EARLY RESPONSE OF SEVEN DWARF COCONUT CULTIVARS TO VARYING LEVELS OF AMMONIUM SULFATE AND POTASSIUM CHLORIDE APPLICATION

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ABSTRACT

Seven dwarf coconut cultivars which were subjected to different levels of ammonium sulfate and potassium chloride application responded similarly to fertilization. Fertilization generally improved the growth and precocity of these cultivars with the fertilized palms developing bigger girths, taller stand and retaining more functional leaves than the unfertilized ones. The former also flowered from 0.19 to 1.29 years earlier than the latter. Fertilizer effects were observed earliest on plant height at 3 months after planting.

Among the cultivars, Camotes, Catigan and Malayan Red Dwarf exhibited better growth. Camotes, Catigan, Lingkuranay and Albuera Dwarf were the early bearers whose mean ages at flowering ranged from 3.08 to 3.39 years from planting.

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KEY WORDS: Dwarf coconuts. N-K fertilization. Growth. Precocity. Leaf spot infection.

INTRODUCTION

Significant effects of fertilizers on coconut growth, reaction to disease infection and precocity of bearing have been reported. Specifically, nitrogen and potassium were observed to improve growth and resistance to diseases as well as shorten the coconut's juvenile phase. Thus, for the full expression of the potential of coconuts, it is deemed necessary that these nutrients be not limiting.

Seven local dwarf coconut cultivars with some potentials, either for use in monoculture or as breeding materials, were evaluated under different levels of nitrogen-potassium application to assess their field performance, and identify some agronomic characters that are responsive to fertilization.

MATERIALS AND METHODS

Seedlings of seven local dwarf coconut cultivars namely; Albuera Dwarf (ALD), Camotes (CAM), Catigan (CAT), Coconiño (CNO), Lingkuranay (LKY), Malayan Red Dwarf (MRD) and Tacunan (TAC) were field planted following a randomized complete block design with three replications in an area with N and K deficient soil. Sixteen seedlings of each cultivar were planted in a plot using 8 m x 8 m square planting scheme.

Each cultivar was subjected to three levels of N-K fertilization and a non-fertilized control (Table 1).

Table 1. Fertilizer treatments.

Age of Palms (months)	Ammonium Sulfate/Muriate of Potash (g) Per Palm Per Year			
	T_0	T_1	T_2[1]	T_3
At planting	0	75/50	150/100	225/150
6	0	100/75	200/150	300/225
12	0	250/250	500/500	750/750
24	0	375/375	750/750	1125/1125
36	0	500/500	1000/1000	1500/1500
48	0	750/625	1500/1250	2250/1875
Bearing onwards	0	1000/750	2000/1500	3000/2500

[1]Philippine Coconut Authority's (PCA) recommended rates.

Data on growth and development of palms were gathered every 3 months from planting until the 24th month and at 6 months interval thereafter until the 36th month. The growth and development parameters considered during the first 3 years of observations were girth size, plant height, leaf count and

length of leaves. Data collection on length of leaves started one year after planting. In addition, the degree of leaf spot infection was assessed following the Philippine Coconut Authority's (PCA) method of rating (Table 2). Flower initiation of the palms was likewise monitored. Age at initial flowering of each palm was recorded when the first spathe became visible indicating the onset of the reproductive stage of the palm.

Table 2. PCA's rating equivalents of damaged coconut trees due to diseases[1].

Plant Parts Affected (%)	Index Value	Qualitative Assessment
0	0	No infection
1-10	1	Slight
11-25	2	Slightly moderate
26-40	3	Moderate
41-55	4	Slightly severe
56-70	5	Moderately severe
71-85	6	Severe
86-100	7	Very severe

[1]Excluding bud rot.

