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Leachate Electrical Conductivity and pH for Ten Foliage Plants[1]

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Abstract

Most foliage plant varieties tested produce salable plants when fertilized with a wide range of rates. About 5 grams 19N-2.6P-10K (19-6-12) per 15 cm pot per 3 months resulted in best *Dracaena fragrans* 'Massangeana', *Nephrolepis exaltata* 'Compacta', and *Philodendron s. oxycardium*. No more than 2.4 grams per pot appears best for *Chamaedorea elegans*. *Aglaonema* 'Silver Queen', *Aphelandra squarrosa* 'Dania', *Codiaeum variegatum* 'Banana', *Spathiphyllum* 'Petite', *Dieffenbachia maculata* 'Camille' and *Epipremnum aureum* 'Marble Queen' grew best at about 10 grams per pot per 3 mos. Only *P. s. oxycardium* and *C. elegans* had a narrow requirement for fertilization levels. Electrical conductivity (EC) of leachate obtained from pots of best quality plants had a very wide range indicating leachate EC is a poor indicator for production of quality plants.

Index word: nutrition

Species used in this study: Apollo zebra plant [*Aphelandra squarrosa* Nees], banana croton [*Codiaeum variegatum* (L.) Blume 'Banana'], corn plant [*Dracaena fragrans* (L.) Ker-Gawl. 'Massangeana'], dumb cane [*Dieffenbachia maculata* (Lodd) G. Don 'Camille'], dwarf Boston fern [*Nephrolepis exaltata* (L.) Schott. 'Bostoniensis Compacta'], heart-leaf philodendron [*Philodendron scandens oxycardium* (Schott) Bunt.], marble queen pothos [*Epipremnum aureum* (Linden & Andre) Bunt. 'Marble Queen'], parlor palm [*Chamaedorea elegans* Mart.], petite peace lily [*Spathiphyllum* Schott. 'Petite'] and silver queen aglaonema [*Aglaonema* Schott. 'Silver Queen'].

Significance to the Nursery Industry

These data demonstrate the effects of a range of fertilizer application rates on foliage plant growth and subsequent effects on plant quality during interior use. As a check on the fertilizer program, the pour-through method of collecting leachate was compared with plant quality to provide a range of leachate readings associated with high quality plants; these are shown in Table 12. Growers should select the lowest fertilizer level that results in high quality plants capable of maintaining quality in an interior environment.

Results indicate that at these production light intensities, the lower fertilizer rates tested should produce salable plants that will do well in interiors. This information will be important to growers since the use of less fertilizer would not only cut production costs, but would also decrease the chance for ground water contamination from excessive fertilizer run-off.

Introduction

Numerous reports dealing with the effects of fertilization rate on growth of the plant species tested in this study have been published (1, 2, 6, 12, 15, 16, 18). Only 5 reports measured EC of the potting medium (3, 4, 5, 17, 20). Utilizing some of these publications and others, fertilization recommendations for the majority of important foliage plants were published (7).

Data have been presented in industry publications for the interpretation of EC (10, 13, 14) and a symposium entitled "Interpretation of Extraction and Nutrient Determination Procedures for Organic Potting Substrates" was held at the 1983 meeting of the American Society of Horticultural Sciences. One paper suggested determination of EC by a pour-through method that utilizes a leachate for analyses (22). One of the first comparisons of saturated paste with the leachate method was conducted in Texas (9). A correlation coefficient for pH determined by the two methods was 0.95. Leachate collection has also been used to determine pH of mixes treated with carbonate solutions (11) and pH and EC of mixes receiving varying amounts of fertilizer and water (8, 19, 21). A comparison of leachate and saturated paste pine bark extract revealed correlation coefficients for N, P and K of 0.93–0.99 (23). A comparison of indoor foliage plant growth and EC of the potting medium determined by both the volume (2:1, water:medium) and saturated paste method revealed that EC is a poor indicator for judging production of quality foliage plants (20).

These experiments were conducted to test the effects of a wide range of fertilizer levels on growth of ten foliage plants and EC and pH of the media.

Materials and Methods

Experiments were initiated to test effects of 10 fertilization levels on growth and interior plant quality of 10 foliage plant genera and to test effects of fertilizer level on EC and pH of leachate of the potting medium. Plants tested and fertilization levels are given in Tables 1–10.

