Effect of Five Levels of Nitrogen at Six Shade Intensities on Growth and Leaf-Nutrient Composition of *Dracaena deremensis* 'Warneckii,' Engler[1]

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ABSTRACT

Rooted cuttings of *Dracaena deremensis* 'Warneckii,' Engler were grown at five N levels (0, 64, 120, 192 and 256 p/m) and six shade intensities (full sunlight, 47, 51, 63, 76 and 92% actual shade). The number of leaves, and length and weight of plants were significantly affected by N levels. The fitting of the yield-nutrient relationship curve $Y = A/1 + B(C-X)^2$ revealed maximum expected values at N levels of 164 to 210 p/m depending on the shade intensity. An increase in N increased leaf N and decreased K, especially at the full sunlight and 47% shade levels. Leaf K content tended to level off at 64 p/m of N application at shade levels over 47%. P and Fe content were not affected markedly by N levels. At 92% shade appearance of the plants was superior to that at other shade levels.

INTRODUCTION

Dracaena deremensis 'Warneckii,' Engler is an important ornamental foliage plant. González-Villafañe and Cucalón[3] reported that during 1971–72 Dracaenas were the most important foliage plant exported. During the last 3 years there has been an increase in exports of ornamental foliage including *D. deremensis* 'Warneckii' which, like most ornamental foliage plants, is grown under shade. Most nursery owners claim a better quality of the cuttings under intense shade as compared to lower shades. Florida workers reported recently a physiological leaf spot in 'Warneckii' caused by fluorine in the irrigation water.[4] The same leaf spot is observed at high light intensities in Puerto Rico. Since nutrition is tied physiologically to environmental factors, especially light intensities, herein are reported some findings on the growth of *D. deremensis* 'Warneckii' at different shade intensities. Also, some mineral nutrient analyses obtained at different N levels under six shade intensities are presented.

[1] Submitted for publication to Editorial Board June 18, 1976.

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[3] Gonzalez-Villafañe, E. y Cucalón, Mauricio, Análisis de las importaciones y exportaciones de plantas ornamentales y flores de Puerto Rico, Est. Exp. Agr. Univ. P.R. Bol. 235, 1974.

[4] Poole, Richard T. and Conover, Charles A., Foliar chlorosis of *Dracaena deremensis* Engler CV. 'Warneckii' cuttings induced by fluorides, Hort Sci. 9(4): 378–379, 1974.

TABLE 1.—*List of treatments*[1]

Nitrogen level	$Ca(NO_3)_2$ .5 M	$CaCl_2$ .5 M	$KHPO_4$ .5 M	$MgSO_4$ .5 M
	Ml/l	*Ml/l*	*Ml/l*	*Ml/l*
0	0	18.0	9	9
64	4.5	13.5	9	9
128	9.0	9.0	9	9
192	13.5	4.5	9	9
256	18.0	0	9	9

[1] Minor elements were supplied as 1 ml/l of each one of standard solutions of Fe, Mn, Zn, Cu, B.

PROCEDURE

Well-rooted cuttings of *D. deremensis* 'Warneckii' were planted in 3-gal plastic pots. The pots were filled with Haydite, a by-product of the brick manufacturing industry. A nutrient solution with differential N treatments was applied daily to each pot (table 1). A total of 500 cm^3 was enough to obtain run-off. During the first week, the solution was applied at half strength until the plants were well established. Thereafter, the nutrient solution was applied full strength.

The pots were placed on work benches under six shade levels: full sunlight, 47, 51, 63, 76 and 92% calculated shades. The treatments were distributed on each bench in a randomized block design with four replicates. Each replicate had one plant.

After 6 months the plants were harvested, measured, and weighed. The leaves were counted and analyzed for nutrient content; they were composited for the laboratory analyses.

All information was first analyzed originally through variance. Capo's yield-nutrient curve $Y = A/1 + B(c - x)^2$ was also fitted to the results of each individual experiment on each shade intensity.[5] Mitscherlich's equation $Y = A - Be^{-cx}$ was fitted to the N and K leaf contents.

