The Effect of Mist-Fertilizer Propagation on the Growth and Nutrient Content of *Euphorbia pulcherrima* and *Chrysanthemum morifolium*[1]

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Abstract. Two cultivars of poinsettias and 3 cultivars of chrysanthemums were propagated under low concentration mist-fertilizer solutions to offset the problem of nutrient losses by leaching that occur under mist. Greater terminal growth, fresh weight, dry weight and degree of rooting resulted. Effects of mist-fertilizer propagation were permanent, so plants flowerd earlier, and had greater fresh and dry weights with increased numbers and larger size flowers. Significantly higher levels of N, P and K occurred in leaf tissue of cuttings that received a complete fertilizer as opposed to tap-water misted cuttings. The N, P and K content of chrysanthemum leaves was higher when cuttings were removed from the propagation bench than when they were inserted.

There were differences due to cultivar but not to media when moisture conditions in the rhizosphere were adequate. Mist-fertilized chrysanthemum cuttings were not satisfactorily stored at 31–33° F.

Introduction

In recent years low pressure, intermittent mist has become a widely used method for vegetative propagation. The many advantages of mist (9, 11) are often offset by nutrient losses from the leaves as a result of the frequent bathing of the leaves in water (12). Redistribution of the nutrients due to growth and root initiation may further dilute the remaining nutrient content of the cutting (7). Rooted cuttings upon removal from the propagation bench are sometimes chlorotic, necrotic and even without leaves. The succulence of the original cutting may change to a hardened type growth, and permanent stunting of the plant may result.

The application of nutrients through the mist propagation system may replace part of the nutrient losses caused by leaching, and will result in foliar uptake of the nutrients applied (14). Foliar applications of fertilizer have proven successful in the growth of certain crops (3, 5, 6) especially where the availability of a nutrient in the soil was low, and where deficiency symptoms persisted in spite of soil applications of fertilizers.

The objectives of the study reported here were: 1) to determine the effects of small amounts of water soluble fertilizers introduced into a mist system to offset nutrient losses of cuttings of some cultivars of *Euphorbia pulcherrima* Willd. and *Chrysanthemum morifolium* Ram; and 2) to determine the effects of various rooting media of these cultivars to a nutrient solution mist.

Materials and Methods

Five experiments consisting of 9 separate propagations of chrysanthemums and poinsettias were conducted. Results obtained from typical propagations are reported. A total of 375 'Barbara Ecke Supreme' and 270 'Ecke's White' poinsettia cuttings were used. Chrysanthemum cuttings totaling 270 each were 'Indianapolis White No. 3', a large standard flowered type, and 'White Shasta' and 'Copperhead', small flowered, spray types.

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Three greenhouse benches were equipped with a 3/4-inch diameter, galvanized pipe, mist line placed 2 1/2 ft above the benches and White Shower 100 mist nozzles spaced 3 ft apart. Water pressure was 60 psi and flow output per nozzle was maintained at 140–150 ml/minute. The mist cycle was regulated by a time clock which provided 6 possible interval-frequency settings (Table 1). Mist was applied daily from 8:00 A.M. until 5:30 P.M. When cuttings were stuck into the propagating medium, mist was applied the first day on setting No. 2; then setting No. 3 was used until root initials were apparent. At this time the interval-frequency was changed through settings 4, 5 and 6 to allow a hardening-off of the cuttings before transplanting.

Table 1. Interval-frequency settings used to apply mist-fertilizer solutions during propagation.

Setting no.	Time on	Time off
1	0.0	Continuous
2	Continuous	0.0
3	10 sec	2 min 40 sec
4	10 sec	4 min 50 sec
5	10 sec	9 min 50 sec
6	10 sec	19 min 50 sec

The control bench mist line applied only tap water. Mist with fertilizer was applied by turbine type pressure pumps that pumped premixed fertilizer solutions from closed polyethylene tanks. One bench was misted with a solution of technical grade urea (46%N) at a rate of 4 oz/100 gallons of water. The other bench received 23-9-14 fertilizer at the same rate.

During the short days of fall and winter, supplementary light was provided daily from 10 PM. to 2 AM with 60-watt incandescent bulbs, 4 ft above the cuttings. Bottom heat of 70° was maintained with electric heating cable.