Liners were obtained and planted in 15 cm (6 in) pots containing Vergro Container Mix (Canadian peat moss-coarse grade vermiculite-perlite, 2-1-1 by volume, plus starter nutrient charge, Verlite Company, Tampa, FL 33680). Plants were placed in a glasshouse where they received 1500–2000 ft-c maximum light intensity at plant level with temperatures

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Table 1. Influence of fertilization rate on plant and root grade and medium pH and EC of *Aglaonema* 'Silver Queen'. 1986.

Fertilizer rate g/pot[z]	Electrical conductivity ($dS \cdot m^{-1}$)							pH		Glasshouse		Interior rooms[y]	
										Plant grade	Root grade	Plant grade	Root grade
	14 Mar	11 Apr	9 May	6 Jun	3 Jul	31 Jul	29 Aug	14 Mar	29 Aug	16 Sept		19 Nov	
2.4	2.33	1.05	0.67	0.47	0.57	0.40	0.22	7.5	6.8	3.7[x]	4.9[w]	3.3	4.7
4.8	3.24	2.42	2.16	1.24	1.91	1.09	0.50	7.4	6.9	4.2	4.9	3.9	4.6
7.2	2.47	3.41	3.44	2.02	3.31	2.03	0.81	7.5	6.3	5.0	4.9	4.3	4.7
9.6	2.61	3.98	4.23	2.69	4.57	2.76	1.11	7.5	5.3	4.8	4.7	4.7	4.2
12.0	2.81	5.21	5.56	3.59	5.71	3.39	1.48	7.5	4.7	4.8	4.4	4.4	4.2
14.4	4.17	5.79	5.97	4.27	6.59	3.83	2.14	7.3	4.1	4.4	4.0	3.7	3.8
16.8	3.11	6.65	6.59	4.20	6.86	3.77	2.84	7.5	3.5	3.5	3.7	4.1	3.4
19.2	3.30	7.31	7.62	5.01	7.53	3.84	2.64	7.5	3.2	2.9	3.2	3.5	3.3
21.6	3.86	7.51	8.45	5.51	7.51	4.17	2.76	7.5	3.3	2.8	2.6	3.0	2.9
24.0	2.59	8.13	9.41	6.65	7.37	3.93	3.09	7.6	3.2	2.6	2.6	3.0	2.5
Significance													
Linear	NS	**	**	**	**	**	**	NS	**	**	**	**	**
Quadratic	NS	**	NS	NS	**	**	NS	NS	**	**	**	**	*

[z]19-2.6-10/6 in pot applied 7 Mar, 6 Jun, 6 Sep

[y]Moved into rooms 18 Sep

[x]1 = poor, not salable; 3 = fair but salable; 5 = excellent quality

[w]1 = 1–20%, 3 = 41–60%, 5 = 81–100% root ball coverage with white healthy roots

varying between 20–35°C (68–95°F) depending upon season. Fertilizer was surface applied as Osmocote 19N-2.6P-10K (19N-$6P_2O_5$-$12K_2O$) Sierra Chemical Co., Milpitas, CA 95035). When most plants of a genera were judged salable they were graded and then moved into rooms maintained at 22°C ± 2°C (72°F ± 3°F) with 12 hours light per day from cool-white fluorescent lamps supplying 125 ft-c to simulate an interior environment. Electrical conductivity and pH were determined every 4 weeks throughout the experiment by leachate collection (22). Tap water (pH-7.4, EC-3.33 $dS \cdot m^{-1}$) was poured uniformly over the medium surface to obtain about 50 ml (1.7 oz) of leachate in a beaker placed under the pot. After both glasshouse production and the interior phase, plants were graded on a quality scale of 1–5 where 1 = dead, 3 = acceptable and 5 = excellent. Root quality rating was 1 = no visible living roots to 5 = excellent root development on about 100% of the outside perimeter of the root ball.

Results and Discussion

Grade of all plants tested was affected by fertilization levels (Tables 1–10). Most plants grew satisfactorily over a wide range of fertilizer and EC levels. Root grade decreased with increased fertilizer rate except for *Epipremnum* 'Marble Queen'. Some plants had high correlations between root grade and plant grade, but many were weakly correlated and *Dracaena* 'Massangeana' and *Epipremnum* 'Marble Queen' had negative correlations after glasshouse production (Table 11). Because plants were grown for various time periods (see Materials and Methods and Tables 1–10) each is discussed separately.