RESULTS AND DISCUSSION

Table 2 presents a comparison of the means of the growth characters measured. The leaf count per plant was significantly increased by N application at each of the six shade intensities. Root weight was not affected by variation of N, except at the 47% level. However, more roots were present with the lighter N application, suggesting more surface area was needed to overcome the low N content. Root development is known to be affected by P accumulation, and leaf P content was higher at zero N level (table 3). Plant growth, measured by length and weight,

[5] Capó, B. G., Additional evidence on the applicability of the new fertilizer-yield relation, J. Agric. Univ. P.R. 51(2): 97–120, 1967.

TABLE 2.—*Effects of N levels on growth of* Dracaena deremensis[6] *Warneckii' Engler, under six calculated shade intensities*

Applied level	Number of leaves	Root growth weight	Total top growth	
			Length	Weight
P/m		*G*	*Cm*	*G*
		Full sunlight		
0	27.5 d[1]	63.2 a	39.29 b	284.99 b
64	33.8 c	53.0 a	50.72 a	363.78 a
128	34.6 bc	67.0 a	54.61 a	379.59 a
192	36.1 ab	57.5 a	55.88 a	385.66 a
256	37.5 a	48.7 a	55.88 a	381.24 a
		47% shade		
0	15.5 c	17.2 a	17.01 b	33.71 c
64	24.9 b	13.8 b	28.68 a	80.75 b
128	27.4 ab	14.1 b	34.29 a	99.79 a
192	28.5 a	11.9 b	30.15 a	97.82 a
256	26.4 ab	11.9 b	31.42 a	91.93 a
		51% shade		
0	18.7 b	10.7 a	20.62 b	45.05 c
64	24.4 a	11.7 a	30.48 a	84.30 b
128	26.2 a	12.5 a	34.29 a	103.05 a
192	26.7 a	10.2 a	33.32 a	96.55 a
256	26.5 a	9.0 a	30.78 a	98.30 a
		63% shade		
0	17.5 b	12.0 a	18.72 b	46.54 b
64	25.8 a	14.2 a	33.02 a	88.07 a
128	25.9 a	15.5 a	32.38 a	94.50 a
192	29.2 a	12.5 a	32.05 a	99.50 a
256	27.7 a	11.7 a	32.05 a	94.13 a
		76% shade		
0	16.2 b	13.7 a	19.05 b	38.75 c
64	18.9 b	15.2 a	29.55 a	70.57 b
128	26.2 a	10.0 a	30.48 a	80.00 b
192	27.2 a	11.7 a	33.96 a	94.50 a
256	27.2 a	10.0 a	33.02 a	91.68 a
		92% shade		
0	15.7 b	10.0 a	19.99 c	41.25 b
64	22.8 a	8.2 a	27.30 b	68.75 ab
128	25.6 a	8.7 a	30.78 ab	89.50 a
192	23.4 a	7.5 a	29.84 ab	70.25 ab
256	25.5 a	99.2 a	32.38 a	85.25 a

[1] Means with one or more letters in common do not differ significantly at the 5% level.

TABLE 3.—*Some leaf nutrient contents of* D. deremensis *'Warneckii' Engler, as affected by N levels and shade intensities*

Applied N level	Leaf Composition			
	N	P	K	Fe
P/m	%	%	%	*P/m*
		Full sunlight		
0	2.02	0.31	5.90	317
64	2.54	.23	3.83	236
128	2.20	.23	3.95	175
192	2.90	.25	3.20	223
256	3.00	.26	3.15	185
		47% shade		
0	1.82	0.33	3.85	362
64	2.40	.19	3.44	247
128	2.34	.24	3.47	309
192	2.88	.22	3.32	252
256	2.76	.22	2.73	306
		51% shade		
0	1.88	0.34	3.52	333
64	2.30	.18	3.00	454
128	2.54	.20	2.89	465
192	2.84	.23	3.15	338
256	2.86	.23	3.34	306
		63% shade		
0	1.82	0.32	4.07	532
64	2.36	.19	3.12	376
128	2.46	.23	2.98	352
192	2.80	.22	3.22	303
256	3.00	.24	3.27	287
		76% shade		
0	2.12	0.31	3.62	465
64	2.18	.20	3.03	320
128	2.68	.23	3.10	408
192	2.84	.26	3.20	295
256	2.92	.24	3.20	247
		92% shade		
0	2.04	0.27	3.68	454
64	2.48	.23	3.27	357
128	2.66	.24	3.27	397
192	2.80	.25	2.92	397
256	2.80	.24	2.98	360

