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Hydrophilic Polymer and Wetting Agent Had Limited Effect on Growth and Postproduction Performance of Poinsettia

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ABSTRACT

Rooted poinsettia *(Euphorbia pulcherrima* Willd. ex Klotzsch) 'Gutbier V-14' shoot tip cuttings were planted singly in two-liter pots. The four treatments were 1.) 450 g base medium per pot (control); 2.) 450 g base medium and 6 g dry Supersorb C; 3.) 450 g base medium and 372 g of fully hydrated Supersorb C (6 g dry); and 4.) 540 g base medium which accounted for the additional volume that the hydrated Supersorb C occupied. Plants were grown in a greenhouse and six replications were harvested for recording growth data. The remaining eight replications were moved into a postharvest room receiving 25 umol•m^{-2}•s^{-1} photosynthetic photon flux following an irrigation with or without a wetting agent, Aqua-Gro, and evaluated after 13 days. Air temperature ranged between 16 and 25C. For the greenhouse production phase, Supersorb C and the amount of medium had no effect on plant quality at harvest. Plants had low dry weight when produced in medium amended with Supersorb C. Increasing base medium volume from 450 g to 540 g increased the size of large bracts and number of small bracts. Overall plant quality in an interior environment 13 days after the last irrigation was not affected by Supersorb C or the reapplication of the wetting agent. The wetting agent did not increase the water holding capacity of the medium. There were few or no meaningful differences in the concentration of major and minor elements in the bracts among plants in various treatments.

RESUMEN

Esquejes aplicales enraizados de nochebuena (*Euphorbia pulcherrima* Willd. ex Klotzsch) var. 'Gutbier V-14' fueron plantados individualmente en macetas de 2 litros. Los cuatro tratamientos fueron 1.) 450 g de medio base por maceta (control); 2.) 450 g de medio base y 6 g de Supersorb seco C ; 3.) 450 g de medio base y 372 g de Supersorb C completamente hidratado (6 g seco); y 4.) 540 g de medio base el cual se consideró por el volumen adicional que ocupó el Supersorb C hidratado. Las plantas crecieron en un invernadero y se cosecharon seis repeticiones para registrar los datos del crecimiento. Las ocho repeticiones restantes se trasladaron a un cuarto de postcosecha donde recivieron un flujo de fotones fotosintéticos de 25 umol•m^{-2}•s^{-1} y riego con o sin un agente humectante (Aqua-Gro) y fueron evaluadas después de 13 días. Las temperaturas del aire variaron entre 16 y 25° C. En la fase de producción en el invernadero, ni el Supersorb C o la cantidad del medio basal tuvieron efecto sobre la calidad de la planta en el momento de la cosecha. Las plantas tuvieron pesos secos bajos cuando crecieron en un medio modificado con Supersorb C. El incremento en el volumen del medio basal de 450 g a 540 g aumentó el tanaño de las bracteas grandes y el número de las bracteas pequeñas. La calidad general de la planta mantenida en un ambiente interior 13 días después de la última irrigación no fué afectada por el Supersorb C o la reaplicación del agente humenctante. El agente humectante no incrementó la capacidad de retención del agua del medio. Hubo pocas o insignificantes diferencias en la concentración de elementos mayores y menores en las bracteas entre las plantas de los diferentes tratamientos.

Improving the quality of potted, greenhouse-grown poinsettia and maintaining its interior quality are a never ending effort by producers. Reports show that incorporation of hydrophilic gel (hydrogel) improves plant growth of *Chlorophytum comosum* (Wang and Boogher, 1987) and *Ligustrum lucidum* 'Compactum' at low fertility (Taylor and Halfacre, 1986). *Ligustrum lucidum* 'Compactum' had higher tissue N and K, while concentrations of some divalent ions were lower when grown in hydrogel amended medium (Taylor and Halfacre, 1986).

It has been demonstrated that the amount of water being held in a given size container can be increased by the use of hydrogel in the medium (Elliott, 1992; Wang and Gregg, 1990) or by a wetting agent (Elliott, 1992). This additional water was shown to reduce irrigation frequency (Taylor and Halfacre, 1986) or delay the onset of wilting (Gehring and Lewis, 1980) of container-grown plants.

