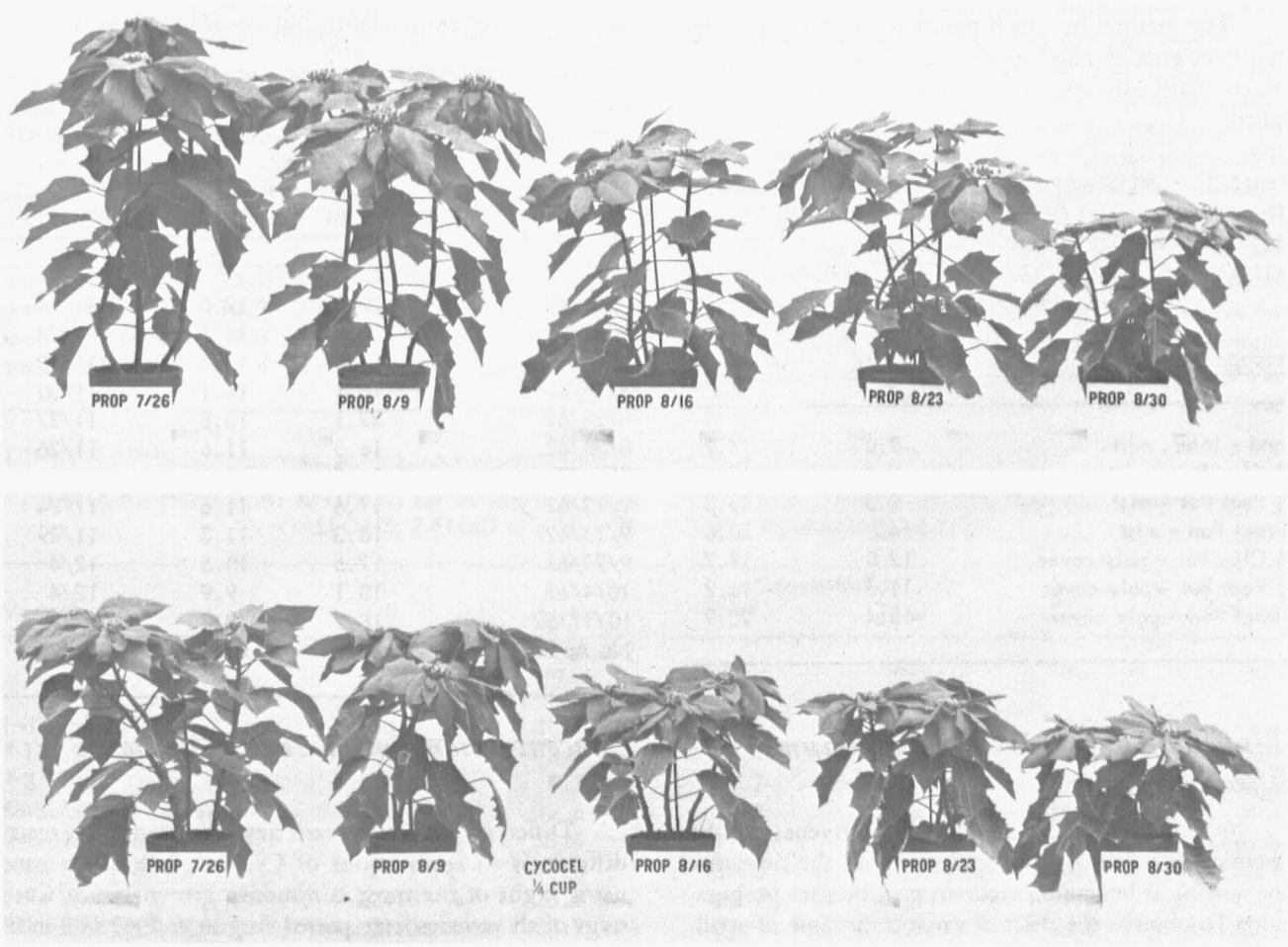
The most advantageous propagation period for plants on which the chemical will be used depends largely on individual grower practices. In general, we have found that propagations made before the last week of July grow too tall in spite of the use of the chemical. There is also considerable difficulty in maintaining plants in the small pots for this long period of time through the hot weather. We have found August propagations with a chemical treatment in early to mid-September to give best results for Cycocel-treated plants. See Figure 5. Table 2 shows the final heights of both treated and untreated plants which were propagated at weekly intervals and treated about 4 weeks after the date of propagation.