RESULTS AND DISCUSSION

Growth

All the cultivars exhibited similar growth reactions to fertilization as shown by insignificant cultivar x fertilizer interaction. Nelliat *et al.* (1978) reported a similar observation in their study on the response of high yielding coconut genotypes to fertilizer treatments under rainfed condition, indicating the general need of most coconut genotypes for these fertilizers for optimum growth. In the present study, results also showed the general condition of the soil which lacked N and K nutrients. A leaf tissue analysis done in 1983, when the palms were at their early stage of flowering, revealed low levels of N content in most of the experimental palms with values ranging

from 1.15 - 2.15%, 74.36% of which were below 1.8%. Potassium, on the other hand, was as low as 0.43% to as high as 1.15%. However, of the total number of palms, 30.77% had below 0.8% K content in their leaves. The reported critical levels for N and K in coconut leaves were 1.8 - 2.0% and 0.8 - 1.0%, respectively (IFC, 1977).

Generally, better growth performance of the experimental palms was noted with the application of fertilizers. Fertilized palms under T_1, T_2 and T_3 did not vary much. Fertilized palms had significantly bigger girths, taller stature and more functional leaves which were also longer than those of the unfertilized ones (Fig. 1). Similar observations have been reported by Almaden and Santiago (1980), Oguis (1984) and Fagan (1985). Fertilizer effect on girth size were evident as early as 18 months after planting when the mean girth size of the unfertilized palms was only 30.35 cm compared to the means of fertilized ones which ranged from 36.68 - 40.05 cm. This enhancement of girth development could be due to the combined effect of nitrogen and potassium or by potassium chloride alone. Nitrogen proved to have beneficial effects on growth. Similarly, potassium chloride was reported to significantly increase girth measurements of PB 121 coconut hybrid at 26 and 36 months after planting in Ivory Coast and Indonesia (Ollagnier *et al.*, 1983). PCARRD (1988) likewise reported the improvement of girth size of pre-bearing palms (1 - 5 years from planting) due to potassium chloride application.

Plant height appeared to be the most responsive to fertilization as significant differences among treatments were noted as early as 3 months from planting. In the following year, however, such differences were not observed probably because of the long drought that occurred during the period (1982-1983), indicating the sensitivity of this plant character to moisture supply changes. At 21 months after planting, significant differences among treatments were again evident with the unfertilized palms being significantly shorter than the T_2 and T_3 palms.

Significant beneficial effects of the N-K fertilizers were also noted in leaf count. The fertilized palms had more functional leaves in their crown than the unfertilized ones. This could be attributed to the former's faster leaf production rates or improved leaf longevity or both which may further positively influence yield in two ways: more photosynthesizing tissues and longer support for maturing nuts thus making them less vulnerable to bunch falls during gusts of wind and typhoons. Results of an experiment elsewhere indicated that the total leaf area might be an important factor that

