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A Note on the Outstanding Growth of Coconut Seedlings in a Photoperiodic Experimental Nursery and its Relation to Soil Conditions

In a two year old coconut nursery of variety "West Coast Tall" maintained under 24 hr photoperiod (under photoperiodic studies) at this Institute, a group of four seedlings showing exceptionally vigorous growth was observed. This outstanding growth was confined to a specific site (A) of the nursery and was in contrast with vigour of seedlings found in the rest of the area (B) of the same nursery (Table 1).

TABLE 1. Growth characteristics of coconut seedlings

Growth	Outstanding A (average of a group of four seedlings)	Ordinary B (average of 5 groups of four seedlings each)
Height (cm)	406.9	156.5
Girth at collar (cm)	78.2	27.1
No. of leaves	17.0	13.0

This disparity in the growth of seedlings despite their comparable age and treatments (Pillai *et al.*, 1973) seemed worth investigating to find out whether it is associated with variation in soil conditions. Moreover, our attention was drawn to the fact, rather an anomaly that several years back, the location (A) was having a compost pit-like large excavated area used to dispose off the organic and inorganic wastes. This was made up at a later period and left unnoticed during the formation of the said nursery. The presence of chlorophyll-type compounds in the location (A) confirmed the anomaly as it indicated the possibility that cattle-shed litter or wastes or plant refuse has been incorporated in the soil. The significance of such compounds in supplying nitrogen has been reported by Hoyt (1966a, 1966 b, 1967) and Conforth (1969). The soil in the location (A) had 0.663 C. U. / 100 (Chlorophyll units / 100 g) approximately assessed according to Hoyt's method, (1966a, 1967) whereas it was totally absent in (B).

Soil characteristics from the composite soil samples taken in the localised areas along with showed clear-cut variation in textural, chemical, and biological (enzymic) factors for differential behaviour of the seedlings and the results (Tables 2, 3 and 4) are explained as follows:

TABLE 2. Mechanical composition of soil (Buoyoucos) in the locations under seedlings with outstanding growth (A) and ordinary growth (B)

Growth location	Outstanding (A) (one location under a group of 4 seedlings)		Ordinary (B) (five locations under 5 groups of 4 seedlings each)	
Depth (cm)	0–50	50–100	0–50	50–100 (Mean of five values)
Clay per cent	11.8	11.8	10.7	10.0
Silt per cent	2.0	2.0	1.0	0.6
Sand per cent	86.2	86.2	88.3	89.4
Textural designation	Ls	Ls	Ls	Ls / S

Ls—Loamy sand
S—Sand

TABLE 3. Soil chemical factors

Growth depth (cm)	Outstanding (A) 0–50	50–100	Ordinary (B) 0–50	50–100
1. pH				
(a) 1 : 2.5 Soil : Water suspension	6.70	6.70	5.35	5.60
(b) 1 : 2 Soil : 0.01 M Ca Cl_2 suspension	5.90	6.40	4.20	4.56
2. Specific conductivity (1 : 5 Soil : Water suspension and expressed as µmhos/cm at 27°C)	18.90	Low	10.21	low
3. Organic C m. e. / 100 g (Walkley and Black's method as per Piper, 1966)	127.50	146.00	69.21	38.46
4. Available N ppm (Subbiah and Asijah's method, 1956)	85.40	103.60	90.88	72.16
5. Avaiable P_2O_5 ppm (Bray's method No. 1 as per Jackson, 1967)	70.60	80.64	79.15	54.53
6. Available K_2O ppm (By flame photometry method as per Jackson, 1967)	32.22	29.19	16.43	10.03
7. Exchangeable Ca m. e./100g (By versenate method as per Jackson, 1967)	1.8970	3.1200	0.2947	0.1050
8. Exchangeable Mg m. e./100g (By versenate method as per Jackson, 1967)	0.1500	0.1870	0.0815	0.1050
9. Cation exchange capacity m. e./100g (By Piper's method, 1966)	2.500	3.750	1.750	0.870