Chemical treatment of all these propagations was effective in reducing plant height, but propagations after August 30 produced plants short enough that there was no need to reduce height further. Also, treatment of later propagations appeared to accentuate delayed development of the bracts.

TABLE 2. EFFECT OF PROPAGATION DATE ON THE FINAL HEIGHT OF BARBARA ECKE SUPREME POINSETTIAS TREATED AND UNTREATED WITH CYCOCEL, 1 QT./10 GAL., 2 FL. OZ./PLANT.

Date of Propagation	Untreated	Treated
	in.	in.
7/26/62	24.0	18.0
8/9/62	23.4	15.0
8/16/62	17.4	9.9
8/23/62	17.7	9.2
8/30/62	10.1	6.4

Fig. 5. Successively later propagation dates result in shorter and shorter plants. In our area (39° N. Latitude) most plants propagated after September 1 are sufficiently short without any special treatment. Barbara Ecke Supreme. Above, untreated. Below, treated with 1 quart of Cycocel per 10 gallons.



Method of Propagation-Its Influence on Response to the Chemical

Since some methods of propagation tend to produce plants that root and begin to grow more quickly than others, a comparison was made to determine if there was any need for altering the amount or concentration of chemical to be applied if the propagation techniques were altered. The results are shown in Table 3.

Cuttings rooted directly in sand, potted and then panned, were of smaller size than those rooted directly in pots, but treatment with a 1 quart per 10 gallon concentration (¼ cup per 3″ pot) produced dwarfed plants equal in height to those rooted by other methods and treated chemically. Although the control plants varied considerably in height, treated plants showed much less variability regardless of the way in which they had been propagated.

In this instance, plants that were rooted under a polyethylene cover without mist rooted more quickly and grew taller, presumably due to the higher temperatures which existed under the plastic. Both treated and untreated plants rooted directly in the pans grew taller than those rooted in a sand bench or in the small pots. These plants, however, could not be sorted for uniform size; as a result the pans lacked uniformity, and both treated and untreated plants were commercially undesirable.

The method by which plants were propagated did not have enough effect on the growth of the cuttings to warrant any alteration in the quantity of chemical applied.

TABLE 3. INFLUENCE OF PROPAGATION METHOD ON THE FINAL HEIGHT OF BARBARA ECKE SUPREME POINSETTIA TREATED AND UNTREATED WITH CYCOCEL, 1 QT./10 GAL.; 2 FL. OZ. PER PLANT. PROPAGATION DATE, 8/23/62.

Propagation Method	Treated	Untreated
	in.	in.
Sand - inter. mist.	9.0	14.9
2¼ Clay Pot - mist	9.2	17.7
2¼ Peat Pot - mist	9.3	15.3
Direct Pan - mist	14.0	20.6
2¼ Clay Pot - poly cover	12.0	19.7
2¼ Peat Pot - poly cover	11.5	16.2
Direct Pan - poly cover	15.4	23.9

Time of Application for Maximum Effectiveness

In order to achieve maximum effectiveness of the chemical it is necessary to apply it about the time that the cutting is beginning vigorous growth after propagation. To observe the effect of varying the time of application, a large number of Barbara Ecke Supreme cuttings were potted in 3-inch pots. These pots were then divided into 13 equal sized groups, and each group received a single application of Cycocel. The first group was treated the day unrooted cuttings were potted, and each succeeding group one week later. One group was left untreated as a control group. All the plants were panned, 3 to a 6-inch pan, on October 12, the day after the last group was treated with growth retardant solution.

Table 4 shows that the maximum effect of the chemical occurred when the plants were drenched August 30 or September 9, 4 or 5 weeks after the cuttings were taken. Plants treated before this time were somewhat variable in their response, and did not show the normal effects of Cycocel treatment—darker leaves, bract crinkle, or delayed bract expansion. The two groups showing maximum retardation were of good quality while those treated after the middle of September showed more bract crinkle and flowering delay than would be commercially desirable. They were also not dwarfed appreciably, since the plants were already about 15 inches high at the time of treatment. Plants treated after October 1 were extremely delayed in bract development and although true flowers on these 2 groups reached anthesis in the first week in December, bract diameters never reached the size attained by the other groups.

