

Table 1. Influence of increasing concentrations of a 10 NaCl:1 MgCl₂ on growth rate and tissue content of *Livistona chinensis* in solution and soil culture.

10 NaCl:1 MgCl ₂ concn (ppm)	Foliar content (% dry wt)						Plant height new growth (cm)	New growth as % of untreated palms	Increase in Na content over control (%)
	N	P	K	Ca	Mg	Na			
<i>Soil culture</i>									
0	1.76 a*	0.14 a	1.19 a	0.14 a	0.23 a	0.24 a	4.5 a		
250	1.95 a	0.13 a	1.35 ab	0.19 a	0.29 ab	0.40 a	3.0 a	66	160
1000	1.91 a	0.14 a	1.78 b	0.17 a	0.30 b	0.58 ab	2.5 b	55	240
3000	1.78 a	0.13 a	1.73 b	0.17 a	0.32 bc	0.98 bc	1.5 c	33	400
5000	1.61 a	0.12 a	1.69 b	0.18 a	0.35 c	1.61 d	0.5 c	11	670
7500	1.76 a	0.14 a	1.70 b	0.19 a	0.35 c	1.45 d	0.6 c	13	600
10,000	1.76 a	0.16 a	1.72 b	0.17 a	0.37 c	1.72 d	0 c	0	710
15,000	1.81 a	0.15 a	1.35 ab	0.18 a	0.34 c	1.01 c	0 c	0	420
<i>Hoagland's solution</i>									
0	2.31 a	0.27 a	1.46 a	0.07 a	0.13 a	0.17 a	12.9 a		
250	2.21 a	0.21 a	1.54 a	0.08 a	0.14 abc	0.20 ab	8.9 ab	69	110
1000	2.48 a	0.26 a	1.58 a	0.11 a	0.18 abc	0.24 abc	9.0 ab	69	140
3000	2.25 a	0.27 a	1.53 a	0.09 a	0.20 c	0.32 abc	8.5 ab	65	180
5000	2.36 a	0.28 a	1.59 a	0.08 a	0.20 c	0.35 cde	7.4 bc	57	200
7500	2.43 a	0.22 a	1.68 ab	0.07 a	0.18 abc	0.43 ef	4.8 bcd	37	250
10,000	2.31 a	0.29 a	1.78 ab	0.09 a	0.19 bc	0.39 e	2.5 d	19	220
15,000	2.30 a	0.33 a	2.04 b	0.07 a	0.20 c	0.49 f	3.2 cd	25	280

*Each figure is the mean of 6 replicates. Means separation within columns within treatments by Duncan's multiple range test, 5% level.

Ream (4) found similar Na levels in frond tissue of container-grown date palms when irrigated with similar saline concentrations.

However, as reported here and elsewhere (4) the increases in mineral content of tissue did not correspond directly with element concentrations in the saline solution. Na and Mg substrate levels were similarly increased for plants grown in Hoagland's solution and containers. Plants grown in containers had higher levels of Na and Mg in their tissue than plants grown in Hoagland's solution (Table 1). This reflects the alternating increase and decrease of substrate salt concentrations of the container-grown palms with irrigation periods. However, Mg in tissue increased 1.5 for plants grown in Hoagland's solution and 1.6 for plants grown in containers, while Na in tissue increased 2.9 for plants grown in Hoagland's solution but 7.2 for container-grown plants. Lunt (6) has stated that foliar Na exclusion may depend on root aeration. Possibly the improved root aeration in Hoagland's solution may have depressed Na uptake while not affecting Mg uptake.

Increased substrate concentrations of Na and Mg did not affect N, P, or Ca absorption (Table 1). No difference in frond tissue levels of Cu, Fe, Mn, or Zn occurred in solution- or container-grown palms with increasing substrate saline concentrations. However, K tissue levels increased in plants grown in Hoagland's solution treated with 15,000 ppm and container-grown plants treated with 1000 ppm and higher salt concentrations (Table 1). Based on the concepts of Shear et al. (9), Hewitt (5) and others (3), depressed absorption of Ca and K would have been expected with increases in Mg and Na due to ionic antagonisms.

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Production of *Ficus elastica* 'Decora' Standards¹

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Abstract. Best commercial quality of *Ficus elastica* Roxb. ex Hornem 'Decora standards were produced when single stem plants were topped at either 76 or 46 cm above the soil line and grown under 90 or 70 klx on 27 or 36 g 18-3-10 (N-P-K) per 30 cm container per 6 months. Number of branches per standard decreased as shade level increased, but height and plant quality were greater under shade than in full sun. Branched standards over 1 m tall were produced in 16 months from rooted single-eye cuttings, and were of excellent quality.

Ficus elastica cultivars have been popular as indoor foliage plants since

the turn of the century. A popular cultivar, *Ficus elastica* 'Decora' is grown commercially in 15 cm diameter pots with 1 single-stemmed plant about 30 cm tall, or 3 plants may be planted in 30 to 35 cm diameter pots and allowed to reach about 70 cm in height before sale. Occasionally a specialty nursery produces a few attractive tree form 'Decora' standards, but most commercial

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foliage plant producers are unaware of the high consumer demand for these plants. The cultural information necessary for propagation and production of single or multiplant 'Decora' is available, but none is available on production of 'Decora' standards (5,6).