The objective of this research was to determine the effect of hydrogel and a wetting agent on poinsettia growth in a greenhouse and on its performance in an interior environment.

MATERIALS AND METHODS

Rooted poinsettia 'Gutbier V-14' shoot tip cuttings were planted singly in 2-liter pots on 14 Sept. 1990. The base potting medium consisted of two parts sphagnum peat moss, one part composted pine bark, and one part perlite (by volume) amended with 3.5 kg dolomitic lime and 1 kg Micromax per m^{-3} medium and the granular Aqua-Gro wetting agent at manufacturer's recommended rate. The four treatments were 1) 450 g base medium per pot (control); 2) 450 g base medium and 6 g dry Supersorb C; 3) 450 g base medium and 372 g of fully hydrated Supersorb C; and 4) 540 base medium. Supersorb C was hydrated overnight

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in water containing 1.5 g·liter^{-1} 20 N-4.6 P-16.6 K water soluble fertilizer. The 372 g hydrated Supersorb C added to treatment 3 was equivalent to 6 g dry material used in treatment 2. The 540 g medium in the fourth treatment was chosen to represent 20% over the volume of the control and equivalent to the volume in treatment 3. There were two adjacent pots of the same treatment in each of the 14 replications and treatments were arranged in a randomized complete block design.

Immediately following potting, plants were placed under long photoperiod conditions furnished by night interruption with incandescent lighting between 2200 HR and 0200 HR the next morning until 18 Oct. Plants were given a hard pinch to leave 6-7 leaves (mostly 6) on 1 Oct. All plants were irrigated with water containing 1.5 g·liter^{-1} of the above water soluble fertilizer (providing 300 ppm N) with 2 mg·liter^{-1} ammonium molybdate when those in treatment 1 (450 g base medium) needed water. This stage of irrigation was chosen in expectation that plants in other media would undergo less water stress. Calcium nitrate at a rate of 0.8 g·liter^{-1} was used at every fourth irrigation. A mixture of 0.12 g $MnSO_4$, 2.0 g $MgSO_4$ and 80 mg ammonium molybdate per liter was sprayed to the foliage on 18 Oct. and again on 5 Nov. Bracts started to develop color around 20 Nov. and fertilizer concentration was dropped to 1.0 g·liter^{-1}. Fertilization was discontinued after 1 Dec., except on 13 Dec. when plants were given 0.5 g·liter^{-1} water soluble fertilizer. All irrigations were applied by watering rings lying on the medium surface. Banrot fungicide was applied on 9 Nov. and 28 Nov. as soil drenches.

On 20 Dec., plant height and width (the average of two measurements at perpendicular angles), number of lateral shoots, size of the inflorescence, number of large and small bracts, area of the largest bract, stem length and leaf number on the leading shoot, and numer of leaves with necrosis were recorded on all plants of six replications. Shoots and roots were collected for dry weight measurements. Bracts from the leading shoot in one pot of each treatment were collected for tissue analysis from each replication.

One of the two plants in each treatment of the remaining eight replications was irrigated with water containing Aqua-Gro at the manufacturer's recommended rate, whereas the second plant received water only. They were then transferred to a postharvest facility under 25 umol•s^{-1}•m^{-2} photosynthetic photon flux. Air temperatures ranged between 16 and 25C. Relative humidity was not controlled and fluctuated between 40% and 90%. Plants were evaluated for leaf abscission and overall grade after 13 days without additional water being added. Shoots were clipped at the soil line and pots were weighed and reweighed after being watered four times to reach full hydration for estimating the amounts of water being used. The volume of medium was determined by laying a thin plastic film on top of the medium and estimating the volume between medium surface and pot rim by water replacement technique. This volume was subtracted from two liters to obtain medium volume.

RESULTS AND DISCUSSION

Visual differences among plants in various treatments were not apparent at the end of greenhouse phase as indicated by similar heights and widths (Table 1a). Plants in medium with dry Supersorb incorporated had slightly more lateral shoots than those in medium with fully hydrated Supersorb. A previous study had shown that using a fully hydrated polyacrylamide to replace 20% of the base medium promoted the growth of spider plants by 50% (Wang and Boogher, 1987) but was not compared to incorporating the dry material in the medium.