This points out that a grower can not wait until the plant has almost reached a desirable height and then apply a large dosage in order to control the plants. He will not only have short plants, but small bracts as well.

TABLE 4. EFFECT OF TIME OF APPLICATION OF A ONE QUART PER 10 GALLON CONCENTRATION OF CYCOCEL ON BARBARA ECKE SUPREME POINSETTIAS PROPAGATED 7/26/62.

Time of Application	Height	Bract Diameter	Anthesis Date
	in.	in.	
7/26/62	20.3	12.6	11/24
8/2/62	24.0	14.1	11/24
8/9/62	25.0	14.4	11/23
8/16/62	18.1	11.1	11/30
8/23/62	22.1	13.8	11/27
8/30/62	16.5	11.6	11/26
9/6/62	16.8	12.2	11/26
9/13/62	17.6	11.6	11/24
9/20/62	18.3	11.3	11/29
9/27/62	17.5	10.5	12/4
10/4/62	18.1	9.9	12/4
10/11/62	18.2	9.7	12/7
No Application	23.9	11.5	11/29

Concentration and Varietal Response

Different poinsettia varieties were found to react differently to applications of Cycocel, following tests using eight of the most commonly grown kinds. Cuttings of all varieties were potted August 6, 1962 in 3-inch pots of a sterilized soil mixture and were rooted under

intermittent mist. Cuttings were removed after rooting, but since all varieties did not root equally rapidly, there was some variation in this removal date.

The young plants of each variety were divided into 6 uniform groups of 18 plants each before the Cycocel was applied on September 17, 1962. Each group of plants was treated with 2 fl. oz. of Cycocel per 3-inch pot using the following concentrations: 0, 1 pint, 1 quart, 1½ quarts, 2 quarts, and 2½ quarts of Cycocel (11.8%) per 10 gallons of water. On October 11 and 12, the small plants were all panned, 3 to a 6-inch pan.

Because of differences in the rate of rooting and the time of starting into rapid growth, there was considerable variation in the height of the different varieties at the time of treatment. These differences are shown in Table 5.

Table 6 shows the final height at anthesis of the plants in each treatment. Ecke Pink showed least effect from treatment of any of the varieties tested. The 2 highest concentrations reduced growth markedly during the first 2 weeks, but after that time the rate of growth again increased. The lower concentrations reduced the rate of growth slightly at first, but the plants soon regained almost the normal rate of growth.

The white varieties showed somewhat less effect than the red ones. In addition there appears to be some difference in the type of reaction exhibited by the two varieties. New Ecke White appears to be reduced in height in a fairly regular step-wise manner at each increasing concentration applied, whereas Ecke White did not show this effect. See Figures 6A and B. With the latter variety, the 1 pint and 1 quart rates of application resulted in plants of essentially the same height and the 1½, 2 and 2½ quart rates resulted in another grouping of shorter height. The exact significance of this observation is not completely apparent at the moment.

The effect of the chemical was quite similar on all of the red varieties. Even the lowest concentration dwarfed the plants quite well except in the case of Improved Albert Ecke. See Figures 6 C,D,E,F,G.

TABLE 5. HEIGHT OF 8 POINSETTIA VARIETIES AT THE TIME OF TREATMENT.

Variety	Height	Variety	Height
	in.		in.
Ecke Pink	13.7	Barbara Ecke Supreme	4.9
Ecke White	10.9	Indianapolis	4.9
Imp. Albert Ecke	9.8	# 17	4.8
New Ecke White	7.4	# 3, Elisabeth Ecke	4.2

Relative Sensitivity of Varieties

The 8 varieties grown were ranked in order of sensitivity to the growth retardant, based on the percentage of growth reduction that occurred in the treated plants after treatment. The most sensitive variety (showing the greatest percentage reduction in growth) was Indianapolis, followed in order by #17, #3, now named Elisabeth Ecke, Barbara Ecke Supreme, Improved Albert Ecke, New Ecke White, Ecke White, and Ecke Pink.

