Nitrogen, Phosphorus and Potassium Fertilization of *Brassaia actinophylla, Calathea makoyana* and *Chrysalidocarpus lutescens*[1]

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Abstract

Data indicated a 5-1-2 ratio of N-P-K with N level of 2.5 kg/100m² (0.5 lbs/100 ft²) a month produced the highest quality *B. actinophylla* and *C. makoyana.* A 2-1-2 ratio with N level of 1 kg/100m² (0.2 lbs/100 ft²) a month produced the highest quality *C. lutescens.*

Index words: palm, foliage plants, nutrition

Introduction

Most foliage plants are grown with a 1-1-1 (N-P_2O_5-K_2O) ratio, such as an 8-8-8 or 20-20-20 (about 5-2-4 N-P-K) fertilizer analysis, but use of a 3-1-2 ratio, such as 9-3-6 or 18-6-12 is increasing. In 1981, Conover and Poole (1) suggested using a ratio of 3-1-2, although only limited research has utilized factorial N-P-K experiments. Research indicated the bromeliad *Aechmea fasciata* Baker grew best at a ratio of 6-1-2 (N-P-K) (4), and *Aglaonema commutatum* Schott cvs. Fransher and Pseudobracteatum produced best plants from a ratio of 3-1-3 (N-P-K) (5). In one test a 1-1-1 (N-P-K) ratio produced best Maidenhair fern, *Adiantum raddianum* K. Presley, (6) while other tests (7) indicated best plants were produced with N-P-K ratios of 10-1-6, 6-2-5, 3-1-1 and 9-2-5 for *Dieffenbachia* 'Exotica,' *Dracaena sanderana, Maranta l. kerchoviana* and *Peperomia obtusifolia,* resp. A 5-1-5 (N-P-K) produced the best *Hedera canariesis* (2). The experiments reported here were con-

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ducted to determine the N-P-K requirements of *B. actinophylla, C. makoyana* and *C. lutescens.*

Materials and Methods

Experiment 1: C. lutescens palm seedlings, 15-20 cm (6-8 in) tall were planted July 12, 1979, in 25 cm (10 in) containers in mason sand: Florida sedge peat, (1:3 by volume) amended with 4 kg/m^3 (7 lbs/yd^3) dolomite and 2 kg/m^3 (3 lbs/yd^3) Perk and placed in a shadehouse receiving 7,000 ft-c maximum. Plants were watered twice weekly and grown under a temperature range of 21 to 35°C (70 to 95°F). Treatments consisted of a 4x2x3 factorial combination in a randomized block design of N, P and K at 170, 340, 510, or 680 mg N, 85 or 170 mg P and 170, 340, or 510 mg K per pot applied at bi-weekly intervals in 125 ml of solution. Nitrogen was obtained from NH_4NO_3 and KNO_3, K from KNO_3 and P from H_3PO_4. Treatments were replicated 5 times with 5 seedlings/pot as the experimental unit. Data collected at experiment termination, August 22, 1980, included height from pot rim to tip of leaves, plant grade (1 = poor to 5 = excellent) and color grade (1 = light green to 5 = dark green). The first mature leaves from the apex of the plant were collected and analyzed for elemental tissue content.

Experiment 2: C. makoyana crowns divided to provide divisions with 4 to 6 breaks and placed in 6-inch tubs were tested in a 4x2x3 factorial experiment with 70, 140, 210 or 280 mg N, 35 or 70 mg P, and 70, 140, or 210 mg K bi-weekly. The soil mix was the same as Experiment 1, but plants were placed under 1,200 ft-c maximum and temperatures ranged from 18-35°C (65-95°F). Treatments were initiated November 5, 1979, and data were collected May 7, 1980.

Experiment 3: Schefflera *B. actinophylla* seedlings, 3 per 7.5 cm (3 per 3-in) pot were placed in 20 cm (8 in) pots and received the same growing conditions as previously described for the *C. makoyana* in Experiment 2. Fertilizer treatments were increased proportionately with the increase in surface area of the pot.

Results and Discussion

Experiment 1: Treatments had no effect on growth parameters, indicating that lower rates of fertilizer should be used and a ratio of 2-1-2 would be acceptable for *C. lutescens.* Plant height at termination of the experiment was 76 cm (30 in) with a plant grade of 3.3 and color grade of 3.2. Plants had an average tissue content of 1.8% N, 0.15% P, 0.31% K, 0.74% Mg and 1.0% Ca. With the exception of low K, tissue composition was in the range suggested by Poole and Conover (2). Increasing K level increased tissue K (Table 1), but did not influence plant appearance. An increase in N application greatly increased Mn uptake, but changes in Mn level were not reflected in plant response.

