periment were hairy bittercress (*Cardamine hirsuta* L.), spotted spurge (*Chamaesyce maculata* L.), prostrate spurge (*Chamaesyce supina* Raf.) and garden spurge (*Chamaesyce hirta* L.).

Weed dry weight was affected by medium. There was a significant interaction between the type of medium and the use of screening (Table 3). On unscreened treatments, weed dry weight was greater on BPS than GR. Screening reduced weed dry weight on BPS, but had no effect on weed dry weight on GR.

Weed number was also affected by medium, and there was a significant interaction between the type of medium and use of screening (Table 3). On unscreened treatments, number of weeds was greater on GR than on BPS. Screening reduced the number of weeds on GR, but had no effect on number of weeds on BPS.

Weed growth ratings were greater on BPS than on GR, whether or not they had been screened (Table 3). Screening reduced weed growth ratings on BPS and GR compared to the unscreened treatments.

Weed growth and development were different in GR and BPS. BPS had a greater weed dry weight and weed rating than GR, but GR had a larger number of weeds. Average weight per weed was thus very small on GR compared to that on BPS. The small individual weed weight on GR was accompanied by a cessation of weed development beyond the first true leaf stage and a distinct reddening of the leaves. The weeds did not develop further but did not die during the experiment.

The mechanism of inhibition of weed development on GR is not yet clear. Soluble salt and pH levels in GR were well within acceptable biological ranges (2), and no surface salt accumulations were present. Water stress or nutrient deficiency in the upper layer of the GR medium are possible explanations for the weed inhibition. In previous work, rooted cuttings of woody plants were not inhibited on GR, and exhibited no deficiency or toxicity symptoms (5). However, weed growth in the same containers was observed to be reduced. Further work is being conducted to determine the activity, mechanism, and limitations of the GR inhibition on plant development, especially seed germination and rooting.

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IRRIGATION INTERVAL AND GROWTH RETARDANTS AFFECT POINSETTIA DEVELOPMENT[1]

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Additional index words. Euphorbia pulcherrima, ancymidol, chlormequat, drought stress.

Abstract. **A factorial experiment with 3 chemical treatments and 3 irrigation intervals was imposed on** Euphorbia pulcherrima **Wild. cv. Annette Hegg Dark Red. Chemicals were ancymidol (0.5 mg per pot drench), chloremequat (707 mg per pot drench), and untreated. Plants were irrigated when evapotranspiration amounted to 175, 225, or 275 g as determined by weight change. Plants were then provided sufficient water to replace the amount lost. Bract, leaf and total shoot dry weights were reduced by increasing irrigation interval for plants not treated with a growth retardant. Growth retardants reduced the dry weights for well-watered plants (175 g treatment). Plant height was reduced by chemical treatment and increased irrigation interval. Total evapotranspiration was reduced by 20% in ancymidol treated plants compared to controls. Irrigation interval had little effect on total evapotranspiration.**

Despite their importance to the floriculture industry and the present concern for water conservation, relatively little is known about poinsettia water relations and response to drought stress. White and Holcomb (4) compared drought stress and growth retardants for height control and found control was more easily achieved with the chemicals. Also, they reported that irrigation intervals, which caused wilting, during the period from planting to bract color reduced inflorescence diameter 20% and plant height 45%. Barrett and Nell (1) indicated that the growth retardants ancymidol and chlormequat reduced whole plant transpiration rates because of reductions in leaf area. Gilbertz et al. (2) studied the effects of drought stress on final crop quality by withholding water at different stages of crop development. They observed that water potentials of −13 to −11 bars caused leaf abscission in reproductive plants but not in younger vegetative plants. Plant height and time to flower were affected most by drought prior to bract coloration but inflorescence size was reduced more by stress after coloration.

This research evaluated the influence of ancymidol and chlormequat and increased irrigation frequency on poinsettia quality and total water use.

Materials and Methods

Poinsettias 'Annette Hegg Dark Red' were obtained from commercial sources as rooted cuttings, potted 1 per 15-cm pot using a Florida peat; perlite; sand (1:1:1) medium,

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placed in a glass greenhouse on September 6, and pinched to 4 nodes 2 wk later. Non-inductive photoperiods were provided by dark interruption between 2200 and 0200 hr until October 4 when inductive photoperiods were imposed by covering plants from 1700 to 0730 hr.