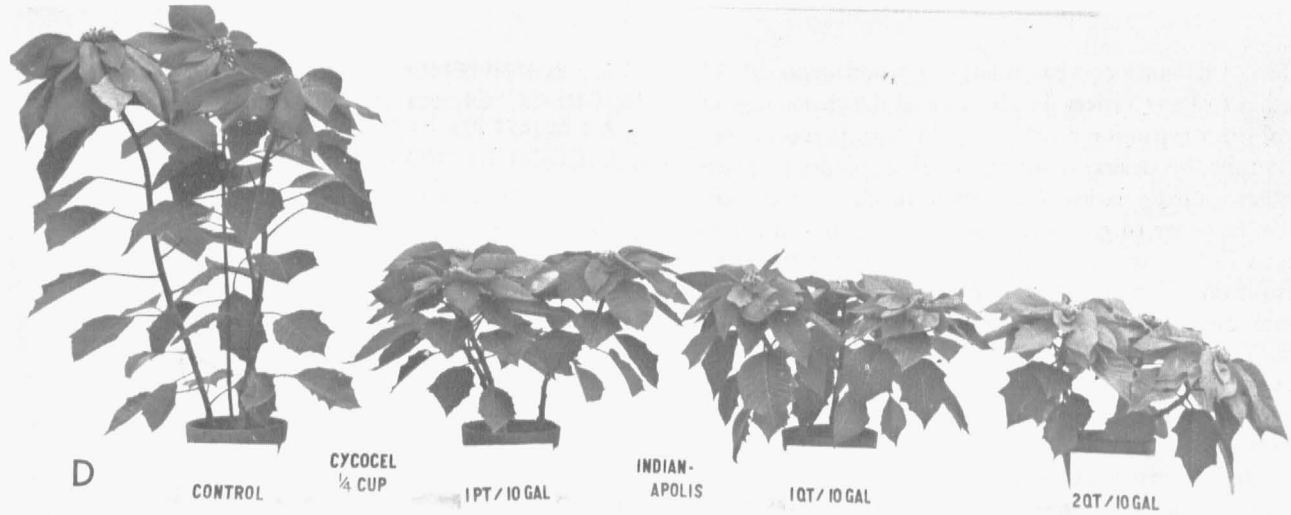
Effects of Treatment on Bract Diameter and Date of Anthesis

Cycocel treatment definitely reduces total diameter of the bracts, but results in more compact bracts, particularly attractive to most retail customers. Red varieties on which bract diameters on the untreated plants measured 12 to 15 inches at maturity showed a 2 to 3 inch reduction in diameter on the treated plants. See Figure 1. In general, the white varieties showed somewhat greater reduction in bract size than did the reds and at the highest concentrttions of growth retardant displayed severe bract crinkle and epinastic curvature of the leaves, which would have made them undesirable for sale. See Figure 2. The pink variety showed only slight reduction in size of bracts and no noticeable crinkle at any concentration. There appeared to be no very great

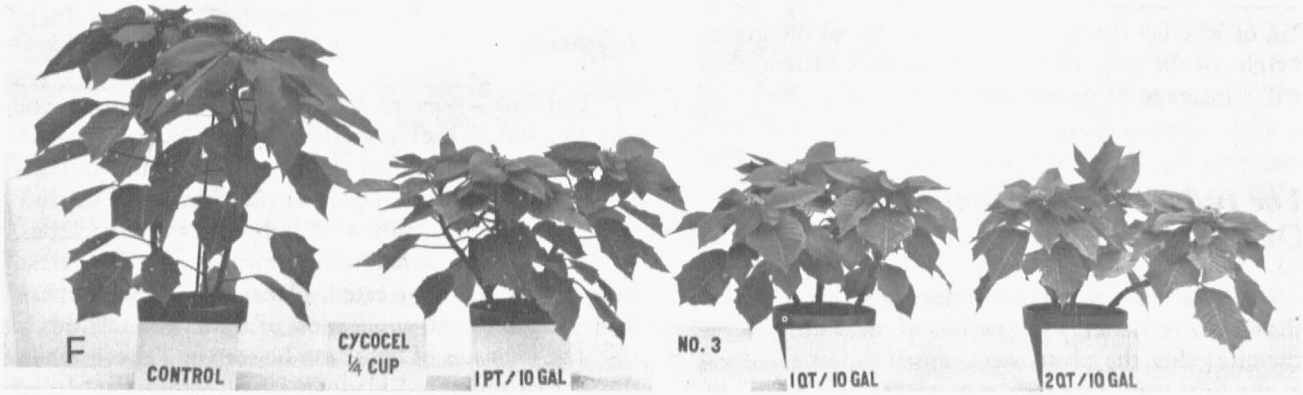
TABLE 6. HEIGHT AT ANTHESIS OF SEVERAL POINSETTIA VARIETIES TREATED WITH CYCOCEL, 1 QUART/10 GALLONS; 2 FLUID OUNCES PER PLANT. PROPAGATED 8/6/62.