Number of lateral shoots and large bracts and diameter of inflorescence were not affected by Supersorb, although method of incorporation affected the former two variables (Table 1a). Flower initiation was not affected by hydrogel since plants in all treatments had similar numbers of green leaves (Table 1b). Increasing the volume of base medium from 450 to 540 g increased bract size and numbers of small bracts. Plants in media with Supersorb, regardless of how it was incorporated, had less shoot dry weight than those in the base medium. In another study, ligustrum grown in hydrogel amended medium also had smaller dry weight when fertilized at the recommended rate (Taylor and Halfacre, 1986). Root dry weight (Table 1b) was not affected by treatment, suggesting that hydrogel had no beneficial effect on root growth. The potential additional nutrients supplied by soaking the hydrogel in a nutrient solution before incorporating did not affect plant growth. Svenson (1993) showed that a polyacrylamide containing fertilizer in its matrix increased plant growth by acting as a slow release fertilizer. However, the polyacrylamide itself did not render any beneficial effect on plant growth. Although the medium was dry after 13 days without additional water under interior conditions, visual plant quality was not affected by Supersorb or Aqua-Gro (Table 2).

Table 1a. Effect of Supersorb C on pot-grown poinsettia produced in a greenhouse.[z]

Amount medium (g/pot)	Supersorb C (g/pot)	Height (cm)	Width (cm)	No. lateral shoots	Inflorescence dia (cm)	No. large bracts	No. small bracts	Bract size (cm^2)
450	0	25.5 a	47.9 a	6.3 ab	37.1 ab	8.3 ab	6.0 c	130 b
450	6	24.9 a	44.7 a	6.7 a	35.5 b	7.7 b	7.0 bc	142 ab
450	6H[y]	25.0 a	46.3 a	6.1 b	35.8 ab	8.5 a	8.2 b	128 b
540	0	25.3 a	48.1 a	6.3 ab	38.0 a	8.3 ab	10.9 a	146 a

[z]Means in each column followed by different letters are significantly different at $\alpha = 0.05$, Duncon's multiple range test.
[y]Six g of Supersorb C, fully hydrated.

Table 1b. Effect of Supersorb C on pot-grown poinsettia produced in a greenhouse[z].

Amount medium (g/pot)	Supersorb C (g/pot)	Dry wt (g)		Stem length (cm)	No. green leaves
		Shoot	Root		
450	0	25.1 a	3.1 a	24.4 a	7.3 a
450	6	21.1 b	2.3 a	22.0 ab	6.9 a
450	6H[y]	21.5 b	2.5 a	20.9 b	6.4 a
540	0	25.4 a	2.2 a	23.6 ab	6.8 a

[z]Means in each column followed by different letters are significantly different at $\alpha = 0.05$, Duncon's multiple range test.
[y]Six g of Supersorb C, fully hydrated.

There were apparent differences in medium volume. Pots with 450 g base medium had the smallest volume and weight, whereas those receiving hydrated Supersorb C or with 540 g base medium were similar and had the largest volume (Table 2). Using the hydrated Supersorb C instead of the dry material resulted in larger medium volume while keeping the maximum pot weight similar. Therefore, using the hydrated Supersorb C may have resulted in more pore space in the medium than incorporating the dry hydrogel. The Aqua-Gro wetting agent did not affect plant quality, maximum pot weight, or pot weight after 13 days.

N by a container medium with the incorporation of a hydrogel (Henderson and Hensley, 1985). Phosphorus (Table 3a), Cu and Mo contents (Table 3b) were lower in the two treatments with the highest medium volume (450 base medium with hydrated hydrogel and 540 base medium). There was no difference in K, Ca, Fe, Na and Zn concentrations in the bracts. Boron concentration was the highest (22 mg/kg) in leaves grown in the 540 g base medium, wereas Al content was the highest (77 mg/kg) in bracts of the control plants. It was previously reported that leaf tissue N and K levels of plants grown in hydrogel-amended

Table 2. Poinsettia plant quality, water consumption and medium characteristics after being held 13 days at 25 umol•m^{-2}•s^{-1} photosynthetic photon flux, 16-24C air temperatures, and 35% - 95% relative humidity (uncontrolled)[z].