Table 2. Influence of fertilization rate on plant and root grade and medium pH and EC of *Aphelandra squarrosa* 'Dania'. 1986.

Fertilizer rate (g/pot)[z]	Electrical conductivity ($dS \cdot m^{-1}$)				pH		Glasshouse		Interior rooms[y]	
							Plant grade	Root grade	Plant grade	Root grade
	7 Mar	4 Apr	2 May	30 May	7 Mar	30 May	2 June		25 Aug	
2.4	2.00	1.43	0.71	0.49	5.2	5.5	3.9[x]	5.0[w]	4.1	5.0
4.8	2.54	2.62	2.65	1.77	5.5	5.3	4.2	4.8	4.1	4.7
7.2	2.11	3.71	4.44	2.97	5.4	4.6	4.0	5.0	4.0	4.6
9.6	2.05	4.81	4.61	3.76	5.3	4.2	4.2	5.0	4.2	4.3
12.0	2.29	6.18	7.41	4.63	5.4	3.9	4.1	5.0	4.0	3.4
14.4	2.69	6.23	7.40	5.38	5.4	3.7	4.2	4.8	3.9	3.8
16.8	2.88	7.87	8.89	7.62	5.4	3.8	4.0	4.6	3.7	3.4
19.2	3.19	8.28	9.96	7.68	5.5	3.7	4.0	4.4	3.5	3.0
21.6	2.66	8.36	10.27	7.68	5.6	3.5	3.8	4.0	2.0	1.8
24.0	3.04	8.80	10.84	8.42	5.4	3.6	3.8	4.0	2.7	2.3
Significance										
Linear	*	**	**	**	NS	**	NS	**	**	**
Quadratic	NS	**	*	NS	NS	NS	*	**	**	NS

[z]19-2.6-10/6 in pot applied 28 Feb and 30 May

[y]Moved into rooms 24 June

[x]1 = poor, not salable; 3 = fair but salable; 5 = excellent quality

[w]1 = 1–20%, 3 = 41–60%, 5 = 81–100% root ball coverage with white healthy roots

Table 3. Influence of fertilization rate on plant and root grade and medium pH and EC of *Chamaedorea elegans*. 1986

Fertilizer rate g/pot[z]	Electrical conductivity (dS·m^{-1})								pH		Glasshouse		Interior rooms[y]	
	28 Feb	28 Mar	25 Apr	22 May	20 Jun	18 Jul	15 Aug	11 Sept	28 Feb	11 Sept	Plant grade	Root grade	Plant grade	Plant grade
											23 Sept		2 Dec	
2.4	1.61	1.97	1.47	0.75	1.54	0.70	0.40	0.74	5.4	7.2	4.4[x]	4.8[w]	4.9	3.6
4.8	1.76	2.90	3.43	2.15	2.99	2.96	1.84	3.26	5.7	6.1	4.5	4.8	3.0	3.2
7.2	1.70	4.22	5.09	3.52	4.39	4.55	3.75	5.00	5.5	3.6	4.6	4.7	3.6	2.9
9.6	1.79	4.52	6.22	4.71	4.98	5.38	4.36	5.57	5.5	3.0	3.5	3.9	2.1	2.7
12.0	2.22	5.82	7.10	5.29	6.47	6.84	5.81	6.93	5.5	2.9	2.9	3.4	2.3	2.8
14.4	2.07	6.52	8.00	5.86	6.64	6.52	5.01	6.86	5.3	3.0	2.6	2.9	2.2	2.4
16.8	2.39	7.50	8.29	7.02	7.22	6.52	5.60	6.97	5.3	3.0	2.4	2.8	1.9	2.2
19.2	2.15	8.18	10.05	7.15	7.16	6.45	5.59	7.64	5.4	3.0	2.2	2.2	1.6	2.0
21.6	2.54	0.02	11.03	7.38	8.11	7.20	6.20	8.58	5.3	3.0	1.9	2.1	1.9	1.5
24.0	2.66	9.59	11.73	8.07	9.07	8.75	7.74	10.11	5.3	3.1	1.7	1.9	1.7	1.4
Significance														
Linear	**	**	**	**	**	**	**	**	**	**	**	**	**	**
Quadratic	NS	NS	*	**	**	**	NS	**	NS	**	**	**	**	NS

