INFLUENCE OF MICRONUTRIENT SOURCES AND LEVELS ON RESPONSE AND TISSUE CONTENT OF APHELANDRA, BRASSAIA AND PHILODENDRON[1]

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Abstract. **Three micronutrient sources, Perk, Vigoro Supplement X and FTE-503 were applied at 3 levels each to** Aphelandra squarrosa **Nees. 'Dania',** Brassaia actinophylla **Pav. and** Philodendron oxycardium **Schott. No treatment increased growth or quality over the check. FTE-503 applied at 1/4, 1/2 or 3/4 lb/yd³ induced chlorosis on** Aphelandra **and the 2 highest rates produced chlorosis on** Brassaia**. Perk caused chlorosis of** Brassaia **at rates of 1 1/2, 3 or 4 1/2 lb/yd³. Differences in availability of micronutrients from the various mixtures as shown by tissue content was extensive.**

The Florida foliage industry has grown in wholesale value from approx 16 million dollars in 1970 to more than 70 million annually by 1975 (1). There has been an increased demand for quality along with that for quantity. Considerable research has been accomplished on macronutrient requirements for tropical foliage plants, but only limited information is available on micronutrient requirements. Dickey and Joiner (6) produced B and Fe deficiencies in *Philodendron oxycardium* and *Scindapsus aureus* grown in sand culture, but were unable to develop symptoms of Cu, Mn and Zn deficiencies. Cibes and Samuels (3) in extensive work on *Dracaena godseffiana* and *D. sanderiana* in sand culture showed deficiency symptoms of Fe, Mn and B. Conover and Poole (5) suggested levels of micronutrients to include in potting media and fertilizers based on the work of Joiner and Waters (8) and others (3,6,11).

[1]Florida Agricultural Experiment Stations Journal Series No. 7071.

Many tropical plant growers commonly add micronutrients to potting soils and include them in fertilizer programs even though little is known about their influence on plant growth or availability of specific nutrients in micronutrient mixtures as determined by tissue analysis.

Materials and Methods

Three experiments were initiated February 22 and terminated May 22, 1974 to determine influence of micronutrient sources and rates on *Aphelandra squarrosa* (zebra plant) Experiment 1, *Brassaia actinophylla* (schefflera) Experiment 2 and *Philodendron oxycardium* (philodendron) Experiment 3. A single rooted tip cutting of zebra plant, 3 seedlings of schefflera and 3 rooted single-eye cuttings of philodendron were planted per 4 inch pot in a potting medium composed of native peat, pine bark and cypress shavings (2/1/1 v/v/v), which was amended with 7 lb dolomite and 10 lb 14-14-14 Osmocote/yd³. Treatments were replicated 6 times for a total of 60 pots/genus and plants grown in a glass greenhouse shaded to provide 3000 ft-c maximum light intensity and maintained at 65°F minimum night and 70°F minimum day temperatures.

Treatment variables included Perk at 1 1/2, 3 and 4 1/2, Vigoro Supplement X at 1, 2 and 3 and FTE-503 at 1/4, 1/2 and 3/4 lb/yd³ and a check (Table 1). The 3 granular materials were incorporated into the potting medium at time of mixing.

Data obtained at termination of the experiments included plant height for zebra plant and schefflera, vine length for philodendron and leaf size $\frac{(\text{length} + \text{width})}{2}$ and chlorosis ratings for all 3 genera. Chlorosis was rated as 1 = none, 2 = moderate with either marginal yellowing or vein clearing and 3 = severe with at least 50% of foliage showing yellowing and some necrotic spotting. Recently mature tissue was selected at termination of the experiment for tissue analyses.

Results and Discussion

Potting media composed of wood by-products and peat moss have been shown to be low in

Table 1. Treatments, rates, cost and actual elemental levels of 4 micronutrients applied per yd^3.