was affected significantly by N application at all shade intensities. The mean length was at a minimum with zero N applied. The same was true for mean weight, but the response was not uniform with variations in N level. Under full sunlight, the effect of the N level was not significant

but the original rooted cutting was better developed than those at the other shade intensities.

Table 3 and figure 1 present the N, P, K and Fe contents of the leaf. Leaf N content increased with the application of N in solution at all shade intensities. The Mitscherlich equation explains quite satisfactorily the influence of N content of the leaf (fig. 1). The K content

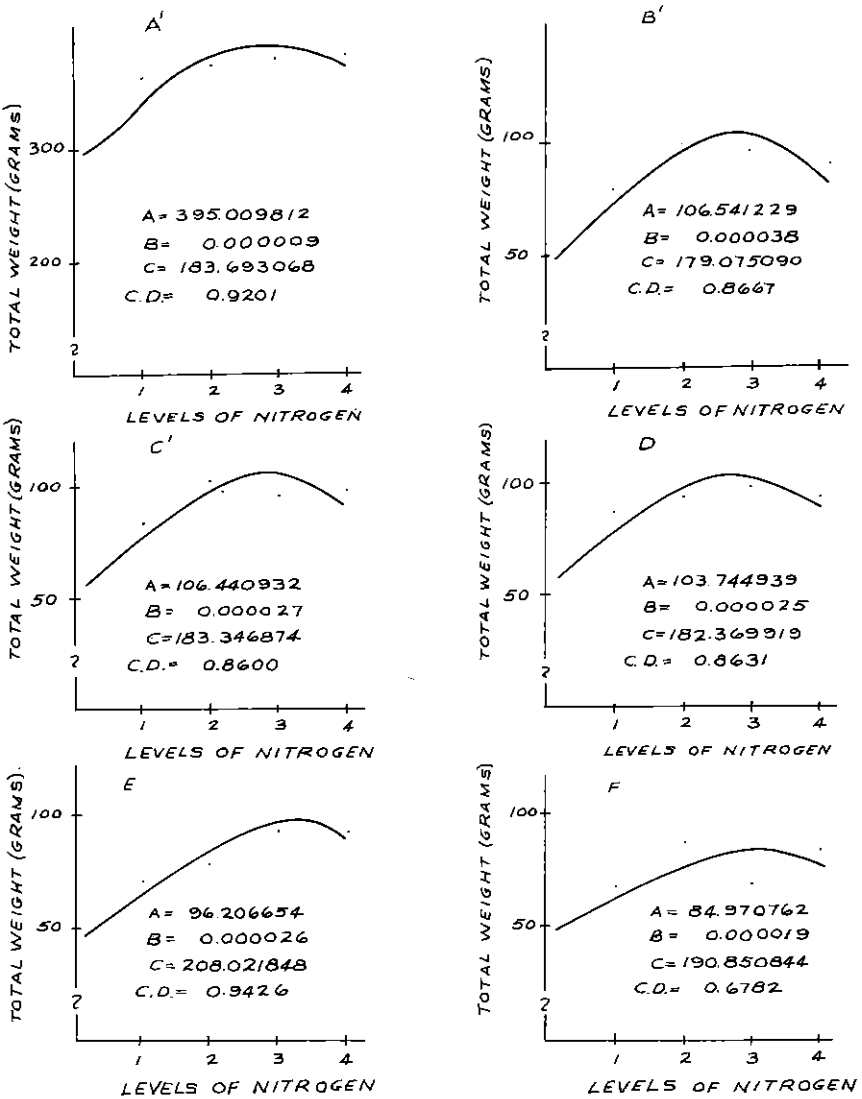

FIG. 1.—Effect of N levels on total fresh weight of *D. deremensis* 'Warneckii' grown at 6 shade levels; A', B', C', D, E and F represent full sunlight, 47, 51, 63, 76 and 92% shade, respectively.