Experiment I. On October 13, 1961, 5 media-container combinations were used in the propagation of 'Barbara Ecke Supreme' poinsettias. Three treatments were a mixture of 9 silt loam soil, 6 sphagnum peat moss, 4 perlite, 2 sand by volume in: 1) 2 1/4-inch peat pots; 2) 2 1/4-inch plastic pots; 3) 2 1/4-inch clay pots. Other treatments were 4) sphagnum peat moss and horticultural vermiculite, 1:1 by volume and 5) sphagnum peat moss and horticultural perlite, 1:1 by volume, in standard greenhouse flats 22 × 14 × 3 inch dimensions. On Sept. 21, 1962, a second propagation with 'Barbara Ecke Supreme' was done with the same media as described in Experiment II. In this propagation, leaf mineral content was determined.

Experiment II. On August 20, 1962, 'Ecke's White' poinsettias were propagated in 3 media. Each bench was divided into 3 sections, 2 of which were filled to a depth of 5 inches with 1) sphagnum peat moss and horticultural vermiculite and 2) sphagnum peat moss and horticultural perlite, 1:1 by volume. In the third section, 2¼-inch peat pots were filled with a 2:1:1 by volume mixture of silt loam soil, sphagnum peat moss and horticultural perlite.

The poinsettias in Experiments I and II were 4-inch terminal, vegetative tips from stock plants, and were placed in the various propagation media at a spacing of 3 × 5 inches.

Experiment III. On June 28, 1962, unrooted chrysanthemum cuttings of 3 cultivars from Yoder Brothers, Barberton, Ohio were stuck into 3 media at a spacing of 1¼ × 4 inches. The rooting media were 1) sphagnum peat moss and perlite, 2) sphagnum peat moss and vermiculite and 3) perlite and vermiculite all 1:1 by volume, placed into greenhouse benches to a depth of 5 inches.

No rooting hormones were used. When cuttings were removed from the propagation media, height, fresh and dry weight, degree of rooting and mineral content by foliar analysis were determined. Height was measured in cm from the top of the rooting medium to the tip of terminal growth. For fresh weight, the cuttings were severed at the soil line and weighed immediately. Dry weight was recorded after drying in a forced draft oven at 65°C for 24 hr.

The degree of rooting was rated on a scale of 0—no callus formation, 1—callus tissue present, 2—poor, 3—fair, 4—good, and 5—excellent root formation.

At the beginning and end of the propagation period, a random sample of rooted cuttings was selected, washed 3 times in distilled water, oven-dried at 65° C, and analyzed for total N, P, K, Ca, and Mg. Total N was determined by a modified Kjeldahl method (2). Phosphorus was determined colorimetrically by the ammonium molybdate method of Greweling and Peech (8). Potassium, Ca and Mg were determined from 0.3 *N* nitric acid solution using a Beckman Model B flame spectrophotometer. The nutrient contents are reported as per cent dry weight.

In experiment I, 6 rooted cuttings were randomly selected from each media-fertilizer combination and grown to maturity. In Experiment II, 10 plants and Experiment III, 5 plants were grown. The date of anthesis was recorded for the poinsettias, and the commercial maturity date was recorded for chrysanthemums. At maturity all plants were measured for height, fresh weight and bract or flower diameter.

As part of the chrysanthemum study, low temperature storage of rooted cuttings was evaluated. Rooted cuttings were sprayed with a ferbam suspension (2 tablespoons of ferbam per gallon of water), allowed to dry, then placed in open polyethylene bags in a polyethylene lined cardboard box, and stored for 8 weeks at 31–33° F. The cuttings were evaluated once weekly to determine the feasibility of cold storage of mist-fertilizer, propagated cuttings.

The data were analysed as a factorial ANOV on an IBM digital computer. Honestly significant difference values were computed according to Tukey's W-procedure.

Results

Experiment I. Applications of the 23-9-14 and the urea mist-fertilizer significantly increased the fresh weight of the cuttings over those of the check treatments (Table 2) but there were no significant differences in the height, dry weight, or root evaluation.

Cuttings propagated in the soil mix in 2¼ inch pots were superior to those in the bulk peat-perlite and vermiculite media. Cuttings in all pots were significantly taller than those in the peat and perlite media, but only those in plastic pots were significantly taller than cuttings propagated in peat and vermiculite. Fresh weight, dry weight and production of roots were all significantly better on cuttings propagated in pots than in bulk. The superiority of the pot propagated material may be speculatively attributed to improved moisture conditions within the rhizosphere of the pots.

