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INFLUENCE OF IRRIGATION METHOD AND FERTILIZER SOURCE AND LEVEL ON GROWTH OF FOUR FOLIAGE PLANTS[1]

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Abstract. Aphelandra squarrosa **Nees cv. Dania, (Zebra plant),** Dieffenbachia maculata **(Lodd) G. Don cv. Exotica (Dieffenbachia),** Philodendron scandens oxycardium **(Schott) Bunt (Philodendron) and** Nephrolepis exaltata **Schott cv. Bostoniensis (Boston fern) were hand watered 3 times weekly or grown on capillary mats and supplied with the equivalent of 500, 1000, 1500 or 2000 lb N/A/ year from Osmocote® 14-14-14 or liquid 20-20-20. Osmocote was incorporated into the potting medium of native peat, pine bark and cypress shavings, 2/1/1 (v/v) prior to potting, while liquid fertilizer was supplied weekly by irrigation. Best growth of** Aphelandra **and** Nephrolepis **was achieved with capillary watering, but** Dieffenbachia **and** Philodendron **were generally better when hand watered. Fertilizer source had little or no effect on plant growth, while increasing fertilizer level increased growth, but differences varied among genera.**

Commercial producers of African violets and some other floricultural crops have used sand capillary benches to irrigate crops since the early 1940's. Construction and methods of handling such benches were discussed by Seeley (6) in 1948, and problems of bench construction and fertilizer application prevented widespread acceptance. More recently, Ball (1) discussed widspread use of capillary mats in Europe and England and discussed several advantages to their use which included flexibility in plant movement and pot sizes on individual benches, prevention of foliar diseases due to lack of overhead watering and constant moisture availability. Hammer and Langhans (5) showed that growth of 6 inch potted chrysanthemums were as good or better on sand or Dorix capillary mats as when hand watered. More recently, Freeman (4) grew 6 inch potted poinsettias on a 1 inch fiberglass capillary mat using varying rates of Osmocote and found that 12 lbs/yd^3 of 14-14-14 incorporated into the potting medium provided excellent growth and quality. Even though foliage plants are widely grown on capillary mats in Europe (1), there have been no definitive reports in the U.S. on this technique, especially under Florida conditions. Therefore, this research was initiated to examine effects of hand vs. capillary irrigation on growth of several foliage plants as well as influence of their interactions with fertilizer source and levels.

Materials and Methods

Four 4x2x2 factorial experiments in randomized block design were initiated with Zebra plant, Dieffenbachia, Philodendron and Boston fern on November 29, 1974. Plants were grown on U.S. Vattex P capillary mats kept saturated or hand watered 3 times/week. Fertilizer sources were Osmocote 14-14-14 incorporated into the potting medium and liquid 20-20-20 from ammonium nitrate, potassium nitrate and phosphoric acid applied weekly in irrigation water applied to mats or to hand watered plants. Fertilizer levels based on nitrogen (N) were 500, 1000, 1500, or 2000 lb/A/year.[2] There were 4 replications and the experimental unit consisted of 1 Zebra plant or Dieffenbachia rooted cutting, one 3-leaf Boston fern offset or 3 rooted Philodendron cuttings/4 inch sq pot. Plants were grown in a glass greenhouse shaded to provide a light intensity of 1500 to 1800 ft-c and maintained at 65°F min night and 90°F max day temp. The potting medium was 2 native peat/1 cypress shavings/1 pine bark (v/v) amended with 7 lb Dolomite and 1 1/2 lb Perk[3]/yd^3. Benches were divided into compartments, so that plants receiving Osmocote would not receive liquid fertilizer which was applied in solution directly on the mats. Liquid fertilizer were based on the combined surface area of pots on the mat. This system required a reduction in amount of fertilizer applied/compartment, whenever 1 of the 4 genera were selected for harvest. Experiment termination date varied for the different genera because of their growth rates. Philodendron was harvested January 3, Dieffenbachia January 9, Boston fern February 26 and Zebra plant April 2, 1975. Data collected included plant grade: 1 = poor—unsalable, 3 = good—salable and 5 = excellent—salable and leaf color: 1 = light green, 3 = medium green and 5 = dark green for Zebra plant, leaf size $\left(\frac{\text{length} + \text{width}}{2}\right)$ in cm for all 4 plants, ht for Boston fern, Dieffenbachia and Philodendron and no. of runners for Boston fern. Soluble salts were also determined at termination date for each species by the 2/1 water to dry potting medium (v/v) method.

Results and Discussion

Plant grade, leaf color grade and leaf size of Zebra plant and ht and frond size of Boston fern increased when grown on capillary mats vs. hand watering, but no. fern runners produced and ht of Dieffenbachia and vine length of Philodendron were less (Table 1). The shorter growth period of Dieffenbachia and Philodendron may have accounted for these results, since the potting medium may have remained too wet due to less extensive root systems over the shorter growing period, and also due to reduced water need during the cool winter months. The magnitude of the positive growth responses to capillary mats with Zebra plant and Boston fern was not easily noticed, indicating that high water holding capacity of the potting medium (72% by volume) was sufficient for growth of these species. The nearly 50% decrease in fern runners produced when growing on mats may have indicated that runner production was stimulated by variations in water availability or possibly a reduction in oxygen levels in the growing medium on mats.