Treatment	Rate lb/yd^3	Cost/yd^3 Dollars	g/yd^3 Cu	Fe	Mn	Zn
Check	0	0	0	0	0	0
Perk[z]	1 1/2	.31	1.6	24.8	15.8	4.9
Perk	3	.62	3.2	49.6	31.6	9.8
Perk	4 1/2	.93	4.8	74.4	47.4	14.7
Vigoro[y]	1	.25	1.6	28.6	14.1	7.3
Vigoro	2	.50	3.2	57.2	28.2	14.6
Vigoro	3	.75	4.8	85.8	42.3	21.9
FTE-503[x]	1/4	.07	3.4	20.4	8.4	8.2
FTE-503	1/2	.14	6.8	40.8	16.8	16.4
FTE-503	3/4	.21	10.2	61.2	25.2	24.6

[z]Perk is manufactured by Kerr-McGee Chemical Corp., Jacksonville, FL and is composed of sulfate forms with 6% of the iron in a chelated form.

[y]Vigoro Supplement X is manufactured by Swift Agricultural Chemical Corp., Winter Haven, FL and is composed of fritted trace elements with 4.5% of the iron in a chelated form.

[x]FTE-503 is manufactured by Frit Industries, Ozark, AL and is composed of fritted materials.

micronutrient content (9) although none of the micronutrient products increased growth over the check in these experiments. Lack of plant response has been previously reported for Perk (10), but not for other micronutrient sources. Chlorosis was observed on zebra plant from applications of FTE-503 and on schefflera from FTE-503 and Perk (Table 2). Several authors (2,7) have observed B toxicities on chrysanthemums and other crops from use of frits, and this probably explains the chlorosis resulting from use of FTE-503 which contains 9.75% B_2O_3, since tissue levels of Cu, Fe, Mn and Zn did not appear to be in phytotoxic ranges (Tables 3,4). Chlorosis on schefflera at all rates of Perk may have been related to the high Fe level, or the narrowing ratio between Fe:Mn in the tissue (Table 4). Levels of Fe were much higher than suggested for many foliage crops in work reported by Joiner and Waters (8). Toxic

Table 2. Influence of micronutrients on chlorosis of Aphelandra squarrosa and Brassaia actinophylla.

Treatment	Rate lb/yd^3	Chlorosis[z] Aphelandra	Brassaia
Check	0	1.1 a[y]	1.0 a
Perk	1 1/2	1.3 ab	1.4 b
Perk	3	1.0 a	1.4 b
Perk	4 1/2	1.1 a	1.8 cd
Vigoro	1	1.4 b	1.0 a
Vigoro	2	1.2 ab	1.0 a
Vigoro	3	1.2 ab	1.0 a
FTE-503	1/4	1.8 c	1.0 a
FTE-503	1/2	2.4 d	1.5 bc
FTE-503	3/4	2.7 e	1.9 d

[z]Rated, 1 = none, 2 = moderate and 3 = severe.

[y]Numbers in a column followed by the same letter are not significantly different at the 5% level.

Table 3. Influence of micronutrient source and rate on tissue content of Aphelandra squarrosa.

Treatment	Rate lb/yd³	ppm Cu	Fe	Mn	Zn
Check	0	8 a[z]	89 a	131 a	175 b
Perk	1 1/2	11 ab	129 b	179 ab	117 b
Perk	3	15 ab	130 b	261 b	129 b
Perk	4 1/2	20 b	138 b	422 c	91 ab
Vigoro	1	11 ab	93 a	145 ab	81 a
Vigoro	2	9 ab	85 a	147 ab	83 a
Vigoro	3	10 ab	80 a	144 ab	88 a
FTE-503	1/4	15 ab	88 a	153 ab	105 ab
FTE-503	1/2	19 ab	89 a	156 ab	126 b
FTE-503	3/4	31 c	92 a	138 a	178 c

[z]Numbers in a column followed by the same letter are not significantly different at the 5% level.

effects of Perk on rooting of cuttings has been reported previously by Conover and Poole (4), where 3 lb/yd³ of Perk decreased root grades of *Aphelandra, Aglaonema, Maranta* and *Dieffenbachia.*

Uptake of Cu, Fe, Mn and Zn from the potting medium was influenced by plant variety, source and rate of micronutrients added (Tables 3,4,5). To aid in clarifying results, influence of sources and rates are discussed for each plant.

