POOR COCONUT GROWTH IN SOUTH-WEST BOUGAINVILLE

J. H. SUMBAK*

ABSTRACT

Possible reasons for unthrifty growth of coconuts in south-west Bougainville were examined.

Observations on coconut palm characteristics and the growth of crops such as young oil palms, cacao and leucaena, together with sunshine recordings, strongly point to insufficient insolation as being the direct cause of poor coconut development in this area.

Insect pests are not considered to be of much importance but fungal diseases, especially White Thread Blight (Corticium penicillatum), *cause considerable damage. The author suggests that fungal diseases are a secondary cause as they are undoubtedly induced by high rainfall and frequent periods of low sunlight. While unsatisfactory nutrition is sometimes evident, an overriding soil deficiency (or deficiencies) is not the main cause of poor performance. Genetically inferior planting material could be a contributing factor, but this has yet to be tested. Undoubtedly poor drainage for prolonged periods is of some consequence but poor growth is also evident where drainage is satisfactory.*

INTRODUCTION

A LARGE area of south-west Bougainville is suffering from poor coconut performance. Broadly speaking the syndrome consists of reasonable early growth, followed by a slowing down of development, tardiness in bearing and very poor production. A survey showed the unthriftiness to be widespread although palms near the coast were somewhat better than those further inland, but generally speaking the majority of palms were poor, characterized by upright fronds, few spathes and even fewer nuts. A few reasonable stands were noted.

The exact areas of numbers of palms affected are not known. An approximate count for the Siwai area (G. D. Hill, pers. comm.) was:—

10,000 palms on the coast;

20,000 palms in the flat hinterland, 5 to 15 miles inland; and

20,000 palms in the mountain areas.

Coconuts were healthy and green up to a mile or so inland and bearing at four and a half years. The coconuts in the hinterland were very poor (80 per cent bearing lightly or not at all) with stems long and thin in the older trees, leaves slightly yellow and tending to dry off prematurely in some cases. Leaves were thin and pointing up instead of being thickly bunched. Patches of better palms were noted. Sixty per cent of the mountain coconuts were reported to be well grown and bearing in six years or so but areas of poor coconuts were also evident.

R. V. Frost (pers. comm.) gave the following approximate figures for the four Census Divisions of the Buin Administrative areas:—

25,000 palms in coastal villages;

55,000 palms from 5 to 15 miles inland (hinterland); and

20,000 palms in mountain villages.

He described palms in the hinterland as very stunted, thin-stemmed with very erect pale green fronds. Isolated areas of healthy palms occurred. The coastal belt was generally better with the palms deeper in colour and approximately half producing by the sixth year. These areas were subject to a very high water table for most of the year. There appeared to be a lower incidence of disease. The mountain area (300 to 500 ft) had less disease but only one or two areas which bore in the sixth year. Palms grew to 30 to 40 ft, had pale green leaves, thin trunks and erect fronds.

Factors that could affect performance are discussed below.

* Agronomist, Lowlands Agricultural Experiment Station, Keravat.

POSSIBLE CAUSES OF POOR GROWTH

Pests and Diseases

Although T. L. Fenner (pers. comm.) found *Axiagastus* present in considerable numbers he concluded that this pest was not a major cause of unthriftiness and that it was equally present in all sections. The author noted little evidence of insect damage and *Axiagastus,* although it had been reported to be a menace from time to time, was not conspicuous. Frost (pers. comm.) noted that rhinoceros beetle and other beetles caused negligible damage and affected less than five per cent of palms. Pests are certainly not a major contributing factor to poor performance.

Most palms suffered seriously from fungal attack. White Thread Blight (*Corticium penicillatum*) was the prevalent disease (T. L. Fenner, pers. comm.). R. V. Frost (pers. comm.) reported in 1969 that more than 50 per cent of palms were affected by White Thread Blight and attributed this to the heavy rainfall (185 inches in the preceding nine-and-a-half months). Leaf spot disease, probably attributable to *Pestalotsiopsis palmarum*, was also noted, mainly on the older fronds. Fungal damage probably contributes to poor performance through reduction in effective photosynthetic area.

Planting Material

Genetically inferior planting material is a possibility. In certain isolated geographical areas palms are probably derived from a limited number of nuts and the resultant population would be inferior if these were, by chance, genetically poor.

For a conclusive test of whether Buin palms are of genetically inferior stock it is intended to plant Buin seednuts and seednuts from other sources (probably New Ireland and Buka) for a comparison of growth of each strain, both at Buin and at the Lowlands Agricultural Experiment Station, Keravat.

Nutrition

Soil and foliar samples have been collected from the area under consideration on a number of occasions. While unsatisfactory nutrition has been noted occasionally, nothing consistently amiss has been detected. *Table* 1 gives details of foliar analyses from samples of fronds collected in November 1965. The samples were fourteenth fronds or oldest fronds in the case of some palms which had fewer than fourteen fronds. Samples came from various sites in the Buin area. In addition, one sample was included from palms with yellowish fronds on the DASF station at Kubu, Sohano (Buka Island).