[z]19-2.6-10/6 in pot applied 10 Feb, 23 May, 23 Aug

[y]Moved into rooms 24 Sep

[x]1 = poor, not salable; 3 = fair but salable; 5 = excellent quality

[w]1 = 1–20%, 3 = 41–60%, 5 = 81–100% root ball coverage with white healthy roots

Aglaonema 'Silver Queen'. Only the 3 highest fertilizer levels resulted in poor quality plants after glasshouse production, with highest plant grade at 7.2 g (Table 1). High quality plants also resulted from 9.6 and 12 g of fertilizer. These high plant grades were maintained through 2 months indoors. About 1 month after initial fertilization, the high quality plants listed above had EC readings of 3.41–5.21 dS·m^{-1} (11 April). Electricity conductivity just before movement of these plants into rooms ranged from 8.10 to 1.48 dS·m^{-1}, while pH was 6.3 and 4.7, respectively.

Aphelandra squarrosa 'Dania'. There was very little response to fertilizer rates, but the lowest rate and highest two rates resulted in the poorest plants while grown in the glasshouse (Table 2). However, best plants after two months in the interior rooms resulted from rates of 2.4 to 12.0 g fertilizer with EC of 0.49 to 4.63 dS·m^{-1} and pH of 5.5 to 3.9 before movement into the rooms.

Chamaedorea elegans. The 3 lowest fertilizer levels (2.4 to 7.2 g) resulted in the best plants after glasshouse growth, but only the lowest fertilizer level was clearly the best after 2½ months indoors (Table 3). Electrical conductivity of 3.26 dS·m^{-1} or higher before placement of plants into interiorscapes appears to be damaging. The low pH associated with higher fertilization levels may also have resulted in poor plant quality.

Codiaeum variegatum 'Banana'. These plants responded to a wide range of fertilizer levels, with only the two highest yielding unacceptable plants (Table 4). Best plants were fertilized with 4.8 to 12.0 g corresponding to a final EC

Table 4. Influence of fertilization rate on plant and root grade and medium pH and EC of *Codiaeum* 'Banana'. 1986.

Fertilizer rate g/pot[z]	Electrical conductivity (dS·m^{-1})			pH		Glasshouse	
	27 Feb	27 Mar	24 Apr	27 Feb	24 Apr	Plant grade	Root grade
						24 Apr	
2.4	1.43	1.89	0.83	5.8	5.1	3.3[y]	4.4[x]
4.8	1.73	3.00	2.22	5.9	4.7	3.8	4.4
7.2	1.79	3.71	4.02	5.9	4.8	4.0	4.4
9.6	2.07	5.26	5.99	5.8	4.8	4.1	4.0
12.0	2.35	5.44	5.95	5.9	4.4	3.9	4.0
14.4	2.87	6.17	7.70	5.7	4.3	3.7	3.5
16.8	2.68	7.95	9.15	5.7	4.1	3.4	3.2
19.2	3.13	8.82	11.47	5.6	4.1	3.2	2.9
21.6	3.66	9.47	11.06	5.6	4.1	2.2	1.8
24.0	4.23	9.51	10.59	5.5	4.1	2.3	1.8
Significance							
Linear	**	**	**	**	NS	**	**
Quadratic	NS	NS	*	NS	NS	**	**

[z]19-2.6-10/6 in pot applied 21 Feb

[y]1 = poor, not salable; 3 = fair but salable; 5 = excellent quality

[x]1 = 1–20%, 3 = 41–60%, 5 = 81–100% root ball coverage with white healthy roots

Table 5. Influence of fertilization rate on plant and root grade and medium pH and EC of *Dieffenbachia* 'Camille'. 1986.