Although 'Decora' plants can be rooted easily from single-eye cuttings (6), the majority of 'Decora' plants produced commercially are propagated by air layering (1). Using plants from air layers or single-eye cuttings, Conover and Poole (4) suggested light and nutritional levels of 90 klx and 2000 kg/ha per yr of N applied as a ratio of 18-3-10 (N-P-K) for potted acclimatized *Ficus elastica* cultivars and, in later research (6), suggested light and nutritional levels for potted 'Decora' to be 90 klx and 1700 kg/ha per yr of N. Full sun in Central Florida is approx 130 klx. This experiment was initiated to study the influence of several cultural factors on production of 'Decora' standards.

A 2x3x3 factorial experiment in randomized block design was established with 5 month old 'Decora' plants averaging 25 cm in height on March 28, 1976. Treatments included 2 topping heights 46 and 76 cm above potting medium level; 3 (polypropylene) shade levels, 130, 90 and 70 klx maximum; and 3 fertilizer levels, 18, 27 and 36 g per 30 cm diameter container each 6 months from Osmocote 18-3-10 (N-P-K). Fertilizer was surface applied April 1 and October 1, 1976. There were 4 replications with 1 plant as the experimental unit from a single-eye cutting stuck November 5, 1975 in a 8 cm container, repotted January 9, 1976 into a 15 cm container and grown under 90 klx max until repotted March 28, 1976 into the final 30 cm diameter production container and spaced 75 cm on center. Trees were topped when firm wood existed at topping height (about 46 cm of soft stem usually existed at that time above desired topped height). The potting medium was composed of Florida sedge peat and washed mason sand (4:1 by vol) amended with 4.2 kg/m³ dolomite, 1.8 kg/m³ CaCO₃ and 0.6 kg/m³ Perk (a micronutrient blend manufactured by Kerr McGee, Jacksonville, Florida). Production temperatures were 13°C minimum and 38°C maximum with irrigation water applied by sprinklers once a week during cool months and twice a week during warm months. Data collected March 3, 1977 at experiment termination included: 1) plant height; 2) number of branches; 3) number of leaves/branch; 4) branch length; 5) trunk caliper measured 20 cm above potting medium level; and

Table 1. Influence of topping heights, shade, and fertilizer levels on production of *Ficus elastica* 'Decora' standards.

Treatments	Height (cm) ^z	Avg no. of branches	Avg no. of leaves/branch	Avg branch length (cm)	Trunk caliper (cm) ^y	Plant quality ^x
<i>Topping heights^z</i>						
46 cm	92.8 a ^w	4.9 a	11.8 b	36.1 b	3.3 a	4.4 a
76 cm	108.2 b	6.1 b	9.1 a	28.5 a	3.5 a	4.3 a
<i>Shade levels (klx)</i>						
130	95.1 a	7.4 c	10.3 a	29.9 a	3.4 a	3.7a
90	104.8 b	5.2 b	10.9 a	34.2 a	3.5 a	4.6b
70	101.5 b	3.8 a	10.2 a	32.8 a	3.3 a	4.7b
<i>Fertilizer levels^v</i>						
18	97.0 a	5.6 a	9.9 a	29.2 a	3.3 a	4.0 a
27	101.3 a	5.5 a	10.7 a	34.0 b	3.4 a	4.4 b
36	103.1 a	5.9 b	10.8 a	33.7 b	3.5 a	4.6 b

^zMeasured from the soil level.

^yMeasured 20 cm above soil level.

^xRated on a scale where 1 = poor quality, 3 = good quality and 5 = excellent quality.

^wMean separation within columns within treatment groups by Duncan's multiple range test, 5% level.

^vg/30 cm diam pot 6 months from Osmocote 18-3-10 (N-P-K) surface applied.

6) plant quality rated on a scale of 1-5 where 1 = poor quality, 3 = good quality and 5 = excellent quality.

Topping heights had no influence on the quality of 'Decora'. However, topping at 76 cm increased height and branching of plants but decreased branch length and number of leaves per branch. Poole and Conover (6) observed that topping increased number of branches and decreased branch length when 'Decora' were grown under 130 klx as compared to 90 klx. Shade levels yielding 90 or 70 klx used in this experiment produced taller plants with higher quality, but number of branches decreased as shade level increased (Table 1). Leaves produced by 'Decora' under 70 klx were also longer, darker and more glossy green than those grown under full sun or 90 klx. However, the maroon color of the leaf sheath and young leaves characteristic of 'Decora' grown in full sun was less intense when grown under 70 or 90 klx. Number of leaves per branch, branch length and trunk caliper were not influenced by shade level. Previously Conover and Poole (2,3) had observed reduced trunk caliper on *Ficus benjamina* decreased with increasing shade levels, but 'Decora' apparently responds less to light reductions.

'Decora' fertilized with 36 g Osmocote per 6 months had slightly more branches, while plants receiving either 27 or 36 g had highest quality and branch length (Table 1). Height, average number of leaves per branch and trunk caliper were unaffected by fertilizer

level. Responses to fertilizer were not strong, and thus, the middle level would probably be best when both production and acclimatization are considered, since previous research indicated that 1700 kg/ha per yr of N produced good quality *Ficus elastica* (6). Lack of trunk caliper response to increased fertilizer levels has been reported previously by Conover and Poole (3) with *Ficus benjamina*.

Results of this experiment indicate that excellent quality *Ficus elastica* 'Decora' standards can be produced in 1 year when topped at 46 or 76 cm and grown under 90 or 70 klx on a fertilizer program providing 1400 kg N/ha per yr (27 g/30 cm container/6 months) from Osmocote 18-3-10 (N-P-K).

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