Table 1.—Analysis of coconut fronds, Buin District, November, 1965

Location	Per cent N	Per cent P	Per cent K	Per cent Ca	Per cent Mg	p.p.m Mn	p.p.m. Fe	p.p.m. Cu	p.p.m. Zn.	p.p.m. B
Malabita No. 1	1.14	0.100	0.34	0.74	0.402	87	439	3.8	144	20.3
Malabita No. 2, owner Mim	1.48	0.144	1.60	0.37	0.120	67	74	4.0	32	19.6
Malabita No. 2, owner Numaman	1.24	0.115	1.44	0.49	0.130	40	57	2.3	39	21.0
Malabita No. 3, owner Perokana	1.50	0.131	1.66	0.30	0.108	52	57	4.0	17	22.0
Musiminoi, village Siwai	1.69	0.167	1.18	0.39	0.090	122	58	5.8	23	15.3
Laguai	1.69	0.146	1.40	0.41	0.091	57	63	9.3	36	16.8
Kangu Government Plantation	1.27	0.110	0.78	0.37	0.167	116	100	6.0	18	16.8
Unanai village, Diwai	1.53	0.144	1.58	0.45	0.116	50	39	4.5	24	20.3
Mava village, Nagovissi	1.46	0.139	0.84	0.59	0.250	139	34	3.3	39	21.0
Sisirvai, Nagovissi	1.32	0.120	1.12	0.51	0.193	164	34	3.3	42	14.8
Loro, Nagovissi	1.54	0.131	1.46	0.61	0.100	198	38	4.3	39	16.0
DASF Sohano (from palms with yellowish fronds)	1.84	0.191	1.86	0.25	0.091	26	34	5.8	23	9.6
Critical levels proposed in T.P.N.G.	1.7	0.12	0.9	0.4	0.25	30	40	2.5	10	10

Nitrogen.—Contents are generally below the critical level. However, a private agricultural consultant, Mr L. A. Bridgland, who had inspected the sampled palms, commented that their appearance did not suggest nitrogen deficiency.

Phosphorus.—Contents are generally adequate with one or two low analyses.

Potassium.—Levels are adequate to high. High potassium levels could be limiting magnesium uptake.

Calcium.—Generally adequate and as calcium contents are affected by the uptake of other nutrients it is not considered that a calcium deficiency exists.

Magnesium.—With two exceptions magnesium levels tend to be somewhat low. This is probably due to high potassium levels limiting magnesium uptake. Note that Malabita No. 1 and Mava Village, Nagovissi, which are highest in magnesium were lowest in potassium. DASF Sohano samples, from yellowish palms were low in magnesium, yet palms there are quite productive. Although magnesium levels tend to be on the low side it is not considered that a magnesium deficiency is an important factor in poor coconut growth.

Trace Eelements.—Contents are very variable but, on the whole, satisfactory. In the Malabita No. 1 sample iron and zinc levels were extraordinarily high; however, contamination is suspected as a later sample from the same area failed to reveal similar levels. Boron levels were somewhat higher than usual but there was no suggestion of toxicity.

All in all, these analyses did not suggest that lack of any nutrient or combination of nutrients was the primary reason for poor growth. Sulphur levels were not determined so sulphur deficiency remained a possibility.

Results of analyses of fronds and nut waters collected in November 1966 on the whole were similar to the 1965 analyses (*Tables* 2 and 3). Nitrogen levels tended to be low but levels in poor palms were similar to those in good palms. The extremely high levels of zinc and iron found in the previous Malabita samples were not repeated. Magnesium was again low and potassium levels high while the sulphur status appeared satisfactory.

Analyses of soil and plant samples collected by a private consultant failed to show any serious nutrient problems.

The good growth of cacao (a shade loving tree) and leucaena tend to suggest that there is little wrong with the nutrient supply in these soils.

The poor growth of oil palms relative to other Territory areas, despite regular fertilizing, suggests that factors aside from nutrition are involved.

Drainage

Poor drainage in some areas would adversely affect growth. At Malabita large planting holes (approx. 3 ft x 3 ft x 3 ft) often remain filled with water to within four to six inches of the surface for five or six months of the year. Obviously the rooting area of the palm would be limited severely and a considerable stress applied