Experiment 1. Aphelandra squarrosa 'Dania' tissue Cu levels were increased by FTE-503 at the highest rate of each compared to check, Fe and Mn were increased by Perk and Zn was increased by the highest FTE-503 level and decreased by Vigoro Supplement X (Table 3). When applied levels of elements (Table 1) are compared with tissue levels, uptake of Perk appears most efficient and Vigoro least efficient on zebra plant.

Experiment 2. Brassaia actinophylla FTE-503 treated plants were generally higher in tissue N and K levels compared to the check (Table 4) and Fe and Mn were higher in plants supplied Perk. Perk and FTE-503 increased Zn levels and all treatments except the lowest Vigoro rate increased tissue Cu. Highest tissue Fe and Mn occurred from use of Perk.

Experiment 3. Philodendron oxycardium levels of N and K were generally highest in check plants, although several treated plants were similar (Table 5). Tissue levels of Cu and Fe were higher in the check than any treatment, while Mn was lowest and Zn was generally similar to levels produced by Perk and FTE-503. Fe uptake was especially limited in this plant, even from Perk which was rapidly available for other plants.

Although no beneficial effects were obtained from use of micronutrients in this study, results indicate that Perk (sulfate source) was most efficient in providing microelements to rapidly growing plants. Longer term studies should be made to observe results over periods of 6 months to 1 year since Vigoro Supplement X and FTE-503 both are composed of frits. A comparison of costs is provided in Table 1 showing the relative cost to apply listed amounts of Cu, Fe, Mn and Zn. Although FTE-503 is lowest in cost, it unfortunately was phytotoxic to 2 of the 3 test plants.

Table 4. Influence of micronutrient source and rate on tissue content of Brassaia actinophylla.

Treatment	Rate lb/yd³	% N	% K	ppm Cu	Fe	Mn	Zn
Check	0	2.9 abc[z]	2.9 ab	9 a	127 a	41 a	206 b
Perk	1 1/2	2.7 ab	3.7 c	16 bc	508 b	167 bc	268 c
Perk	3	2.8 abc	3.3 abc	16 bc	590 b	211 c	273 c
Perk	4 1/2	2.5 a	3.1 ab	15 bc	530 b	388 d	260 c
Vigoro	1	2.9 abcd	2.9 ab	6 a	147 a	98 ab	230 bc
Vigoro	2	3.0 abcd	3.2 abc	15 bc	60 a	92 ab	150 a
Vigoro	3	2.7 ab	2.8 a	14 b	64 a	82 ab	203 b
FTE-503	1/4	3.3 d	3.6 c	19 cd	112 a	77 ab	234 bc
FTE-503	1/2	3.2 cd	3.7 c	24 e	126 a	112 ab	263 c
FTE-503	3/4	3.1 bcd	3.4 bc	22 de	87 a	132 abc	253 c

[z]Numbers in a column followed by the same letter are not significantly different at the 5% level.

Table 5. Influence of micronutrient source and rate on tissue content of Philodendron oxycardium.

Treatment	Rate lb/yd^3	%		ppm			
		N	K	Cu	Fe	Mn	Zn
Check	0	2.33 e[z]	3.53 e	19 b	168 c	88 a	116 bc
Perk	1 1/2	2.10 abc	3.27 abcd	12 ab	80 ab	283 e	115 bc
Perk	3	2.30 de	3.38 bcd	15 ab	83 ab	274 e	119 c
Perk	4 1/2	2.27 cde	3.22 abc	12 ab	74 a	405 f	121 c
Vigoro	1	2.17 abcd	3.05 a	11 a	77 ab	127 b	83 a
Vigoro	2	2.10 abc	3.22 abc	10 a	103 b	128 b	99 a
Vigoro	3	2.13 abcd	3.48 de	16 ab	91 ab	199 d	93 a
FTE-503	1/4	2.07 ab	3.25 abcd	11 a	80 ab	141 bc	83 a
FTE-503	1/2	2.07 ab	3.08 ab	10 a	68 a	186 cd	100 ab
FTE-503	3/4	2.03 a	3.32 abcd	12 ab	91 ab	193 cd	100 ab

[z]Numbers in a column followed by the same letter are not significantly different at the 5% level.

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