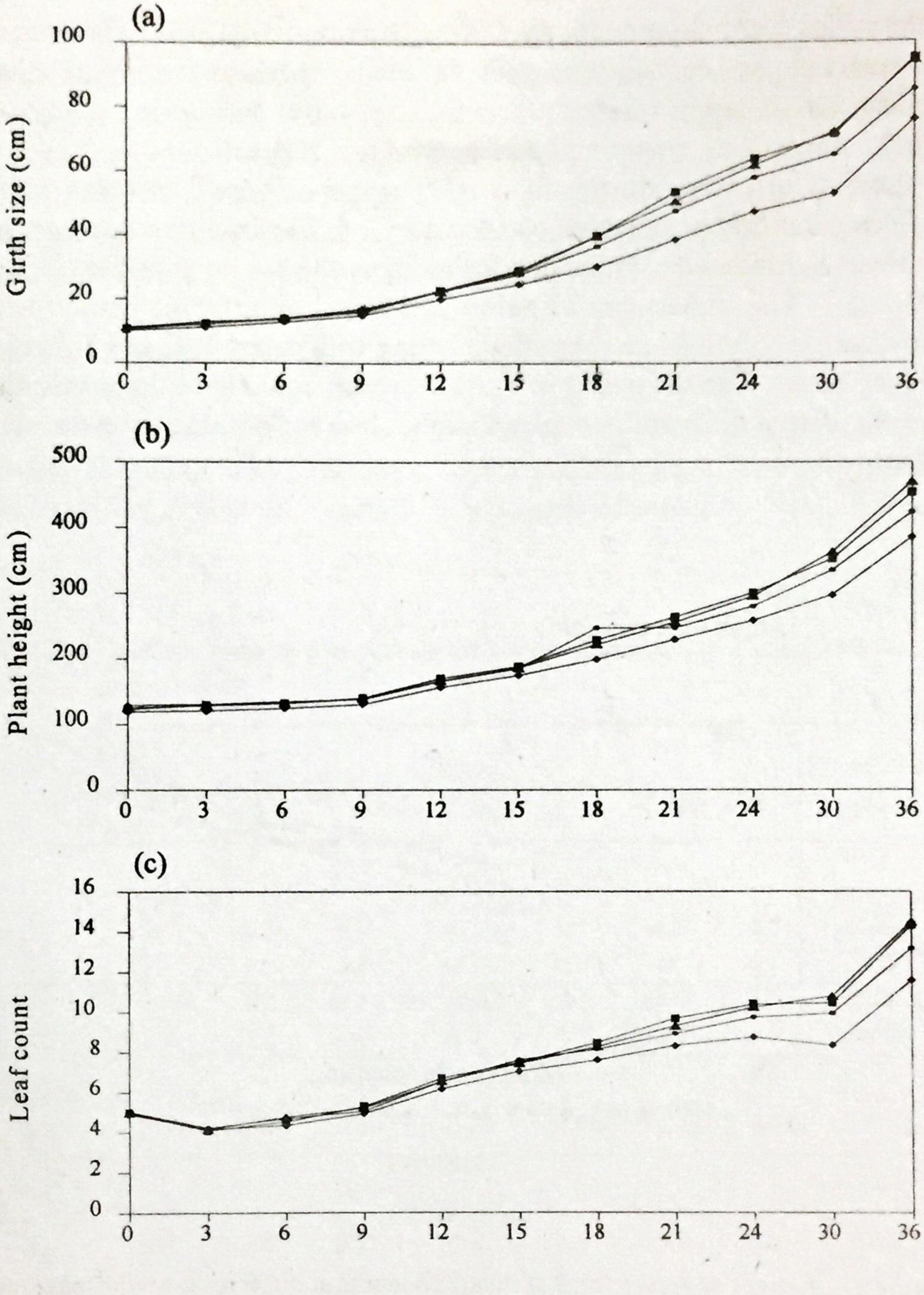

Figure 1. Girth size (a), plant height (b) and leaf count (c) of dwarf coconuts at different growth stages and different levels of ammonium sulfate and potassium chloride treatments.

determines coconut productivity (Shivashankar *et al.*, 1983). The present study, however, seemed to suggest that maturing bunches without leaves underneath to support them are more likely to fall during strong gusts of wind compared to straddling bunches with leaf support.

Length of leaves during the earlier stage of growth seemed to be influenced more by genotype as shown by significant differences among cultivars right from the start of data gathering on the 12th month after planting (Fig. 2). The experimental palms exhibited significant response to fertilization only at 21 months after planting with palms in T_2 and T_3 having longer leaves than the palms in T_0 . This result could have contributed to the significant differences in plant height observed at this particular stage of growth.