TABLE 4. Soil enzyme activity

Growth depth (cm)	Outstanding (A)		Ordinary (B)	
	0–50	50–100	0–50	50–100
1. * Catalase activity	49.98	31.23	14.83	6.25
2. ** Dehydrogenase activity	6.5761	7.8220	3.5648	3.7205

* Method of Boroceio (1957) activity expressed as μ moles of H_2O_2 decomposed/hr/g of soil.
** Methods by Lenhard (1956) Casida *et al.* (1964) and Balasubramaniyam *et al.* (1974) expressed as percentage activity level of endogenous dehydrogenase to its potential level. Activities measured as optical density (at 545 mm in a spectrophotometer) of formazan (TPF) formed in 25 ml reaction-extraction mixture/24 hr/10g of mixture of soil; $CaCo_3$ (: 1.01) at 37°C.

The results showed the basic difference between the set up soil factors in the location (A) and (B). Soil in the location (A) has a loamy sand texture, almost a neutral reaction, comparatively more specific conductivity, available nutrients especially potash, greater C. E. C. and exchangeable Ca and increased biological activity as indicated by catalase and dehydrogenase (per centage of endogenous level for potential level of DHA) whereas comparative values for these soil factors in other locations (B) in the nursery indicated loamy sand and texture of the soil and distinct acid reaction and lower fertility and less favourable biological regime. A congenial soil environment seems likely in the location (A) on viewing these results based on soil fertility concepts (Cornforth, 1969) on base saturation, buffering capacity, capacity to exchange cations, nutrient availability especially nitrogen and potash and biological regime of soil conditions. Calcium base saturation is known to confer most satisfactory physical and nutritional conditions in the soil.

The disparity in seedling growth has been found in the nursery which was under long day of 24 hr treatment for two consecutive years (1970–1972) under photoperiodic studies. Pillai *et al.* (1973) have reported that coconut sprouts of West Coast Tall variety, 45 days after sowing, were planted in the experimental plots after randomization, at the spacing of 1.22 × 1.22 m. The three treatments *viz*, Long Day treatments, LD_1 with 24 hr light and LD_2 with 18 hr light and the control with normal day light (12 hr) were replicated six times with 24 sprouts per plot. The sprouts under LD treatment received additional light after sun set provided with 100 watts tungsten lamps set about 1.22 m above leaf level, throughout the night for LD_1 treatment and up to 12 midnight for LD_2 treatment. All other treatments were uniform and comparable. They have claimed that 24 hr photoperiod increased not only the vigour of the seedlings but also increased the chlorophyll fractions, besides promoting the initiation of inflorescence primordium. Anisaux (1968) observed interactions to exist between lighting and mineral feeding of plants and optimum nutritional conditions that must be adapted for optimum effects of light. He observed that in the case of complete nutrition, the synthesis of growth regulators is particularly favoured by predominance of NO_3 among the anions and Ca predominance among cations. McEnvoy (1967) reporting on the influence of photoperiod and light intensity on the uptake of radiophosphorus by *Chrysanthemum* and *Pelargonium*, suggested that increased P^{32} uptake with increased photoperiod and light intensity is related to increased supply of photosynthate. According to Mitsui *et al.* (1960) light increased transpiration and carbohydrate accumulation in wheat seedling and so increased H_2O and N uptake in proportion to its intensity, P and K uptake depended on factors indirectly connected with photosynthesis. Zucher (1972) has established a fundamental need for biochemical regulation of responses to light, particularly photoregulation of enzymes in plants. The photosynthetic effect has been attributed to light induced uptake of nitrate and photosynthetic generation of reducing power (Beevers and Hageman, 1969). These observations would show the interacting effect and or modifying influence of light on mineral nutrition of plants (Withrow, 1961). Therefore it is possible that a group of four seedlings, since they happened to be growing under conducive soil conditions sand increased the biological activity as assessed by soil catalase and dehydrogenase activities in a localised area (A) of the nursery showed robust growth, which was also accounted by the growth effect of a photoperiod (long day of 24 hr) received at an early period.

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