A factorial experiment with 3 chemical treatments and 3 irrigation frequencies was established in a randomized complete block design with 4 replications and 6 plants per experimental unit. Chemicals were ancymidol as a 0.5 mg per pot drench, chloremequat as a 707 mg per pot drench, and untreated. Irrigation intervals depended on rate of evapotranspiration. Plants were irrigated when weight change indicated 175, 225, or 275 g of water had been lost. Then plants were provided sufficient water to replace the amount lost. Irrigation water contained fertilizer at 200, 87, and 166 ppm of N, P, and K, respectively. Plants were irrigated with twice as much water as needed once per 10 days to provide leaching. Sixty-eight days after start of short days plant heights were measured and each plant divided into bracts, leaves, and stems. Leaf area and dry weight of each plant portion was determined. Total shoot dry weight was calculated by adding dry weights of each plant portion.

Results and Discussion

Irrigation based on evapotranspiration resulted in average time between waterings of 2.5, 3.2, and 4.3 days for the 175, 225, and 275 g water loss levels, respectively. Time between waterings decreased with increasing plant size during the experiment. The plants in the 175 g treatment remained well-watered throughout the experiment. Plants in the 225 g treatment did not wilt between irrigations but the medium surface did become dry. Plants in the 275 g treatment exhibited midday wilt between irrigations.

Total shoot dry weight (Table 1), bract dry weight (Table 2), and total leaf dry weight (Table 3) data indicate an interaction between growth retardant effects and irrigation interval effects. Generally, ancymidol and chlormequat caused a considerable reduction in the dry weights of these plant parts at the most frequent irrigation interval (175 g). However, the chemicals had little effect at the longest irrigation interval (275 g). Decreasing the irrigation frequency reduced dry weights of these plant parts in non-treated plants, but irrigation interval had little effect on growth retardant treated plants.

Table 1. Growth retardant and irrigation effects on total shoot dry weight.

Chemical	Shoot dry weight (g)[z]		
	Irrigation[y]		
	175	225	275
Control	22	20	14
Ancymidol	11	10	12
Chlormequat	15	14	14

[z]Separation of any 2 means by Tukey's HSD, 5% level = 4; 1% level = 5.
[y]Amount (g) of evapotranspiration between irrigations.

Table 2. Growth retardant and irrigation effects on bract dry weight.

Chemical	Bract dry weight (g)[z]		
	Irrigation[y]		
	175	225	275
Control	4.6	4.6	3.3
Ancymidol	3.1	2.7	3.1
Chlormequat	4.0	4.1	3.3

[z]Separtion of any 2 means by Tukey's HSD, 5% level = 0.9; 1% level = 1.2.
[y]Amonut (g) of evapotranspiration between irrigations.

Table 3. Growth retardant and irrigation interval effects on dry weight of leaves.

Chemical	Leaf dry weight (g)[z]		
	Irrigation[y]		
	175	225	275
Control	5.3	4.6	3.3
Ancymidol	3.9	3.2	3.7
Chlormequat	3.9	3.8	3.8

[z]Separation of any 2 means by Tukey's HSD, 5% level = 1.0; 1% level = 1.3.
[y]Amount (g) of evapotranspiration between irrigations.

Reduction of bract size for well-watered plants by the growth retardants has been reported for ancymidol drench applications (4). Gilbertz et al. (2) found that drought stress reduced bract size when the stress occurred during bract development. Ancymidol and chlormequat treatments did not reduce leaf dry weights in a previous study (1). However, vegetative single stem plants were used in that study and the experiments were terminated 4 wk after treatment. Total shoot dry weights were reduced by the growth retardants in the previous study as in this one, but the effect was due to reduced stem dry weight not leaf dry weight.

Growth retardants and irrigation interval did not have interactive effects on plant height, leaf area, or total evapotranspiration. Average plant height was 26, 23, and 22 cm for 175, 225, and 275 g irrigation interval, respectively. This reduction in plant height due to drought stress is similar to the response reported in other poinsettia studies (2, 4). Ancymidol and chlormequat resulted in reduction of final height at all irrigation intervals (Table 4). Leaf area was not greatly affected by irrigation interval, but was reduced by growth retardant application (Table 4), as previously observed (1). The average time to anthesis from start of short days was 57 days and was not significantly affected by growth retardants or irrigation interval.

Table 4. Growth retardant effects on plant height, leaf area and total water applied.

Chemical	Height	Leaf area (cm^2)	Total water (liters)
Control	32	1059	5.1
Ancymidol	16	817	4.0
Chlormequat	23	955	4.9
Dunnett's, 1% level	4	178	0.8

Irrigation interval had little effect on total evapotranspiration, but ancymidol caused an approximate 20 percent reduction compared to untreated plants (Table 4). This was probably due to effects on transpiration since medium surface areas were the same and ancymidol has been reported to reduce transpiration (1). Total irrigation water needed to produce a chrysanthemum crop was observed to be reduced by ancymidol (3).