Treatment			Post Harvest Grade (1-5)[y]	Medium Volume (cm^3)	Pot wt after 13 days (g)	Maximum pot wt (g)	Water use (g/pot)
Amount medium (g/pot)	Supersorb C (g/pot)	AquaGro					
450	0	Yes	3.8 a	1347 c	418 c	926 e	508 ab
	0	No	3.8 a		445 c	957 d	512 ab
450	6	Yes	4.0 a	1456 b	554 ab	1077 a	524 ab
	6	No	4.0 a		595 a	1094 a	498 ab
450	6H[x]	Yes	3.9 a	1570 a	532 a	1067 ab	536 a
	6H	No	3.8 a		571 ab	1085 a	514 ab
540	0	Yes	4.0 a	1570 a	519 b	1036 c	517 ab
	0	No	4.3 a		571 ab	1050 bc	479 b

[z]Means in each column followed by different letters are significantly different at $\alpha = 0.05$, Duncan's multiple range test.
[y]5 = Excellent, 4 = Superior, 3 = Good, 2 = Barely Acceptable, and 1 = Poor.
[x]Six g of Supersorb C fully hydrated.

Regardless of treatments, most plants used similar amounts of water during the interior holding (Table 2). Pots receiving the reapplication of Aqua-Gro consistently had lower weight (although not statistically significant) after 13 days and did not hold more water following irrigation (Table 2). Judging by the maximum pot weight, adding Supersorb C or increasing the amount of medium had nearly equal effect on water holding capacity on a per pot basis. However, other studies have suggested that part of the water being held by the hydrogel may not be readily available to plant roots (Evans, et al., 1990; Tripepi, et al., 1991). Therefore, increasing the amount of medium may provide more available water than using hydrogel.

There was no meaningful difference in N (2.72% - 2.92%) and Mg (0.20% - 0.22%) concentrations (Table 3a) in bracts among all treatments, despite previously reported increased retention of

medium were higher while concentrations of other elements were lower when compared to plants produced in unamended medium (Taylor and Halfacre, 1986). In this study, concentrations of most elements, except zinc and molybdenum, in the bracts were much lower than those reported for poinsettia leaves (Staby and Kofranek, 1979).

Results of this study show that, under the conditions of this research, incorporating a hydrogel in the potting medium to improve plant growth and postharvest longevity of poinsettia provides limited benefits. Contrary to expectations, reapplication of a wetting agent to the container medium at the recommended rate prior to shipping did not increase the water holding capacity of the medium and had no effect on the postharvest quality of the poinsettia plants.

Table 3a. Concentrations of selected elements in poinsettia bracts as affected by incorporations of Supersorb C in the medium.[z]

Amount medium (g/pot)	Supersorb C (g/pot)	N	P	K	Ca	Mg
				(% dry weight)		
450	0	2.82 ab	0.50 a	2.52 a	0.20 a	0.22 a
450	6	2.92 a	0.48 a	2.47 a	0.20 a	0.21 ab
450	6H[y]	2.92 a	0.42 c	2.40 a	0.19 a	0.20 b
540	0	2.72 b	0.45 b	2.48 a	0.18 a	0.21 ab

[z]Means in each column followed by different letters are significantly different at $_{a} = 0.05$, Duncan's multiple range test.

[y]Six g of Supersorb C, fully hydrated.

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Table 3b. Concentrations of selected elements in poinsettia bracts as affected by incorporation of Supersorb C in the medium.[z]

Amount medium (g/pot)	Supersorb C (g/pot)	Mn	Fe	Cu	B	Zn	Mo	Al	Na
						(mg/kg)			
450	0	16 ab	62 a	5.8 a	17 b	35 a	2.0 a	77 a	400 a
450	6	15 b	60 a	5.5 ab	15 b	37 a	1.6 ab	64 b	414 a
450	6H[y]	14 b	59 a	4.9 b	17 b	50 a	1.4 b	64 b	457 a
540	0	18 a	57 a	5.0 b	22 a	50 a	1.4 b	63 b	405 a

[z]Means in each column followed by different letters are significantly different at $_{a} = 0.05$, Duncan's multiple range test.

[y]Six g of Supersorb C, fully hydrated.