The 23-9-14 fertilizer prevented a hardening of growth in the propagation bench and resulted in a 13-day earlier anthesis than check plants (Table 2). Cuttings that received urea matured 3 days earlier than the check plants.

Table 2. Response of 'Barbara Ecke Supreme' poinsettia cuttings to propagation under 3 mist-fertilizer treatments and 5 rooting media measured at the time of removal from the propagation media and at maturity. Experiment I.

Treatment	Plants after rooting: Height cm	Fresh weight g	Dry weight g	Rooting evaluation	Plants at maturity: Days to anthesis	Bract diameter cm	Height cm	Fresh weight g
Non-fertilized	6.2a[v]	9.7a[w]	1.4a[w]	3.0a[w]	84[y]	33.6a[y]	31.0a[y]	55.8a[y]
Urea	7.1a	11.1b	1.3a	3.6a	81	34.0a	32.0a	57.0a
23–9–14	8.0a	12.2c	1.3a	3.0a	71	33.6a	36.0a	49.9a
Media								
Peat pot	7.4ac[x]	12.8a[y]	1.5a[y]	3.1ac[y]	79[z]	36.0a[z]	34.7a[z]	60.1a[z]
Clay pot	7.4ac	12.4a	1.6a	3.6a	79	35.3a	37.7a	61.3a
Plastic pot	8.6a	13.0a	1.5a	3.9a	79	35.9a	38.0a	61.6a
Peat-perlite	5.5b	7.2b	1.0b	2.2b	80	29.5a	25.7b	39.2b
Peat-vermiculite	6.7bc	9.7c	1.0b	2.6bc	78	32.0a	26.0b	49.0ab

[v]Avg. of 125 plants.
[w]Avg. of 50 plants.
[x]Avg. of 75 plants.
[y]Avg. of 30 plants.
[z]Avg. of 18 plants.
Means within a given column followed by the same letters do not differ significantly at the 0.05 level.

Table 3. Mineral content expressed as per cent dry weight of 'Barbara Ecke Supreme' poinsettia cuttings and mature plants propagated under 3 mist-fertilizer treatments in 3 media.

Treatment	N	P	K	Ca	Mg
		Cuttings[y]			
Original content	5.79	.610	2.53	0.35	.270
Non-fertilized	2.44a	.387a	1.15a	0.32a	.193a
Urea	5.33b	.313a	1.22a	0.38a	.212a
23-9-14	4.71b	1.053b	1.43a	0.42a	.205a
Media					
Peat pot	4.47a	.560a	1.07a	0.52a	.228a
Peat-perlite	4.07a	.580a	1.38a	0.31a	.198a
Peat-vermiculite	3.93a	.513a	1.36a	0.28a	.183a
		Mature plants[z]			
Non-fertilized	5.23ab	.270a	2.75a	1.21a	.547a
Urea	5.43a	.376b	2.80a	1.38a	.608b
23-9-14	4.92b	.420b	2.48a	1.31ab	.597b
Media					
Peat pot	4.89a	.331a	2.36a	1.38a	.626a
Peat-perlite	5.29ab	.367a	2.78b	1.27b	.564b
Peat-vermiculite	5.40b	.368a	2.89b	1.27b	.562b

[y]Avg. of 10 plants.
[z]Avg. of 5 plants.
Means within a given column followed by the same letter do not differ significantly at the 0.05 level.

Table 5. Mineral content expressed as percent dry weight of 'Ecke's White' Poinsettia cuttings and mature plants propagated under mist-fertilizer treatments in 3 media.

Treatment	N	P	K	Ca	Mg
		Cuttings[y]			
Original content	5.01	.770	2.07	0.30	.325
Non-fertilized	2.02a	.267a	0.70a	0.22a	.140a
Urea	4.75b	.283a	0.84a	0.44a	.222a
23-9-14	4.63b	.800b	1.63b	0.43a	.258a
Media					
Peat pot	3.47a	.483a	1.02a	0.44a	.212a
Peat-perlite	3.90a	.437a	0.81a	0.29a	.167a
Peat-vermiculite	4.03a	.430a	1.34a	0.36a	.242a
		Mature plants[z]			
Non-fertilized	5.56a	.464a	1.73a	0.63a	.295a
Urea	5.38ab	.567b	2.26b	0.89b	.452b
23-9-14	5.07b	.609b	2.57c	0.88b	.460b
Media					
Peat pot	5.25a	.549a	2.05a	0.80a	.376a
Peat-perlite	5.37a	.566a	2.39b	0.85a	.434a
Peat-vermiculite	5.39a	.524a	2.12a	0.75a	.397a

[y]Avg. of 30 plants.
[z]Avg. of 30 plants.
Means within a given column followed by the same letters do not differ significantly at the 0.05 level.