Fertilizer rate g/pot[z]	Electrical conductivity (dS·m^{-1})			pH		Glasshouse Plant grade	Glasshouse Root grade	Electrical conductivity (dS·m^{-1})			Interior rooms[y] Plant grade
	21 Mar	18 Apr	16 May	21 Mar	8 Aug	2 Jun		13 Jun	11 Jul	8 Aug	4 Nov
2.4	1.83	1.48	0.76	5.6	4.6	3.8[x]	5.0[w]	0.20	0.20	0.06	2.9
4.8	1.67	2.28	1.45	5.4	4.1	4.0	5.0	0.42	0.41	0.19	2.9
7.2	2.07	3.75	4.42	5.5	4.0	3.8	4.6	2.19	0.97	0.21	3.9
9.6	2.29	4.11	5.89	5.2	3.7	4.0	5.0	2.92	1.51	0.30	3.9
12.0	2.31	5.74	7.06	5.4	3.4	3.8	4.6	4.66	2.44	0.49	3.9
14.4	2.25	6.38	7.84	5.3	3.3	3.5	3.7	4.70	3.60	0.77	3.9
16.8	2.47	6.50	8.60	5.3	3.3	3.7	3.8	4.58	3.03	0.75	4.4
19.2	3.10	7.15	8.73	5.3	3.2	3.2	3.2	5.00	4.36	1.20	3.7
21.6	3.39	8.36	9.39	5.5	3.2	3.1	2.8	5.77	4.48	1.49	3.9
24.0	2.78	8.63	10.20	5.4	3.2	3.0	2.6	5.37	4.30	1.31	4.1
Significance											
Linear	**	**	**	NS	**	**	**	**	**	**	**
Quadratic	NS	*	**	NS	NS	*	*	**	NS	NS	*

[z]19-2.6-10/6 in pot applied 14 Mar and 14 Jun

[y]Moved into rooms 27 Aug

[x]1 = poor, not salable; 3 = fair but salable; 5 = excellent quality

[w]1 = 1–20%, 3 = 41–60%, 5 = 81–100% root ball coverage with white healthy roots

from 2.22 to 5.99 dS·m^{-1} and a pH from 4.8 to 4.4. These plants were not placed in rooms because of space limitations.

Dieffenbachia maculata 'Camille'. All fertilizer rates resulted in salable plants, but best plants resulted from the lower levels of 2.4 to 12.0 g (Table 5). However, after plants had been held in the rooms for 12 weeks, best plants were in the containers that had received the higher rates and plants that had received the lower rates were unacceptable. Unpublished results by the authors indicate that dieffenbachia benefit from relatively high fertilization while growing in an interiorscape. Electrical conductivity of 0.21 to 1.31 dS·m^{-1} and a pH of 4.0 to 3.2 resulted in attractive plants for 12 weeks in the rooms.

Dracaena fragrans 'Massangeana'. All plants except those fertilized with 2.4 grams per pot were of high quality after glasshouse growth, but after 6 weeks in the rooms, best quality plants were those that had received lowest levels of fertilizer resulting in EC of only 0.36 to 2.71 dS·m^{-1} and pH from 7.6 to 5.8 before placement in rooms (Table 6).

Epipremnum aureum 'Marble Queen'. Plant grades were best at the 2 highest fertilizer levels after glasshouse growth, but after 2 months in the rooms, plants that had received 7.2 to 24.0 g fertilizer had excellent plant grades (Table 7). Electrical conductivity of pots maintaining good grades after placement indoors had a range of 1.19 to 5.64 dS·m^{-1} and a pH of 5.0 to 2.7.

Nephrolepis exaltata 'Compacta'. Only the lowest rate of fertilizer failed to produce a good grade of fern after glasshouse production (Table 8), although better quality plants were near the middle of the range. This was the only

Table 6. Influence of fertilization rate on plant and root grade and medium pH and EC of *Dracaena* 'Massangeana'. 1986.

Fertilizer rate g/pot[z]	Electrical conductivity (dS·m^{-1})					pH		Glasshouse Plant grade	Glasshouse Root grade	Interior rooms[y] Plant grade	Interior rooms[y] Root grade
	9 Sept	3 Oct	31 Oct	5 Dec	5 Jan	5 Sept 86	5 Jan 87	12 Jan 1987		23 Feb 1987	
2.4	1.75	0.40	0.38	0.21	0.36	7.4	7.6	3.0[x]	4.7[w]	4.0	4.8
4.8	1.65	0.74	0.52	0.21	0.91	7.4	7.5	4.4	4.4	4.4	4.6
7.2	1.50	1.20	0.90	0.21	1.83	7.5	7.0	4.8	4.2	4.4	4.6
9.6	1.66	1.60	1.23	0.30	2.71	7.4	5.8	4.4	4.2	4.2	4.2
12.0	1.67	2.35	1.46	0.25	3.46	7.5	5.4	4.6	4.0	3.6	3.6
14.4	1.65	2.64	1.72	0.41	4.06	7.4	4.6	4.7	3.8	3.8	3.4
16.8	1.26	2.69	1.69	0.53	4.20	7.5	4.6	4.7	4.1	4.0	3.8
19.2	1.70	3.68	2.28	0.69	5.09	7.5	4.6	4.6	3.8	3.8	3.4
21.6	1.65	3.76	2.60	0.85	5.27	7.5	4.4	4.5	3.6	3.6	3.6
24.0	1.54	3.87	2.64	1.07	5.46	7.6	4.2	4.4	3.6	3.2	3.0
Significance											
Linear	NS	**	**	**	**	**	**	**	**	*	**
Quadratic	NS	NS	NS	**	**	NS	**	**	NS	NS	NS

