

Growth Response of Coconut Seedlings from Seednuts Collected from Palms Fertilized with Sodium Chloride (Common Salt)

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The growth response of nursery seedlings from seednuts of coconut mother palms fertilized with five rates of sodium chloride (0.00, 0.88, 1.76, 3.52 and 7.04 kg/tree/yr) was studied in 1986.

The application of NaCl at 1.76-7.04 kg/tree/yr on coconut palms significantly influenced earliness and total percentage of germination of seednuts, girth, and leaf production of seedlings. The work indicated that the growth of seedlings at the nursery stage likely depended on the nutrition of the mother palms.

Key Words: sodium chloride fertilizer, girth, leaf production, seednut germination, leaf nutrients

INTRODUCTION

Fertilizer experiments on crops are usually conducted to determine the effects of fertilizers on the growth and yield of the crops. Frequently though, research interest is confined to the agronomic performance and economic yield of the crop being fertilized; it rarely extends to those of the immediate progenies. Evidently, there is a dearth of information in coconut research on the effects of fertilizers on the progenies of fertilized mother palms.

A study was therefore undertaken to evaluate the indirect effects of sodium chloride (NaCl) fertilizer on the germination, growth, and nutrition of the progenies of coconut mother palms grown on chlorine-deficient soil. The results of the study can be used to increase agronomic and fertilizer management efficiency.

MATERIALS AND METHODS

Collection of Seednuts and Sowing

The 'Laguna' tall coconuts regularly fertilized with increasing levels of NaCl were utilized as sources of seednuts. A blanket application of 2.0 kg

ammonium sulfate per year was given to the mother palms fertilized with NaCl as follows:

Treatment	Rate (kg/palm/yr)
NaCl ⁰ (control)	none
NaCl ¹	0.88
NaCl ²	1.76
NaCl ³	3.52
NaCl ⁴	7.04

Twenty seednuts from each plot with fertilizer treatments as above were randomly collected, trimmed just above the germinating "eye" and laid end-to-end on the germinating bed. In this study, the treatments corresponded to seednuts and seedlings collected from mother palms fertilized with NaCl⁰, NaCl¹, NaCl², NaCl³, and NaCl⁴.

Polybagging

After the shoots had emerged and grown to about 5-7 cm tall, the plants were transferred to black polyethylene plastic bags containing river sand (sand is a growing medium which can minimize any influence of soil nutrients). No fertilizer was applied during the entire duration of the nursery stage. The growing medium had the following benchmark analysis: pH, 7.0; organic matter, 0.12%; exchangeable Ca, Mg, Na, and K of 9.9, 0.50, 0.04 and 0.20 m.e./100 g soil, respectively; and a sandy (Entisol) soil texture.

Data Gathering

The percentage germination of the seednuts was monitored during the first 3 months from sowing. The seedling girth, accumulated leaf production, leaf count, leaflet count (leaf 3), and height were taken at 2, 5, and 8 months after bagging. Leaf samples were collected (at the final data gathering) for analysis of the concentration of N, P, K, Ca, Mg, Na, Cl, S, and B. The chemical composition of the soil medium was also analyzed before and at the end of the experiment.

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RESULTS AND DISCUSSION

Seednut Germination

The percentage germination of seednuts was influenced by the fertilizers applied on the mother palms with significant differences observed during the first month of germination (Table 1). Seednuts taken from mother palms receiving 1.76 kg NaCl/palm/yr gave significantly higher percentage over the control (minus-NaCl seedlings). About 32% of the seednuts from this treatment germinated within the first month of sowing, as compared with the 3.3% of the control. Germination of seednuts from palms applied with 1.76 kg NaCl/tree was completed in the second month, while 48% of the control seedlings which had yet to germinate extended up to the third month. For the total percentage germination, the control seedlings registered only 56.7%, as against 81.7-91.7% of the seedlings from the NaCl-fertilized palms.