diminished with N application, particularly at full sunlight and 47% shade (table 3). Leaf K did not decrease as strongly at N values above 64 p/m. P content at zero N was higher at all shade intensities. The Fe level was lower in all cases with the maximum N application than with the zero N application. The results were strengthened using Capo's yield-nutrient relationship equation (fig. 2). A high percentage of the total

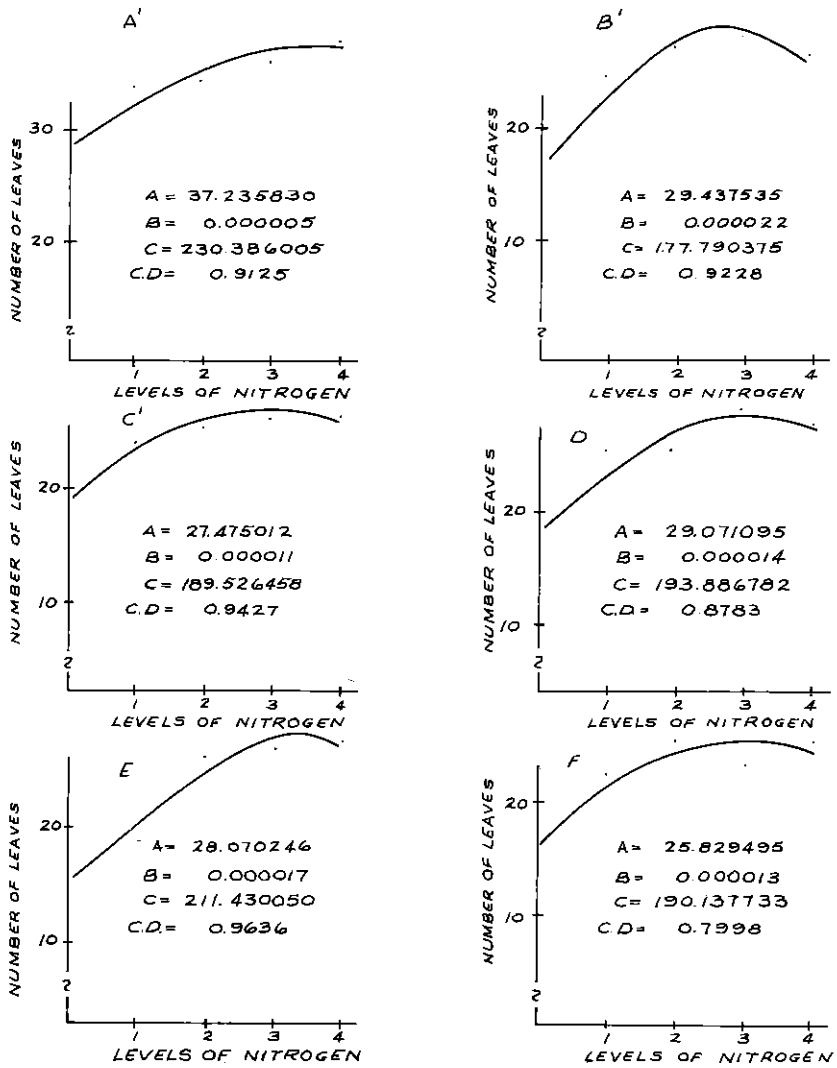

FIG. 2.—Effect of N levels on the number of leaves developed by *D. deremensis* 'Warneckii' at 6 shade levels; A', B', C', D, E and F represent full sunlight, 47, 51, 63, 76 and 92% shade, respectively.

variation under each light intensity was explained by the fitted curve, as indicated by the coefficients of determination (C.D.) in figures 2 to 4. The fitting of the fertilizer-yield equation suggested maximum yields at nutrrient application between 160 and 210 p/m N.

The visual appearance of the plants suggested that 92% shade intensity produced the best color in plants. N application can not overcome the appearance of the leaf spot at low shade intensities.