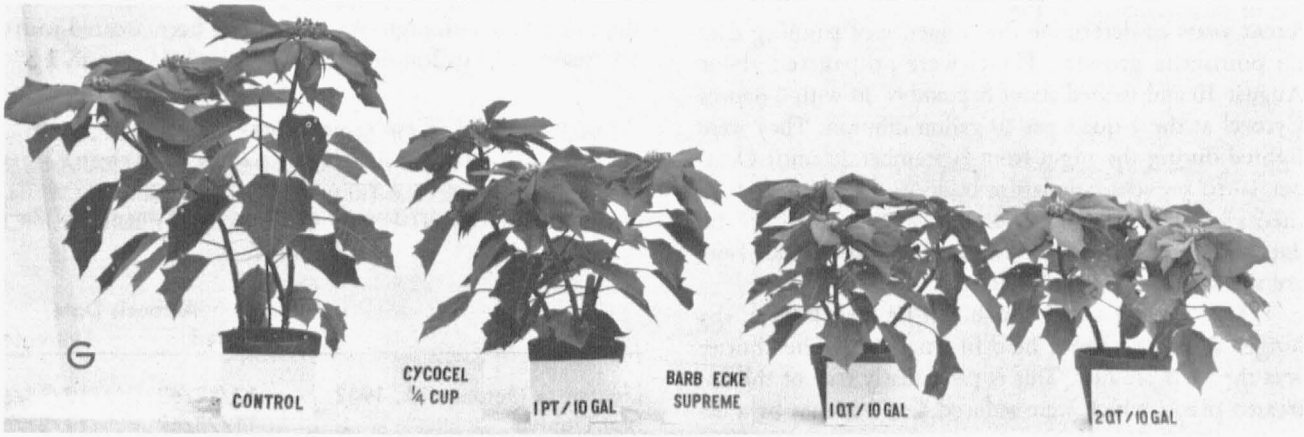
Variety	Concentration					
	0	1 pt.	1 qt.	1½ qt.	2 qt.	2½ qt.
	in.	in.	in.	in.	in.	in.
Indianapolis	23.6	10.9	10.8	10.6	10.7	10.4
# 17	26.3	13.5	12.1	10.7	10.8	10.9
# 3	16.0	9.2	8.2	7.5	7.6	7.2
Barbara Ecke Supreme	21.8	12.6	11.7	10.6	10.2	9.3
Improved Albert Ecke	32.9	21.6	19.7	17.5	16.5	16.6
New Ecke White	25.7	18.3	15.6	13.8	14.2	13.7
Ecke White	24.3	20.4	20.2	16.3	14.8	15.7
Ecke Pink	31.0	30.7	27.9	25.9	24.0	25.2

Fig. 6. Varietal responses of seven poinsettia varieties to three Cycocel concentrations applied at a rate of ¼ cup per 3-inch pot on September 17. Propagated, August 6, 1962. A. Ecke White. B. Improved Ecke White. C. Improved Albert Ecke. D. Indianapolis. E. #17. F. #3, Elisabeth Ecke. G. Barbara Ecke Supreme.