In general, seednuts from well-nourished palms (NaCl-fertilized) did not only give much higher percentage germination but also germinated much earlier than those from undernourished palms (minus-NaCl). Based on this result, the nutrition of the mother palms plays a significant role in the germination of seedlings and hence, must be considered in the selection of seednuts for planting or for experimental purposes, particularly in nursery studies.

Growth of Seedlings

At seven months in the nursery, the seedlings were noted to have significant differences on the girth as well as number of living fronds at the time of leaf count (Table 2). Seedlings from mother palms fertilized with higher NaCl rates (3.52-7.04 kg/palm/yr) produced significantly bigger girth while the highest number of leaves was observed on seedlings from mother palms fertilized with the highest level of NaCl application (7.04 kg NaCl).

The significant effects of NaCl application on the progenies of the mother palms, especially those on girth and leaf count, suggest the development of physiologically and morphologically normal seedlings from palms with adequate nutrition (Fig. 1a and 1b). Those mother palms are likely capable of equipping their progenies with food reserves enough to support them through the seedling stage. Maravilla et al. (1978) pointed out that the nonresponsiveness to fertilization of the seedlings in the early nursery stages could be due to the already sufficient levels of the requirements while they were still in the endosperm stage. This is likely so with seedlings collected from adequately nourished or properly fertilized palms.

Leaf Nutrient Levels of Seedlings

The higher percentage germination and the improvement in the girth and leaf count of the seed-

TABLE 1. Percentage germination of seednuts from mother palms fertilized with NaCl¹

TREATMENT (NaCl/tree/yr)	DAYS FROM SOWING			TOTAL
	0-30	31-60	61-90	
0 kg	3.33	48.33	5.0	56.67
0.88 kg	15.00	65.00	1.67	81.67
1.76 kg	31.67*	60.00	0	91.67
3.52 kg	8.33	76.67	1.67	86.67
7.04 kg	10.00	68.33	3.33	81.67
Statistical Significance	*	NS	NS	NS

¹Analysis based on transformed values = $\log X + 1$.
²Treatments applied on mother palms.
* Significant at 5% level.
NS Not significant.



Figure 1a. Poor early growth of seedlings from seednuts collected from palms without NaCl application.



Figure 1b. Normal early growth response of seedlings from seednuts collected from mother palms receiving regular annual application of NaCl (1.76 kg/tree).

lings of palms receiving NaCl fertilization, relative to the control, could further be explained by the leaf analysis results in Table 3. The elements analyzed, the leaf N and Cl levels of seedlings significantly increased with increasing NaCl fertilization of mother trees, while the leaf-B contents significantly decreased. This trend of response was similar to the leaf analysis of the mother palms observed earlier (Magat et al. 1986); it further substantiated the fact that the nutrition of the mother palms greatly influenced the nutrition of the resulting seedlings.

It is probable that the haustorium, water, and coconut meat of the seednuts were able to release nutrients for the growing shoots. It was through them that the leaf nutrients of the seedlings, especially N, Cl, and S, were transmitted from the mother palms. Thus, the coefficient of correlation was highly significant between leaf-Cl content of the

seedlings and the number of living fronds, and girth, while N and S were positively correlated with the total percentage germination (Table 4).

Soil Analysis

At the end of the study, no significant variations were observed on the properties of the soil used as growing medium for the seedlings under the different treatments (Table 4). This indicated that the influence of soil nutrients on the seedlings, if any at all, was minimal. Based on the benchmark soil analysis, it was noted that, except for the exchangeable Mg which was surprisingly increased at the end of the study regardless of treatments, all other soil properties remained unaffected. The increased Mg status of soil could be due to nutrient recycling, as a result of the leaf leaching of Mg under the influence of rainfall.