In conclusion, *Dracaena deremensis* 'Warneckii' definitely needs a

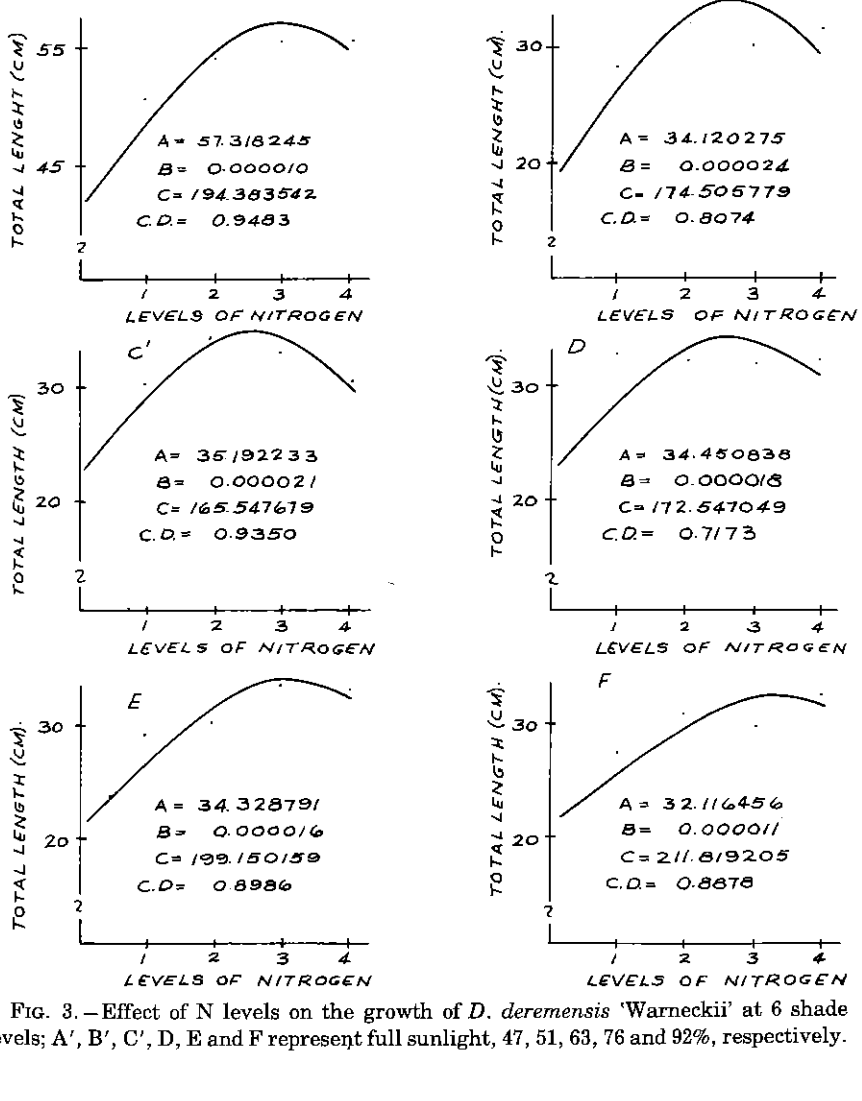

FIG. 3.—Effect of N levels on the growth of *D. deremensis* 'Warneckii' at 6 shade levels; A', B', C', D, E and F represent full sunlight, 47, 51, 63, 76 and 92%, respectively.