The data for bract diameter, mature height and mature fresh weight were not statistically different, as recorded at the time of anthesis.

There were no real differences in the number of days to anthesis or the bract diameter due to the propagation media used. However, mature height and fresh weight of pot propagated poinsettias were significantly greater than those propagated in flats.

No tissue analyses were done on the plant material used in the first propagation of Experiment I. They were, however, made with the poinsettias used in the second propagation. The growth characteristics of the 2 propagations were similar, therefore only the results of the tissue analysis of the second propagation need to be reported here.

At the time of removal from the propagation bench, non-fertilized cuttings were chlorotic with typical symptoms of extreme N deficiency. Mist-fertilized cuttings were dark green in color, similar to that of the cuttings when removed from the stock plants. Applications of mist-fertilizer during the period of propagation significantly increased the nutrient content of the cutting leaf tissue and was associated with the fertilizer applied (Table 3). Use of 23-9-14 and urea resulted in a significantly higher leaf N content in the cuttings. 'Barbara Ecke Supreme' had a higher P content with 23-9-14 but there were no differences in K regardless of the treatment used. The Ca and Mg content of the leaves was not significantly changed by the application of mist-fertilizer. No known Ca or Mg was contained in the materials used in the mist.

The media-containers used for propagation had no significant effect on the nutrient content of the young plants. At maturity, the N, P, and K content of peat-pot propagated plants was significantly lower.

With mature plants, N was greatest in urea-propagated material followed by non-fertilized and the 23-9-14 treated plants. Phosphorus was lowest in the non-fertilized plants. The K content did not differ significantly regardless of the propagation treatment used. Both Ca and Mg were lowest in the leaves of plants from the check treatment.

Experiment II. With 'Ecke's White' poinsettia height and fresh weight were significantly greater when the cuttings were misted with a 23-9-14 fertilizer (Table 4). Differences in dry weight were not significant, but rooting of the plants was greatly improved when the mist was enriched with 23-9-14 fertilizer.

There were no significant differences due to media or container used. In Experiment I, the bulk media were placed in flats with a 3 inch depth whereas in Experiment II the bench depth was 5 inches. This increased volume possibly improved the moisture environment around the root system so the advantages offered by the pot were no longer present.

Plants with the complete fertilizer during propagation bloomed 5 days earlier and urea treated plants bloomed 3 days earlier than the check plants (Table 4). Mature height and fresh weight of the mist-fertilized plants were statistically greater than the checks. Although numerically larger, the difference in bract diameter was not significant. As with the cuttings, the media had no significant effects on the factors evaluated.

For 'Ecke's White', both urea and the 23-9-14 resulted in significantly higher N content of the leaves of young plants at the time of removal from the propa-

Table 4. Response of 'Ecke's White' poinsettia cuttings to propagation under 3 mist-fertilizer treatments, and 3 rooting media measured at the time of removal from the propagation media and at maturity. Experiment II.

Treatment	Plants after rooting				Plants at maturity			
	Height cm	Fresh weight g	Dry weight g	Rooting evaluation	Days to anthesis	Bract diameter cm	Height cm	Fresh weight g
Non-fertilized	7.7a[x]	7.9a[y]	2.0a[y]	3.9a[z]	64[y]	28.7a[y]	57.0a[y]	66.2a[y]
Urea	9.5a	10.8b	3.0a	4.1a	61	31.8a	69.9b	83.8b
23-9-14	11.4b	13.8c	2.1a	4.8b	59	32.1a	69.7b	92.2b
Media								
Peat pot	9.5a[x]	10.1a[y]	2.1a[y]	4.2a[z]	60[y]	30.9a[y]	67.2a[y]	85.9a[y]
Peat-perlite	9.4a	11.3a	2.2a	4.0a	62	31.4a	64.2a	78.0a
Peat-vermiculite	9.9a	11.1a	1.9a	4.6a	62	30.3a	65.2a	78.3a

[x]Avg. of 90 plants.
[y]Avg. of 30 plants.
[z]Avg. of 45 plants.
Means within a given column followed by the same letters do not differ significantly at the 0.05 level.

gation bench (Table 5). The P and K were significantly higher in the leaves of plants that received the 23-9-14. There were no significant differences in the Ca and Mg content, due to misting treatment or the propagation media used.