[z]19-2.6-10/6 in pot applied 4 Sep, 9 Dec and 12 Jan

[y]Moved into rooms 15 Jan

[x]1 = poor, not salable; 3 = fair but salable; 5 = excellent quality

[w]1 = 1–20%, 3 = 41–60%, 5 = 81–100% root ball coverage with white healthy roots

Table 7. Influence of fertilization rate on plant and root grade and medium pH and EC of *Epipremnum* 'Marble Queen'. 1986.

Fertilizer rate g/pot[z]	Electrical conductivity ($dS \cdot m^{-1}$)							pH		Glasshouse		Interior rooms[y]
										Plant grade	Root grade	Plant grade
	23 May	19 Jun	17 Jul	14 Aug	12 Sept	10 Oct	7 Nov	23 May	7 Nov	11 Nov		12 Jan
2.4	1.73	1.27	0.58	0.23	0.34	0.27	0.33	7.3	5.2	2.1[x]	4.4[w]	2.4
4.8	1.86	2.45	1.32	0.33	1.07	0.64	0.66	7.2	5.0	2.3	4.2	3.6
7.2	1.69	3.74	2.93	0.48	2.13	1.80	1.19	7.4	5.0	2.4	4.4	4.3
9.6	1.60	4.66	3.48	0.78	2.73	2.52	2.54	7.4	4.2	2.7	4.3	4.6
12.0	1.99	5.52	4.51	1.19	3.61	3.92	3.36	7.3	3.6	2.6	4.2	4.4
14.4	1.80	6.07	5.59	2.24	3.74	4.12	3.90	7.4	3.2	2.9	4.4	4.6
16.8	1.88	7.00	6.18	2.53	4.37	4.68	4.23	7.4	3.0	3.0	4.2	4.6
19.2	1.65	7.45	5.94	3.06	4.52	5.13	5.24	7.3	2.8	3.2	4.0	4.5
21.6	1.96	8.53	7.30	4.14	4.93	5.56	5.72	7.4	2.7	3.5	4.1	4.4
24.0	1.57	8.53	7.37	3.76	5.16	5.95	5.64	7.6	2.7	3.4	4.3	4.5
Significance												
Linear	NS	**	**	**	**	**	**	*	**	**	NS	**
Quadratic	NS	**	**	NS	**	**	NS	NS	**	NS	NS	**

[z]19-2.6-10/6 in pot applied 19 May and 19 Aug

[y]Moved into rooms 17 Nov

[x]1 = poor, not salable; 3 = fair but salable; 5 = excellent quality

[w]1 = 1–20%, 3 = 41–60%, 5 = 81–100% root ball coverage with white healthy roots

plant with a root grade that did not respond negatively to increased fertilization. It was also the only plant that did not have plant grade affected statistically by fertilizer levels after placement in rooms, indicating an EC range of 0.28 to 1.52 $dS \cdot m^{-1}$ and pH 7.6 to 5.7 are acceptable before plants are placed in the interiorscape.

Philodendron scandens oxycardium. All fertilizer rates resulted in acceptable plants, but plants receiving 4.8 and 7.2 g had the best quality after glasshouse production and after 2 months in rooms (Table 9). Electrical conductivity of 1.04 and 1.46 $dS \cdot m^{-1}$ and pH of 5.7 and 5.2 before placement into rooms were associated with the best plants.