TABLE 2. Growth of 8-month old seedlings from mother palms fertilized with NaCl

TREATMENT ¹	NO. OF LEAFLET	ACCUMULATED NO. OF LEAVES	LEAF COUNT (no.)	GIRTH (cm)	HEIGHT (cm)
0 kg	34.1	6.70	6.77	13.8	108.6
0.88 kg	35.7	6.67	6.87	14.1	106.4
1.76 kg	39.4	6.73	7.57	15.6	129.4
3.52 kg	37.5	7.40	7.60	15.7	119.6
7.04 kg	36.5	6.90	7.77	15.1	123.3
Statistical Significance	NS	NS	*	*	NS
HSD .05	—	—	0.924	1.722	—
C.V. (%)	8.0	5.4	4.5	4.1	9.5

¹Fertilizer applied on mother palms.
 * Significant at 5% level.
 NS Not Significant.

4 Growth Response

TABLE 3. Leaf nutrients of 8-month old seedlings from mother palms fertilized with NaCl (% dry matter, leaf 3)

TREATMENT	N	P	K	Ca	Mg	Na	Cl	S	B(ppm)
NaCl ⁰	1.780	0.147	1.308	0.361	0.219	0.072	0.045	0.143	9.57
NaCl ¹	2.036	0.135	1.337	0.377	0.209	0.094	0.402	0.144	8.53
NaCl ²	2.056	0.136	1.277	0.402	0.206	0.078	0.592	0.141	8.70
NaCl ³	2.052	0.130	2.351	0.382	0.202	0.079	0.651	0.150	8.50
NaCl ⁴	2.018	0.132	1.261	0.409	0.237	0.077	0.758	0.158	8.37
Statistical Significance	*	NS	NS	NS	NS	NS	**	NS	*
HSD .05	0.163	—	—	—	—	—	0.145	—	1.194
.01	—	—	—	—	—	—	0.197	—	—
C.V. (%)	2.9	12.4	10.4	10.8	14.6	38.9	10.5	7.4	4.8

* Significant.
** Highly significant at 1% level.
NS Not significant.

TABLE 4. Correlation coefficient (r) of germination and growth VS. leaf N, Cl and S

LEAF NUTRIENT (%)	LIVING FRONDS	GIRTH	TOTAL PERCENTAGE GERMINATION
N	0.375 ^{ns}	0.059 ^{ns}	0.695 ^{**}
Cl	0.730 ^{**}	0.659 ^{**}	0.450 ^{ns}
S	0.433 ^{ns}	0.086 ^{ns}	0.603 [*]

Tabular r value = .05 = 514
.01 = 641
NS Not significant.
* Significant.
** Highly significant.

TABLE 5. Some soil properties of the growing medium (at the end of the study)

TREATMENT (NaCl/tree/yr)	pH	ORGANIC MATTER (%)	ELECTRICAL CONDUCTIVITY (mmhos/cm)	EXCHANGEABLE CATION (m.e./100 g soil)			
				Ca	Mg	Na	K
0 kg	7.0	0.16	0.050	9.04	1.85	0.03	0.22
0.88 kg	7.0	0.17	0.060	9.20	1.88	0.03	0.21
1.76 kg	7.0	0.15	0.063	8.86	1.24	0.33	0.25
3.52 kg	7.0	0.24	0.057	9.56	1.57	0.04	0.25
7.04 kg	7.0	0.16	0.060	9.11	1.28	0.03	0.21
Statistical Significance	NS	NS	NS	NS	NS	NS	NS
C.V. (%)	0.0	25.5	13.5	8.0	56.8	45.7	19.9

NS Not significant.

CONCLUSION

Given the agronomic and environmental conditions of the study, the following may be concluded:

1. The performance of seedlings in the nursery is strongly dependent on the nutrition of the mother palms; nutrition status must be considered in mother palm selection, seednut selection, and raising of seedlings in the nursery.
2. Chlorine-deficient palms when fertilized with 1.76-7.04 kg NaCl/tree/yr can produce seednuts which germinate early, have high total percentage of germination, and produce seedlings with bigger girth and higher leaf production.

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