Experiment 2: Both N and K affected growth of *Calathea.* Leaf spotting decreased with increased N but increased with increasing K; other parameters increased with increased N, but decreased with increasing K (Table 2). Using values obtained, a 5-1-2 ratio appears satisfactory. Elemental composition of *Calathea* (Table 1) appears to be in the range of other foliage plants (2). P, K, Mg, Fe and Mn content of *Calathea* were affected by treatment. N had the greatest effect, with increases in N causing a strong linear increase of tissue P, K, Fe and Mn and also a linear response for Mg content. An increase in P increased P content and an increase in K increased K, but decreased Mg.

Experiment 3: All growth parameters increased as N increased, but P and K had no influence (Table 3). Limits of elements tested were not reached, but from data available, a 5-1-2 ratio appears satisfactory. N and K (Table 1) are lower than levels suggested previously (2), but amounts given were still high enough to produce high quality plants. An increase in N level increased tissue content of N, but decreased P and K tissue levels.

Table 1. Influence of N, P and K fertilization on foliar composition of 3 foliage plants.

	Calathea makoyana					Brassaia actinophylla			Chrysalidocarpus lutescens	
	% dry wt			ppm		% dry wt			% dry wt	ppm
Treatments[z]	P	K	Mg	Fe	Mn	N	P	K	K	Mn
Nitrogen										
170	.39a[y]	2.7a	.46b	108a	256a	1.5a	.28b	1.2a	1.1a	84a
340	.42a	2.6a	.49b	106a	339b	1.6a	.27b	1.0a	1.1a	103b
510	.52b	2.4a	.46b	141b	579c	1.8b	.26b	0.8b	1.4a	162c
680	.58c	1.8b	.38a	144b	579c	1.9b	.23a	0.7b	1.2a	226d
Phosphorus										
85	.35a	2.4a	.45a	122a	403a	1.7a	.23a	0.9a	1.3a	151a
170	.61b	2.3a	.44a	128a	439a	1.7a	.29b	0.9a	1.2a	150a
Potassium										
170	.50a	1.7a	.57b	127a	430a	1.7a	.25a	0.6a	1.0a	148a
340	.50a	2.5b	.38a	131a	444a	1.7a	.26a	0.9b	1.1a	156a
510	.47a	2.9c	.37a	116a	420a	1.7a	.26a	1.3c	1.4b	127a

[z]Applied bi-weekly, treatments equivalent in mg/25 cm (10 in) pot.

[y]Mean separation within column subheadings followed by the same letter are not significantly different at the 5% level using Duncan's Multiple Range Test.

Table 2. Influence of N and K levels on growth of *Calathea makoyana*.

Nitrogen kg/100m² per month	(lbs/100 ft²)	Leaf spotting[z]	Plant grade[y]	Root grade[y]	Color grade[y]
1.0	(0.2)	4.5 a[x]	1.9a	1.6a	1.7a
1.5	(0.3)	3.3b	2.5b	1.8ab	2.4b
2.0	(0.4)	1.8c	3.3c	2.2bc	3.5c
2.5	(0.5)	1.9c	3.4c	2.5c	3.8c
Potassium kg/100 m² per month	**(lbs/100 ft²)**				
1.0	(0.2)	2.5a	3.1b	2.2a	3.2b
1.5	(0.3)	2.7a	2.8b	1.9a	3.0b
2.0	(0.4)	3.4b	2.5a	2.0a	2.4a

[z]1 = none, 5 = severe

[y]1 = poor, 5 = excellent

[x]Mean separation within column subheadings followed by the same letter are not significantly different at the 5% level using Duncan's Multiple Range Test.

Table 3. Effect of fertilization levels on growth of *Brassaia actinophylla*.

Nitrogen kg/100 m² per month	(lbs/100 ft²)	Plant height (cm)	Plant grade[z]	Color grade[z]
1.0	(0.2)	77a[y]	3.3a	2.8a
1.5	(0.3)	82b	3.9b	3.3b
2.0	(0.4)	86bc	4.2bc	3.6b
2.5	(0.5)	88c	4.4c	4.0c

[z]1 = poor, 5 = excellent

[y]Means within columns followed by the same letter or letters are not significantly different at the 5% level using Duncan's Multiple Range Test.

P and K increased P and K, respectively, in the tissue, but neither N, P nor K changed micronutrient content.

Significance to the Nursery Industry

These experiments support the results of previous tests, indicating that a 1-1-1 ratio of N-P_2O_5-K_2O provides more P and K than required by foliage plants, and that N is the factor with the most influence on plant growth, quality and tissue content. Results from these tests also indicate that changes in tissue content do not necessarily reflect changes in plant response. By using less P and K per unit of N, savings in fertilizer cost would be obtained and potential high levels of soluble salts could be reduced.

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