Mature plants of 'Ecke's White' misted with tap water had significantly lower amounts of P, K, Ca, and Mg than did mist-fertilized plants. The N content of the mature plant foliage of the check was, however, highest for all treatments used. In the mature plants, media resulted in a higher K content of peat and perlite propagated plants. All other differences were not significant.

Experiment III. Cutting height and fresh and dry weight of chrysanthemums were significantly greater when 23-9-14 or urea were applied during the propagation period than with tap water (Table 6). The ratio of cutting height and fresh weight was of the order 1:2:3 for tap water, urea and 23-9-14 treatments respectively.

Mist-fertilizer and media had no significant effect on root development. Cuttings from all 3 treatments averaged almost excellent. There were significant differences in height and fresh weight due to cultivar though the cultivar did not affect dry weight or rooting.

Flower diameter was significantly larger in the urea and 23-9-14 treatments, but the differences were too small to be of economic importance.

Both height and fresh weight were improved when the cuttings were propagated with mist-fertilizer, and the complete fertilizer was superior to urea alone. Since chrysanthemums are sold on the basis of stem length (height) and fresh weight, the benefits derived from mist-fertilizer would be of economic significance.

Propagation media used had no significant effect on flower number, flower diameter, mature height or fresh weight. There were, however, significant differences in both mature height and fresh weight due to the cultivar.

In the storage treatments, the soft growth maintained by the application of mist-fertilizers was detrimental to prolonged storage at 31–33° F. A soft rot of the leaves on the 23-9-14 plants developed 3 weeks after the rooted cuttings were placed in storage. The urea treated plants began to rot a few days after the 23-9-14 plants. Cuttings from the check treatment were still alive and in sound condition after 8 weeks of storage whereas the fertilizer treated cuttings were thoroughly rotted.

Table 7. Mineral content expressed as per cent dry weight of 3 cultivars of chrysanthemum cuttings propagated under 3 mist-fertilizer treatments.

Treatment	N	P	K	Ca	Mg
Non-fertilized	2.04a[x]	.123a	1.83a	0.88a	.188a
Urea	6.56b	.117a	1.64a	0.94a	.283b
23–9–14	5.09c	.639b	3.55b	0.69b	.277b
Media					
Peat-perlite	4.83a[y]	.304a	1.80a	0.89a	.269a
Peat-vermiculite	4.62a	.278a	2.76a	0.81a	.287a
Perlite-vermiculite	4.25a	.288a	2.46a	0.81a	.192a
Cultivar after propagation					
'Indianapolis White No. 3'	4.39a[x]	.278a	1.99a	0.80a	.216a
'White Shasta'	4.59b	.287a	2.53a	0.71a	.197a
'Copperhead'	4.72b	.314a	2.50a	0.99b	.336b
Cultivar before propagation					
'Indianapolis White No. 3'	4.98[z]	.535	2.03	0.55	.190
'White Shasta'	5.77	.470	4.00	0.44	.110
'Copperhead'	4.91	.570	3.18	0.70	.180

[x]Avg. of 30 plants.
[y]Avg. of 90 plants.
[z]Representative leaf samples not statistically analyzable.
Means within a given column followed by the same letters do not differ significantly at the 0.05 level.

With chrysanthemums, urea mist-fertilized cuttings contained significantly more N than those fertilized with 23-9-14 or the checks (Table 7). Since the urea was 46% N, it was providing 2 times as much N as the 23-9-14 treatment. The N in the urea treated cuttings at the time of removal from the propagation bench exceeded the original N content of the cuttings when inserted.

Both the spray-type cultivars contained significantly more N than did the standard cultivar, 'Indianapolis White'.

Application of 23-9-14 fertilizer resulted in a P and K content of the cuttings significantly greater than that of the check or urea treated plants. For P and K this level exceeded the original content, except for he K content of 'White Shasta'. There were no significant differences among cultivars.

Calcium was significantly lower in the leaves of 23-9-14 treated cuttings. This may be an antagonistic effect of the high levels of P and K that were found in these plants. The cultivar 'Copperhead' had significantly more Ca than the other 2 cultivars. Neither urea nor 23-9-14 are reported to contain Mg but cuttings from both treatments contained significantly more Mg than did the check plants. Vermiculite contains Mg which could account for the increased Mg content where that medium was used.