D
CONTROL
CYCOCEL
¼ CUP
1 PT / 10 GAL
INDIAN-
APOLIS
1 QT / 10 GAL
2 QT / 10 GAL


E
CONTROL
CYCOCEL
¼ CUP
1 PT / 10 GAL
NO. 17
1 QT / 10 GAL
2 QT / 10 GAL


F
CONTROL
CYCOCEL
¼ CUP
1 PT / 10 GAL
NO. 3
1 QT / 10 GAL
2 QT / 10 GAL


G
CONTROL
CYCOCEL
¼ CUP
1 PT / 10 GAL
BARB ECKE
SUPREME
1 QT / 10 GAL
2 QT / 10 GAL

effect of different concentrations of Cycocel upon date of anthesis of any variety, but because of the slower rate of final bract expansion on the treated plants, it appears that it might be desirable for the treated plants to reach anthesis a little earlier than previously considered desirable, in order to give sufficient time for the bracts to reach full or nearly full development before sale. Our results on this point are somewhat at variance with those from some of the other experiment stations, but since this same effect has been brought to our attention by several commercial growers in this area, we feel that others should be aware of this possible pitfall when using chemical growth retardants.

In summary, we noted that either the 1 pint or 1 quart concentration produced good dwarfing on Barbara Ecke Supreme, #17, and #3 (Elisabeth Ecke). The 1 pint concentration was adequate for dwarfing Indianapolis, while Improved Albert Ecke responded best to 1 or 1½ quarts of Cycocel in 10 gallons of water.

Ecke White was not adequately dwarfed by the two lowest concentrations used, but at the three higher ones showed much leaf crinkle, reduced bract size, and some foliar chlorosis. Thus it appears that the margin of safety with this variety is somewhat restricted. New Ecke White showed good dwarfing at the 1 quart concentration without severe crinkle or any undesirable foliar symptoms.

Ecke Pink was not adequately dwarfed at any concentration tried, and only at the two highest concentrations did it show any of the dark green coloring of the foliage considered typical in plants which respond to Cycocel. Whether it is inately insensitive to the chemical, or whether the lack of effect was due to the greater height of the original plants at the time of treatment still remains to be determined.

The Influence of Panning Date on the Dwarfing Response

Lindstrom[7] has reported that treated poinsettias showed a tendency to grow out of the effect of the chemical after the plants were shifted to untreated soil in the final pans. Our tests were carried out in two different years to determine the influence of panning date on poinsettia growth. Plants were propagated about August 10 and treated about September 20 with 2 ounces Cycocel at the 1 quart per 10 gallon dilution. They were lighted during the night from September 20 until October 10 to prevent premature budding. Short day treatments began October 10. Plants were panned on the dates indicated in Table 7. The final heights of the plants are shown in the same Table.

The general trend which can be seen is that the longer the plants were held in small pots, the shorter was the final product. This is particularly true of the untreated plants which were reduced 4 to 6 inches by a delay in panning of one month. The effect was not so pronounced in the treated plants which were reduced only about 3 inches by the month delay in panning. Generally results were the same for both years. The 1961 group, however, showed a decrease in height in the group panned on October 10 (the day short day treatment began), but after bracketing this date more closely in 1962, the same result did not occur the second year. From this it would appear that cuttings treated in September and panned after October 1 did not show any tendency to stretch away from the effect of the chemical at the tested concentration.

[7]Lindstrom, 1961, op. cit.

TABLE 7. INFLUENCE OF PANNING DATE ON THE FINAL HEIGHT OF POINSETTIAS TREATED AND UNTREATED WITH A 1 QUART PER 10 GALLON CONCENTRATION OF CYCOCEL IN TWO DIFFERENT GROWING SEASONS.

	Untreated		Treated	
Date of Panning	1961	1962	1961	1962
	in.	in.	in.	in.
10/1/62	21.1	20.9	12.7	13.1
10/4/62		21.9		11.8
10/7/62		20.3		12.6
10/10/62	14.2	19.9	9.1	11.8
10/13/62		18.5		10.8
10/16/62		17.3		10.4
10/20/62	16.0	15.4	10.0	10.5
10/30/62	17.0	15.1	10.0	10.7

Lighting

Lighting is done to delay anthesis to Christmas time so that a longer lasting product results. None of our experiments were designed specifically to study the influence of lighting on response to the chemical, but since certain groups of plants were lighted for other reasons, we were able to gather some information of interest. Both treated and untreated plants have their anthesis date delayed by the application of light.