Table 2.—Analysis of coconut fronds, Buin Area, November, 1966

Location	Appearance of Palms	Leaf No.	Per cent N	Per cent P	Per cent K	Per cent Ca	Per cent Mg	p.p.m. S	p.p.m. Mn	p.p.m. Fe	p.p.m. Zn	p.p.m. Cu	p.p.m. B
Kangu	Good	4	1.57	0.153	1.50	0.34	0.171	....	....	....	....	....	....
Kangu	Good	9	1.49	0.157	1.50	0.25	0.162	240	60	29	15.3	4.5	13.0
Kangu	Good	14	1.54	0.153	1.74	0.21	0.140	....	52	28	13.8	....	12.5
Malabita	Poor	4	1.71	0.183	2.40	0.26	0.142	....	34	20	22.8	9.5	9.5
Malabita	Poor	9	1.61	0.183	1.94	0.34	0.182	380	46	26	55.0	7.0	10.0
Malabita	Poor	14	1.50	0.190	1.78	0.40	0.150	....	50	27	27.0	7.0	13.5
Kogu	Good	4	1.66	0.188	1.76	0.27	0.095	....	30	23	35.0	4.8	10.5
Kogu	Good	9	1.74	0.193	1.38	0.46	0.119	360	49	40	39.0	4.8	10.5
Kogu	Good	14	1.80	0.170	1.32	0.50	0.098	....	52	34	24.3	5.0	16.8
Kogu	Poor	4	1.63	0.222	2.18	0.31	0.121	....	39	27	38.9	7.6	....
Kogu	Poor	9	1.65	0.212	1.74	0.40	0.136	450	52	29	31.8	6.3	....
Kogu	Poor	14	1.70	0.203	1.70	0.44	0.121	....	53	24	31.8	4.9	16.8

Table 3.—Analysis of coconut waters, Buin area, November, 1966

Location	Appearance of Palms	K (m-equiv./l)	Comments	p.p.m. S	Comments
Kogu	Good	72.9	High	49	High
Malabita	Poor	65.5	High	60	High

to the palm. Areas similar to Malabita appeared to be common. Poor palms, however, also occur on well drained sites such as hillsides.

It was concluded that, while bad drainage is not the main factor responsible for poor development in the Buin area, it probably contributes to poor growth in some localities.

Insolation

Heavy and continuous cloud cover might be of importance. Often the amount of bright sunshine was less than two hours a day. As the palm is a heavy light demander, such conditions could restrict development severely. The appearance of poor palms was similar to that of shaded palms attempting to reach light, such as when planted under leucaena shade in mixed coconut and cocoa plantings, or in closely planted groves.

The poor growth of light-demanding crops such as oil palm and coconuts and the excellent growth of shade-loving crops such as cocoa and leucaena (which grows well under full sun but tolerates shade) supports the theory of inadequate insolation. Sago palm development is also reported to be poor in the Buin area.

Sunshine recordings for a limited period are shown in *Table* 4 compared with figures for areas where coconuts and oil palms do well (N. J. Mendham, pers. comm.).

Buin records have been consistently low particularly when compared with Aropa, only some 40 miles away. Oil palm growth at Aropa is much superior to that at Buin.

The existence of better palms or groups of better palms can probably be attributed to a number of factors. Local reports state that rainfall in the immediate vicinity of the coast is somewhat less than inland. If this is so it probably follows that sunshine would also be greater and hence the better performance of coastal palms.

The topography of the country could have some effect on palm performance. As an example it is likely that palms on a slope facing the east would get more sunshine than palms on a western slope as cloud cover could be expected to be greater as the day progresses.

Possibly some palms are better users of available light than others and these would be expected to give better performance. In theory, selection for tolerance to low light conditions could be carried out but the task would take too long to be practicable.

Table 4.—Sunshine at Buin and other locations (Jordan Sunshine Recorder)

Date	Average Daily Sunshine (hours)			
	Buin	Keravat	Aropa	Tigak
September, 1968	....	7.01	....	6.31
October	4.32	5.89	....	5.57
November	2.84	5.47	....	4.79
December	3.69	5.24	....	4.75
January, 1969	2.77	3.15	4.20	4.37
February	3.46	3.50	4.41	5.26
March	3.99	4.49	6.35	4.26
April	4.59	4.24	5.39	4.21
May	4.61	6.01	6.58	6.47
June	4.22	7.20	6.39	5.17
July	3.66	5.93	6.48	3.36
August	2.15	5.08	4.64	4.30
September	2.61	3.86	6.28	3.00
TOTAL	1304*	1825	2055*	1687

* The total hours are only approximate, having been adjusted for missing months.

CONCLUSIONS

Observations of coconut palm characteristics, and growth of oil palm, cocoa and leucaena, together with sunshine recordings, strongly point to insufficient insolation as being the direct cause of poor coconut development in the Buin area.

Fungal disease, inadequate drainage and poor nutrition may be contributing factors, particularly in some locations. Control of disease is not practicable because of cost of fungicides, difficulty of application and lack of persistence under high rainfall conditions, although improved drainage may reduce disease incidence where there is any tendancy to waterlogging. Further attention to the nutritional status of the palms will be given in a planned nutritional survey. Comparison of Buin seedlings with seedlings from other sources will show to what extent poor planting material may be involved.

However, the prospects of finding a practical means of improving coconut growth do not seem good. It is therefore recommended that plantings of coconuts be discouraged in this area and that substitute crops be sought.

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