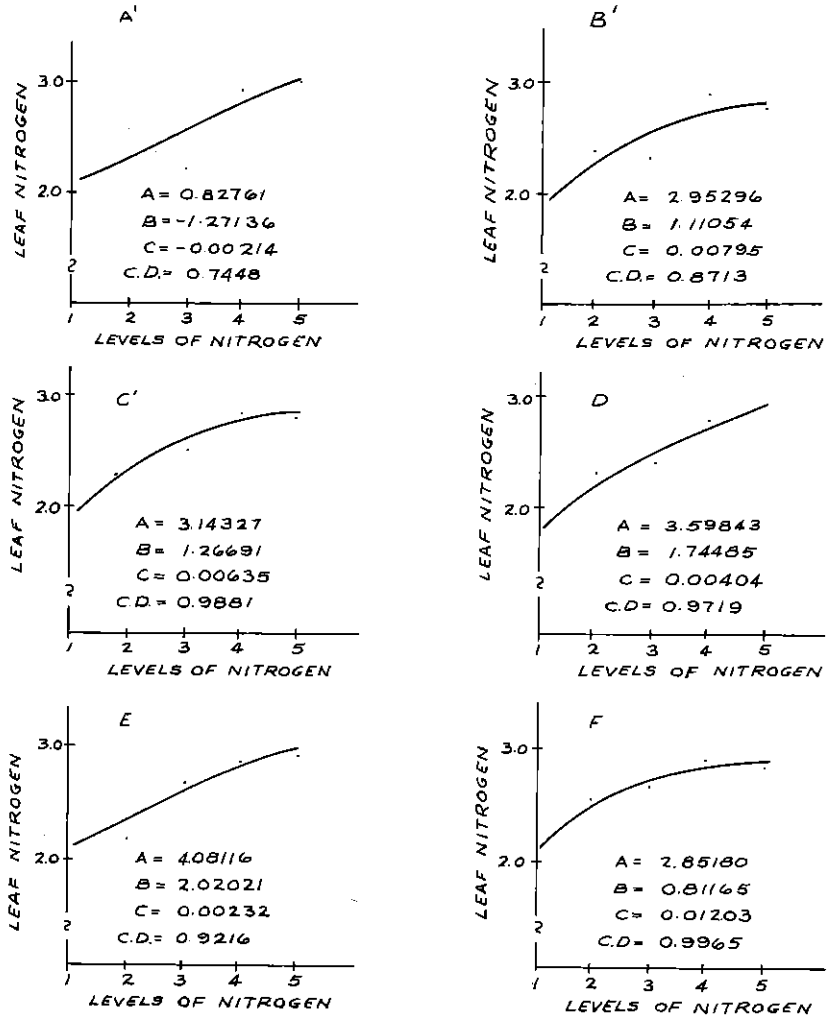

FIG. 4.—Effect of N levels on leaf N content of *D. deremensis* 'Warneckii' at 6 shade levels; A', B', C', D, E and F represent full sunlight, 47, 51, 63, 76 and 92% respectively.

high shade intensity for a good quality plant. Under those conditions the plant will not require a high N application, as shown by the leaf analyses.

RESUMEN

Esquejes enraizados de *Dracaena deremensis* 'Warneckii' se sembraron en un medio inerte conocido como "Haydite." El Haydite es una especie de gravilla derivada de la fabricación de ladrillos cocidos a altas temperaturas. A estas plantas sembradas en tiestos de 3 galones se les aplicaron cinco niveles de nitrógeno en solución. Estos fueron 0, 64, 128, 192 y 256 p.p.m. También recibieron los demás nutrimentos en cantidades

satisfactorias. Las plantas se colocaron bajo seis distintos niveles de sombra. Estos fueron: 0, 47, 51, 63, 76 y 92%.

Las plantas se cosecharon a los 6 meses; se midieron, se pesaron y se les contaron las hojas. También se tomaron muestras de hojas para análisis químico.

Los resultados reflejaron una respuesta favorable a las aplicaciones de nitrógeno. A éstos se les ajustó la curva de abono-rendimiento $Y = A/1 + B\ (C - X)^2$ estimándose que los redimientos máximos se obtendrán con niveles de nitrógeno de 160 y 210 p.p.m.

Los análisis químicos revelaron un aumento de nitrógeno en la hoja correspondiente al aumentar el nivel del nitrógeno en la solución. Al mismo tiempo disminuyó el contenido de potasio. A intensidades de sombra mayores del 47%, la reducción del contenido de K no fue tan marcada. Los análisis para P y Fe fueron erráticos, aunque el contenido más elevado cuando la solución no contenía nitrógeno. La apariencia de las plantas a 92% de sombra fue superior. Los incrementos de nitrógeno a mayor luz no pudieron evitar las manchas foliares.