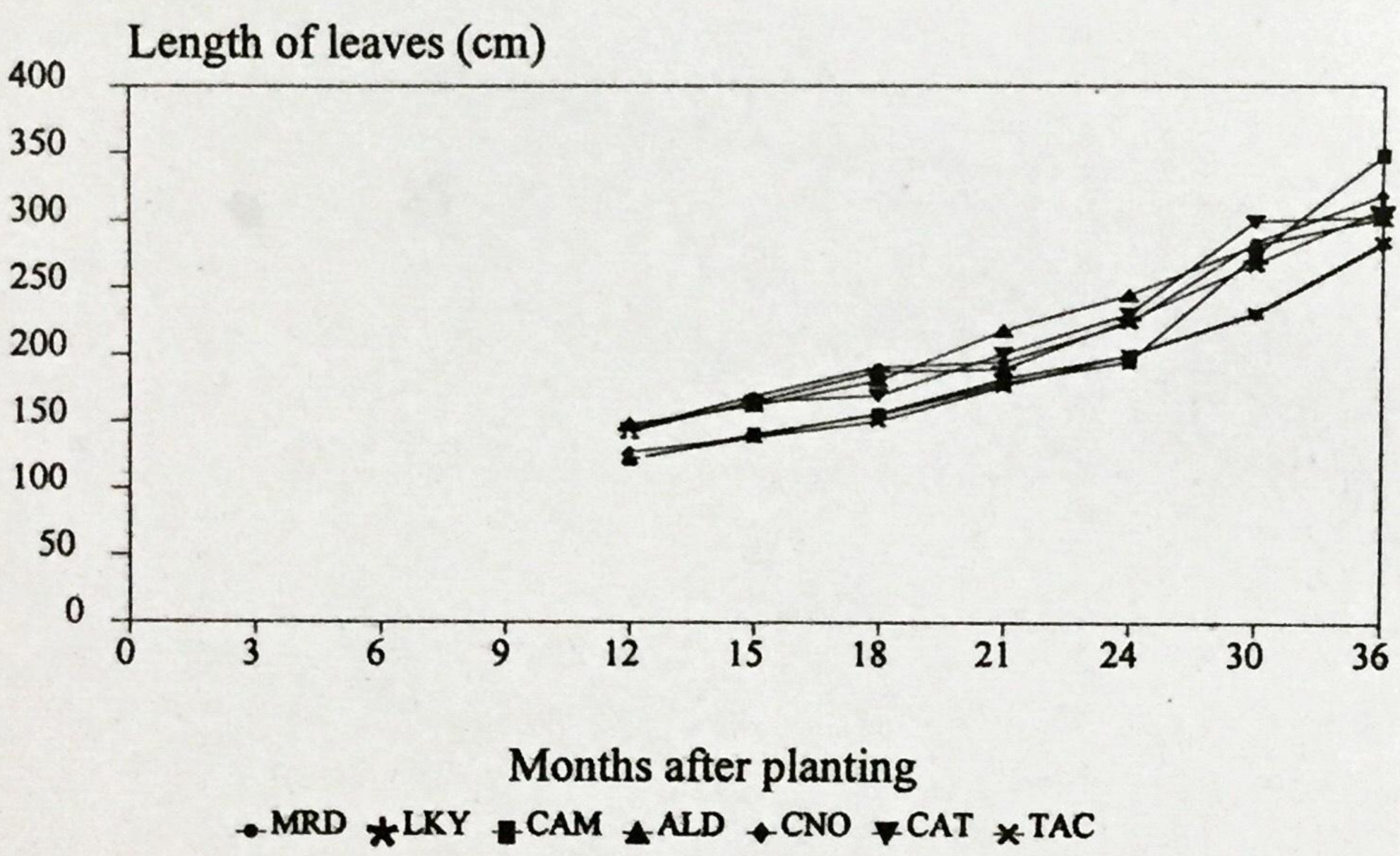

Figure 2. Length of leaves (cm) of dwarf coconuts at different growth stages and different levels of ammonium sulfate and potassium chloride treatments.

Although the seven cultivars had similar positive reactions to N-K fertilization, considerable variations in their growth performance were also noted. During the first year of growth, CAM had the biggest girth and was one of the cultivars with the highest leaf count. The following year, ALD, MRD and TAC developed bigger girths while ALD, CAT, LKY and MRD had the longest leaves, thus, would require bigger area than the other cultivars especially if intercropping will be employed.

Leaf spot infection

High incidence of leaf spot due to *Helminthosporium* sp. ranging from moderate to moderately severe was observed during the 21st to 24th month after planting (Table 3). Variations in degree of infection was observed

Table 3. Leaf spot ratings of seven dwarf coconut cultivars at 21 and 24 months after planting.