Spathiphyllum 'Petite'. The higher fertilizer rates resulted in poorer plants, while those plants that received 4.8 to 12.0 g during glasshouse growth were of higher quality and were even better after 6 weeks in rooms (Table 10). Electrical conductivity of 0.34 to 1.75 $dS \cdot m^{-1}$ and pH of 6.7 to 4.7 before placement of plants into rooms were associated with the best plants in interior rooms.

Table 8. Influence of fertilization rate on plant and root grade and medium pH and EC of *Nephrolepis* 'Compacta'. 1986.

Fertilizer rate g/pot[z]	Electrical conductivity ($dS \cdot m^{-1}$)				pH		Glasshouse		Interior rooms[y]	
							Plant grade	Root grade	Plant grade	Root grade
	27 Jun	25 Jul	21 Aug	18 Sept	27 June	18 Sept	23 Sept		2 Dec	
2.4	4.27	0.95	0.39	0.28	6.3	7.5	2.7[x]	3.4[w]	2.9	4.0
4.8	4.26	1.67	0.64	0.27	6.5	7.6	3.8	3.6	3.7	3.9
7.2	4.54	2.29	1.31	0.29	6.5	7.6	4.1	3.7	3.9	3.5
9.6	5.16	3.30	1.53	0.33	6.4	7.6	3.8	3.7	3.2	3.5
12.0	4.60	4.03	2.07	0.44	6.4	7.4	4.3	4.0	3.2	3.3
14.4	5.32	5.00	2.60	0.59	6.3	7.3	3.8	3.8	2.8	3.0
16.8	5.25	4.21	2.80	0.80	6.3	7.0	3.9	3.8	3.6	2.8
19.2	5.42	4.55	2.97	0.90	6.3	6.8	3.8	3.5	3.5	3.5
21.6	5.22	5.09	3.51	1.17	6.3	6.3	3.7	3.6	2.4	2.7
24.0	5.57	6.61	4.43	1.52	6.3	5.7	3.7	3.4	2.7	2.6
Significance										
Linear	**	**	**	**	NS	**	NS	NS	NS	**
Quadratic	NS	*	NS	**	**	**	**	*	NS	NS

[z]19-2.6-10/6 in pot applied 15 June

[y]Moved into rooms 24 Sep

[x]1 = poor, not salable; 3 = fair but salable; 5 = excellent quality

[w]1 = 1–20%, 3 = 41–60%, 5 = 81–100% root ball coverage with white healthy roots

Table 9. Influence of fertilization rate on plant and root grade and medium pH and EC of *Philodendron s. oxycardium*. 1986.

Fertilizer rate	Electrical conductivity ($dS \cdot m^{-1}$)								pH		Glasshouse		Interior rooms[y]	
											Plant grade	Root grade	Plant grade	Root grade
g/pot[z]	1 Aug	28 Aug	24 Dec	23 Jan	20 Feb	20 Mar	17 Apr	22 May	1 Aug	22 May	20 May		21 Jul	
2.4	3.91	1.57	1.43	1.70	0.99	0.58	1.40	0.33	6.8	6.4	4.1[x]	4.9[w]	4.0	5.0
4.8	3.89	2.68	1.93	2.50	1.71	0.94	2.00	1.04	6.7	5.7	4.6	4.8	4.7	4.6
7.2	4.00	3.56	2.83	3.87	2.50	1.46	3.52	1.46	6.8	5.2	4.4	4.5	4.7	4.8
9.6	4.37	4.68	3.02	4.83	3.28	2.00	4.14	1.98	6.6	4.8	4.2	4.4	4.1	4.5
12.0	4.48	5.04	3.50	5.80	3.94	2.72	5.50	3.12	6.8	4.1	4.0	3.8	4.3	4.6
14.4	4.87	5.62	3.92	6.05	4.23	2.32	5.72	3.40	6.6	3.9	4.0	3.8	4.4	4.2
16.8	4.61	6.21	4.90	7.80	4.37	2.60	6.53	3.94	6.6	3.8	3.8	3.7	4.0	4.1
19.2	4.42	7.50	5.36	8.01	5.48	3.11	8.03	4.62	6.7	3.7	3.8	3.6	3.7	4.2
21.6	5.04	7.41	5.76	8.76	5.53	3.68	8.58	5.36	6.6	3.6	3.6	3.8	3.7	4.0
24.0	5.08	8.66	5.94	8.07	6.79	4.59	8.80	4.76	6.6	3.6	3.4	3.1	3.4	3.4
Significance														
Linear	**	**	**	**	**	**	**	**	NS	**	**	**	*	**
Quadratic	NS	NS	NS	**	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

[z]19-2.6-10/6 in pot applied 8 Dec

[y]Moved into rooms 29 June

[x]1 = poor, not salable; 3 = fair but salable; 5 = excellent quality

[w]1 = 1–20%, 3 = 41–60%, 5 = 81–100% root ball coverage with white healthy roots

Table 10. Influence of fertilization rate on plant and root grade and medium pH and EC of *Spathiphyllum* 'Petite'. 1986–7.