The influence of lights can be seen in Table 8, which shows that unlighted plants reached anthesis at almost the same time although one group had been treated with a 1 quart to 10 gallon dilution of Cycocel, ¼ cup to a 3″

TABLE 8. EFFECT OF SUPPLEMENTAL LIGHTING TO OCTOBER 10 ON THE ANTHESIS DATE OF BARBARA ECKE SUPREME POINSETTIA TREATED AND UNTREATED WITH CYCOCEL, 1 QUART PER 10 GALLONS, 2 FLUID OUNCES PER PLANT.

	Anthesis Date	
	Treated	Untreated
Lighted to October 10, 1962	12/22/62	12/15/62
Not Lighted	11/23/62	11/21/62

pot. Those lighted showed a week's difference in the date of anthesis, so that the treated plants did not reach anthesis until nearly Christmas. This fact, coupled with a slowing down in the rate of bract expansion resulted in underdeveloped plants for Christmas. Although the untreated plants did not reach anthesis early, their bracts developed normally and therefore were salable by Christmas time. If growth retardants are to be used successfully, it may be necessary to make some alterations in growing practice, depending upon plant response in the local situation.

Temperature

Treated plants may also be influenced by temperature with more pronounced effects than untreated plants. We have noticed that plants growing in cool areas of the greenhouse had a more pronounced delay in bract development than those growing in warmer areas. This is also true of untreated plants, but generally the effect is not so noticeable. It is possible that increased temperatures may help in the expansion of delayed bracts if the problem is recognized early enough.

Summary

1. Cycocel has been shown to be very effective in reducing the height of poinsettias, producing darker green leaves, sturdier stems, and more compact bracts.

2. Greatest effectiveness was obtained by application of a liquid drench to the rooted cutting just as it was beginning vigorous growth.

3. Generally, August propagations were the ones which benefited most from Cycocel application.

4. The propagation method did not influence the effectiveness of the chemical and while untreated plants varied in height under different propagation methods, treated plants tended to be more uniform.

5. All the red varieties tested showed a similar response to applications of Cycocel, although there were slight variations between varieties with Indianapolis being the most sensitive and Improved Albert Ecke the least sensitive.

6. Either the 1 pint or 1 quart per 10 gallon concentration produced good dwarfing on Barbara Ecke Supreme, #17, and Elisabeth Ecke. The 1 pint concentration was quite adequate for dwarfing Indianapolis, while Improved Albert Ecke responded best to the concentration of 1 quart or 1½ quarts in 10 gallons of water.

7. Anthesis date was delayed up to 1 week in the red varieties, but this could not be considered the point of optimum salable maturity since bract development was considerably slowed down.

8. Ecke White was not adequately dwarfed by the 1 pint or 1 quart concentration, but showed much crinkle and reduced bract size at the 3 higher concentrations at which it was sufficiently reduced in height. Ecke White showed considerable foliar chlorosis not prevalent in any of the other varieties.

9. New Ecke White showed good dwarfing at the 1 quart concentration without severe crinkle or any undesirable foliar symptoms.

10. Ecke Pink was not adequately dwarfed at any concentration and only at the 2 and 2½ quart treatments did it show darkening of the foliage, which was evident in the treated plants of all the other varieties tested.

11. Best results were obtained by applying ¼ cup of the selected Cycocel concentration to the 3″ pot about 1 month after the date cuttings were taken but treatments after the third week of September usually showed increased bract delay and crinkle.

12. Panning date through October did not influence the effectiveness of the chemical, but both treated and untreated plants were shorter when panned at the end of October than those panned in early October.

13. Plants lighted until October 10 did not have good bract development by Christmas and therefore there is some indication that lighting practices or growing temperatures might have to be altered when the chemical is used.

14. Cool temperatures (below 60° at night) tend to accentuate bract crinkle and delay in bract development.

15. Growth retardants can be an aid to the grower, but he must first test them under his own situation so he will be able to use them wisely and beneficially in his own growing operation.