Fertilizer Level	Cultivar							Fertilizer Mean
	MRD	LKY	CAM	ALD	CNO	CAT	TAC	
				21 Months				
T_0	3.9	3.6	4.0	4.7	5.1	4.8	4.5	4.4a
T_1	3.6	3.2	3.3	4.1	4.0	4.0	4.1	3.8b
T_2	3.4	3.1	3.3	4.0	4.3	4.0	3.9	3.7b
T_3	2.8	3.1	3.1	4.0	4.3	3.9	3.9	3.6b
Cultivar Mean	3.4b	3.3b	3.4b	4.2a	4.4a	4.2a	4.1a	
				24 Months				
T_0	4.1	3.6	3.7	4.8	4.9	5.2	5.0	4.5a
T_1	3.7	3.7	3.8	4.4	4.1	4.4	4.7	4.1b
T_2	3.9	3.5	3.9	4.4	4.3	4.6	4.4	4.1b
T_3	3.9	3.2	3.4	4.5	4.5	4.5	4.3	4.0b
Cultivar Mean	3.9bc	3.5c	3.7c	4.5a	4.4ab	4.7a	4.6a	

among the different fertilizer treatments within a cultivar as well as between cultivars. Similar to previous reports, the unfertilized palms suffered the most from the disease compared to the fertilized ones, most likely because of potassium chloride deficiency. Fagan (1985), for instance, obtained strong evidence pointing to the mitigative effect of potash fertilizer on coconut *Drechslera* leaf spot although nitrogen fertilizer exerted opposite effect. Likewise, Abad and Magat (1977), Abad *et al.* (1978) and Palomar and Betonio (1982) have observed that potassium chloride improved the resistance of coconut palms to leaf spot. Chlorine which is a component of muriate of potash was found to be an element which very likely inhibits leaf spot formation (Magat *et al.*, 1977).

All cultivars were infected with the disease. CAT which was found by Abad *et al.* (1978) to be quite tolerant to leaf spot had slightly severe to moderately severe ratings like ALD, CNO and TAC.

Initiation of flowering

Fertilization generally hastened the initiation of flowering of the dwarf coconut cultivars. Palms fertilized with the highest level (T_3) flowered the earliest at a mean age of 3.18 years although this is not significantly different from the mean age at flowering of the palms in T_2 (Table 4). Palms in T_2

Table 4. Mean age (years) of seven dwarf coconut cultivars at initial flowering.

Fertilizer Level	Cultivar							Fertilizer Mean[1]
	MRD	LKY	CAM	ALD	CNO	CAT	TAC	
T_0	3.78	3.46	3.05	3.85	3.98	3.60	4.52	3.79a
T_1	3.49	3.17	3.25	3.62	3.44	3.16	3.95	3.45b
T_2	3.23	3.21	3.16	3.00	3.56	3.14	3.23	3.22c
T_3	3.25	3.08	2.86	3.08	3.37	3.28	3.24	3.18c
Cultivar Mean	3.44abc	3.23cd	3.08d	3.39bcd	3.59ab	3.29bcd	3.73a	
C.V. (%) = 10.01								

[1]Means in a column or in a row followed by the same letter are not significantly different at 5% level, DMRT.

and T_3 had significantly earlier flowering period compared with the palms in T_1 and T_0. The latter had the longest juvenile phase. This result is in line with the report of Ollagnier and Wahyuni (1984) who noted the beneficial effect of N not only on growth but also on the precocity of bearing of PB121 hybrid. In another experiment, potassium chloride-applied palms were also observed to have 115% more flowering than those not receiving the fertilizer at 5 years from field planting (PCARRD, 1988). Ollagnier *et al.*, (1983) similarly noted the positive effect of potassium chloride on precocity of flowering of PB 121 hybrid.

Among the cultivars, CAM flowered earlier than the rest. Statistical analysis, however, showed that the mean age to flower of CAM, LKY, CAT and ALD did not differ significantly. Their mean ages at first flowering ranged from 3.08 - 3.39 years from field planting. TAC, CNO and MRD were the late bearers.

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