This study indicates that drought stress resulting from long intervals between irrigations can reduce poinsettia quality as indicated by reduction in bract and shoot dry weight (Tables 1 and 2). This effect is reduced in crops treated with a growth retardant which suggests a beneficial use for these chemicals on cultivars which do not require them for height control.

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A DIFFERENT CONCEPT OF PLANT PRODUCTION IN PLASTIC BAGS[1]

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Additional index words. poly-pot-pack (PPP), *Dieffenbachia maculata, Ficus benjamina.*

Abstract. **A technique of plant production in a prepackaged unit of peat-lite mix or similar growing medium, referred to as the poly-pot-pack (PPP), is described. Emphasis is given to conservation of moisture, fertilizer, pesticides, plastic, cardboard boxes, paper sleeves and fuel through use of the PPP. Sanitation and ease of handling features of the PPP and PPP-grown plants are also mentioned. Facts suggest the PPP is most likely to find application with high value crops which require long distance shipping.**

Nurserymen and florists in the United States have grown plants in a variety of containers made from different materials including: wood, clay, steel, plastic (solid, foam and film), asphalt impregnated paper, peat, wood composition and paper composition. Most containers used by horticulturists are rigid or semi-rigid to confine a given volume of root medium to a specific shape and support the plant during its development. The rigid container has been the standard in the nursery industry until recently when plastic film bags have been used for commercial crop production.

In 1966 Boodley and Sheldrake (5) reported that cut chrysanthemums could be grown in 4- or 6-inch diameter polyethylene film tubes filled with Cornell peat-lite mixes and perforated in the top only for planting. In 1967 Henley (6) described growing cut chrysanthemums in peat-lite mixes contained in mats, 3.5 x 38 x 60 inches, fabricated from 4-mil, black polyethylene film perforated on the top for planting and the bottom for drainage. Open-top plastic bags for growing seedlings and finished plants have been studied by other investigators (8, 9, 10, 11, 13). During the past few years there has been renewed interest in plant production in horizontal, media-filled plastic tubes (12).

The idea of a single unit as medium container is not new to horticulturists involved with propagation of small plants. Products such as Jiffy-7®s, Jiffy-9®s, BR-8® blocks, Kys-Kubes, Rootcubes® and Horticubes® have been used successfully for some time. The primary differences in the technique described in this paper are: the growing medium in the PPP is loose, it may range from less than a pint to several gallons and the finshed plant may be several inches to several feet in height.

The objective of this paper is to describe a different container-media system in which a specific volume of clean root medium is sealed within a plastic film package made to fit the dimensions of an anchorage container during the growing process. The packaged medium will remain clean during storage and requires no "soil" handling during planting. As proposed, the package is perforated below for drainage and above for insertion of seed, seedling, cutting (unrooted or rooted) or air layer. Prior to insertion of the propagule, the package is placed in an anchorage pot which forms the root ball and supports of the growing plant. The finished plant, with attached root medium package, is removed from the anchorage container, packed and shipped. This unit will be referred to as the poly-pot-pack (PPP).

The PPP-grown plant should have a well developed root system within the package and a top matching industry standards (2) for containers 1 to 2 sizes larger than the PPP. Such a unit requires additional support considerations, such as staking or guying in shadehouses or outside where wind is a factor, and more frequent irrigations during the final stages of production. Since most of the root medium surface, including the top, is covered with polyethylene, PPP-grown plants are excellent candidates for drip or modified capillary mat.

The finished PPP-grown plant can be plunged into an ornamental container of the same inside dimensions as the root ball or larger containers, using extra root medium, either peat-lite mixes or hydroponic clay particles, placed around the package. Several vertical cuts running the length of the PPP sidewall will permit extension of roots to medium outside the film. Use of PPP-grown plants actually eliminates the need for discarding the production pot, which is frequently done, by the northern wholesaler, retailer or interiorscaper.

Advantages of the PPP

Experiments have shown that *Dieffenbachia maculata* (Lodd.) G. Don growth in the PPP is equivalent or greater than plants grown in conventional pots (Table 1). Non-published research findings with PPP-grown *Ficus benjamina* L. indicate comparable growth can be expected in both pot-grown and PPP-grown plants.

A study using *Dieffenbachia maculata* in 6-inch pots and PPPs of clear and black 4-mil polyethylene demonstrated that the PPP saved approximately 40% of the moisture re-

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