Fertilizer rate	Electrical conductivity ($dS \cdot m^{-1}$)							pH		Glasshouse		Interior rooms[y]
										Plant grade	Root grade	Plant grade
g/pot[z]	22 Aug	19 Sept	17 Oct	14 Nov	12 Dec	8 Jan	8 Feb	22 Aug	6 Feb	20 Feb		2 Apr
2.4	1.49	0.83	0.44	0.38	0.78	0.52	0.20	7.4	7.1	3.2[x]	4.9[w]	4.2
4.8	2.20	1.47	0.82	0.38	1.82	1.36	0.34	7.1	6.7	4.0	4.8	4.7
7.2	2.95	2.12	1.22	0.60	2.92	2.45	0.61	6.7	6.2	4.5	4.6	4.7
9.6	3.52	2.78	2.02	1.15	4.05	3.38	1.30	6.7	5.4	4.1	4.1	4.9
12.0	3.40	3.66	2.93	1.70	4.93	4.23	1.75	6.7	4.7	4.4	2.8	4.7
14.4	3.60	4.23	3.83	2.10	5.75	5.06	2.81	6.7	3.7	3.7	3.3	4.2
16.8	4.63	4.65	3.78	2.17	6.25	4.78	2.82	6.4	3.4	3.3	2.9	4.0
19.2	5.40	5.57	4.62	2.64	6.74	5.27	3.41	6.5	3.2	3.2	3.1	3.5
21.6	6.19	6.00	4.87	3.02	7.52	5.90	3.74	6.2	3.1	2.6	2.8	2.8
24.0	6.53	6.27	5.33	3.37	8.07	6.31	3.86	6.3	3.2	2.6	2.6	2.8
Significance												
Linear	NS	**	**	**	NS	**	**	**	**	**	**	**
Quadratic	NS	**	NS	NS	**	**	NS	NS	*	**	NS	**

[z]19-2.6-10/6 in pot applied 22 Aug, 17 Nov and 12 Feb

[y]Moved into rooms 2 Mar

[x]1 = poor, not salable; 3 = fair but salable; 5 = excellent quality

[w]1 = 1–20%, 3 = 41–60%, 5 = 81–100% root ball coverage with white healthy roots.

Table 11. Correlation (r) of plant grade and root grade at end of production phase and interior phase.

Plant	Production	Interior
Aglaonema 'Silver Queen'	0.84	0.60
Aphelandra 'Dania'	0.69	0.90
Chamaedorea elegans	0.99	0.82
Codiaeum 'Banana'	0.89	—
Dieffenbachia 'Camille'	0.97	—
Dracaena 'Massangeana'	−0.62	0.85
Epipremnum 'Marble Queen'	−0.53	—
Nephrolepis 'Compacta'	0.72	0.48
Philodendron s. oxycardium	0.86	0.70
Spathiphyllum 'Petite'	0.43	—

Table 12. Ranges of EC ($dS \cdot m^{-1}$), immediately before movement of plants to interiors, that maintained attractive foliage plants for about 2 months while under 12 hours of 125 ft-c.

Plant	$dS \cdot m^{-1}$
Aglaonema 'Silver Queen'	0.50–2.84
Aphelandra 'Dania'	0.49–4.63
Chamaedorea elegans	0.74 or less
Codiaeum 'Banana'	4.02–5.99
Dieffenbachia 'Camille'	0.21–1.31
Dracaena 'Massangeana'	0.36–2.71
Epipremnum 'Marble Queen'	1.19–5.64
Nephrolepis 'Compacta'	0.28–1.52
Philodendron s. oxycardium	1.04–1.46
Spathiphyllum 'Petite'	0.34–1.75

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