Table 6. Response of 3 cultivars of chrysanthemum cuttings to propagation under 3 mist-fertilizer treatments and 3 rooting media measured at the time of removal from the propagation bench and at maturity. Experiment III.

Treatment	Plants after rooting				Plants at maturity			
	Height cm	Fresh weight g	Dry weight g	Rooting evaluation	Flower number (pompon)	Flower diameter (Ind. Wh.) cm	Height cm	Fresh weight g
Non-fertilized	6.5a[v]	2.3a[w]	0.5a[w]	4.8a[w]	15.3a[x]	12.9a[y]	85.9a[z]	87.0a[z]
Urea	11.5b	4.0b	0.6b	4.8a	18.0a	13.9b	95.6ab	113.1b
23–9–14	16.1c	6.6c	0.7c	4.9a	18.8a	13.8b	100.0b	119.9c
Media								
Peat-perlite	10.6a[v]	4.4a[w]	0.5a[w]	4.8a[w]	17.6a[x]	13.4a[y]	92.5a[y]	109.9a[z]
Peat-vermiculite	12.1a	4.7a	0.6a	5.0a	17.4a	13.7a	92.8a	105.3a
Perlite-vermiculite	11.4a	4.1a	0.6a	4.7a	17.1a	13.4a	96.4a	107.5a
Cultivar								
'Indianapolis White No. 3'	12.4a[v]	4.7a[w]	0.6a[w]	4.7a[w]	—	13.5[z]	79.3a[z]	105.9a[z]
'White Shasta'	10.7b	3.7b	0.6a	4.7a	17.1a[x]	—	109.9b	95.4b
'Copperhead'	11.0b	4.4a	0.6a	5.0a	17.5a	—	92.3c	120.1c

[v]Avg. of 270 plants.
[w]Avg. of 90 plants.
[x]Avg. of 30 plants.
[y]Avg. of 15 plants.
[z]Avg. of 45 plants.
Means within a given column followed by the same letters do not differ significantly at the 0.05 level.

Discussion

These results show that a low concentration (4 oz/100 gal water) of fertilizer introduced into the mist during propagation was beneficial, agreeing with the findings of Dick (4) and Teuscher (13).

By preventing a hardening or checking of growth during the propagation period, the cuttings that were mist-fertilized remained in a vigorous growing condition, bloomed earlier, and had greater height, fresh weight, and flower number and size than those rooted under tap water mist.

A greater response was obtained with a complete analysis fertilizer than with urea alone. The absence of phytotoxicity substantiates the recommendation of Asen et al. (1) who suggested increasing the number of applications and lowering the concentrations as a means of overcoming low plant tolerances to a given concentration.

Although applications of mist-fertilizer were beneficial for the subsequent growth of chrysanthemums, the physiological condition of the cuttings was detrimental to long-term, low-temperature storage. On the basis of these studies, mist-fertilizer propagation should be used only where the rooted cuttings are to be planted immediately in their final growing location.

The results of this study indicate that minerals from the nutrient-mist entered the cuttings through the leaves, especially during the early part of the propagation period. Soil tests of the media showed that only trace amounts of the fertilizers were retained in the media. This fact supports the conclusion that absorption of the nutrients took place through the leaves and not through the developing roots. Susbequent work by Good and Tukey (1966) and Wott and Tukey (1966) has shown conclusively that cuttings take up nutrients through their foliage when bathed by a nutrient mist during propagation. In the case of poinsettias the first roots did not appear for at least 3 weeks after the cuttings were inserted. By this time, the unfertilized cuttings were chlorotic. These results preclude the possibilities of large amounts of nutrients being absorbed through the root system up to this time since the root system had not developed.

Applications of low concentrations of a complete analysis (23-9-14) fertilizer during the propagation period of poinsettias and chrysanthemums had a positive effect on the mineral nutrient content of the rooted cuttings. With certain elements the effect was residual and was reflected in the nutrient content of the leaves of the mature plants.

Only one formulation of a complete analysis fertilizer was used. The results do not presuppose that a similar analysis material which may be composed of different fertilizer constituents would perform the same. Meyer and Boodley (10) have shown that the fertilizer used in this study was superior in its effects on growth to some other complete analysis fertilizers.

Differences in nutrient content due to cultivar were found in both chrysanthemums and poinsettias. There were no consistent differences due to propagation media.

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