Except for leaf size of Philodendron (a difference of only 0.4 cm), no plant response to fertilizer source was noted (Table 1). This is especially noteworthy, since it indicates that liquid fertilizer applied to mats at rates equivalent to those supplied when Osmocote is incorporated is equally available to plants. This knowledge could be bene-

[1]Florida Agricultural Experiment Stations Journal Series No. 766.

[2]For metric equivalents see Table near the front of this Volume. Ed.

[3]A micronutrient blend manufactured by Kerr-McGee Chemical Co., Jacksonville, FL.

Table 1. Influence of watering method and fertilizer source and level on growth of 4 foliage plants.

Treatment	Zebra plant 18 wks crop			Boston fern 13 wks crop			Dieffenbachia 6 wks crop		Philodendron 5 wks crop	
	Plant grade[x]	Leaf size[y] (cm)	Color grade[z]	Ht. (cm)	Leaf size (cm)	No. runner	Ht. (cm)	Leaf size (cm)	Vine length (cm)	Leaf size (cm)
Irrigation										
Hand watered	2.3 a[w]	7.1 a	1.7 a	27.5 a	18.0 a	5.9 b	28.0 b	11.8 a	26.6 b	8.4 a
Capillary mat	3.2 b	9.0 b	3.3 b	31.5 b	21.2 b	3.1 a	26.3 a	11.0 a	23.7 a	8.6 a
Fertilizer Source										
Osmocote	2.8 a	8.0 a	2.4 a	29.7 a	19.7 a	4.4 a	27.2 a	11.7 a	24.9 a	8.7 b
Liquid	2.7 a	8.1 a	2.6 a	29.3 a	19.5 a	4.7 a	27.1 a	11.1 a	25.4 a	8.3 a
Fertilizer Level lb N/A/yr										
500	1.9 a	7.3 a	1.5 a	26.3 a	16.8 a	5.3 a	26.3 a	11.1 a	25.7 a	8.4 a
1000	2.3 a	7.8 a	2.3 b	30.8 b	20.3 b	4.1 a	27.3 a	11.5 a	25.4 a	8.4 a
1500	3.6 b	8.0 a	3.1 c	29.7 b	20.4 b	4.8 a	27.5 a	11.7 a	24.3 a	8.7 a
2000	3.1 b	9.1 b	3.2 c	31.1 b	21.1 b	4.0 a	27.5 a	11.3 a	25.2 a	8.5 a

[x]Graded as: 1 = poor—unsalable, 3 = good—salable, and 5 = excellent—salable.

[y] $\left(\frac{\text{Length} + \text{Width}}{2}\right)$

[z]Graded as: 1 = light green, 3 = medium green, and 5 = dark green.
[w]Means within a column within treatment groups followed by the same letter are not significantly different at the 5% level according to Duncan's multiple range test.

ficial to growers using Osmocote who wanted to add fertilizer near the end of a crop cycle. Mats used in these experiments that received liquid fertilizer developed considerable algae growth, but it was easily controlled by turning the mat over before the next crop was started. In this manner, mats were used for more than a year without treating to kill algae.

In the short term Dieffenbachia and Philodendron crops, fertilizer level had no effects on growth, while with Zebra plant and Boston fern the 1500 or 2000 lb N/A/year rate was best (Table 1). These rates are consistent with those developed over several years of research with hand watering and variable fertilizer rates (2).

Soluble salts data (Table 2) were taken at termination of each individual experiment. Philodendron and Dieffenbachia were only grown for 5 and 6 weeks, respectively while Boston fern and Zebra plant were grown for 13 and 18 weeks, respectively. This would explain why soluble salts levels of plants receiving Osmocote were somewhat higher in the early crops, since 3 months supply was initially incorporated. Reductions in growth noted where liquid fertilizer was used were probably due to lower availability, since only 5 or 6 weekly applications had been made. Soluble salts levels were much higher in all plants grown on capillary mats and this could have been attributed to the lack of leaching that occurred with this procedure vs. considerable leaching in hand watered pots (Table 2). Soluble salts levels increased as fertilizer level increased to the highest level for all 4 plants tested (Table 2). However, none of the levels were high enough to cause problems of acclimatization (3). Generally, soluble salts levels lower than 1000 ppm at the time plants are moved indoors are considered acceptable and do not present any problem. Therefore, results of this research indicate that soluble salts levels present in capillary mat grown plants will not present problems provided correct fertilization rates and methods are utilized.

Table 2. Influence of watering method and fertilizer source and level on soluble salts levels (ppm) at termination of the experiments as determined by the 2/1 water to dry potting medium (v/v) method.

Treatment	Zabra plant 18 wks	Boston fern 13 wks	Dieffenbachia 6 wks	Philodendron 5 wks
Irrigation				
Hand watered	55 a[v]	44 a	158 a	509 a
Capillary mat	486 b	972 b	1124 b	831 b
Fertilizer Source				
Osmocote	294 a	485 a	797 b	807 b
Liquid	247 a	492 a	484 a	534 a
Fertilizer Level lb N/A/yr				
500	168 a	64 a	330 a	252 a
1000	196 a	84 a	334 a	327 b
1500	340 b	424 b	413 a	287 ab
2000	378 b	405 b	631 b	474 c

[v]Means within a column within treatment groups followed by the same letter are not significantly different at the 5% level according to Duncan's multiple range test.

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