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# A Simple Fertilizer Trial with Coconuts

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ABSTRACT

Young coconuts grew significantly better with 8-8-8 or potassium nitrate than without fertilizer; there was no difference between the fertilizers. Response (+19%) was measurable within 7 weeks, and increased to over 30%. After 15 weeks without fertilizer, the control palms were fertilized and their growth rate caught up with the previously fertilized palms after 4 weeks. Maypan hybrids grew significantly faster than Malayan Yellow Dwarf which in turn grew faster than Malayan Green Dwarf. All varieties responded equally to fertilizer. It is suggested that palm growers carry out their own trials.

Fertilizing may not be the most expensive of palm growers' maintenance procedures, but it is desirable to use the most suitable type of fertilizer if young palms are to grow fast and flower early, and mature palms are to have a healthy appearance.

Much research has been done in the world on fertilizing of palms, mainly oil palm (*Elaeis guineensis*), coconut (*Cocos nucifera*) and date (*Phoenix dactylifera*), and the literature on this subject is correspondingly profuse. The best fertilizer depends upon the nutrient needs of that particular palm species and on the nutrient supplying power of the particular soil. However, there is a need in most cases for a steady supply of nitrogen, especially for young palms, and a heavy requirement for potash, particularly with palms bearing large amounts of fruit. Phosphate is needed only in specific areas of deficiency, and then in quite limited amounts (Romney 1987). Magnesium may be useful, especially when large quantities of potash have been used (Brunin 1970). Deficiency of sulphur occurs only in certain soils of Papua New Guinea (Galasch 1976), of iron and manganese in the corals of Tahitian atolls, and of chlorine in some Pacific soils (de Taffin and Quencez 1980): palms receiving sulphate of ammonia and potassium chloride are anyway not likely to suffer from deficiency of sulphate or chlorine. Boron deficiency may occur in very calcareous soils or after very cold weather (Donselman 1981).

The formulation of a general fertilizer for palms has to provide those nutrients known to be needed, but also to include at least small quantities of other nutrients that might be required and whose absence might result in unbalanced nutrition. Hence the general advice given by Donselman (1981) can be followed without fear.

The main procedures used by growers to determine the specific nutrient needs of their palms are soil and leaf analysis, and these can be very good guides. However, soil analysis measures the nutrients extracted from the soil by a chemical solution, which does not always correspond to the amounts extractable by the roots of the plant. Leaf analysis shows the quantities of nutrients which have been extracted by the plant. With both, the answers are reliable only if the correct sample is taken, and an expert is required to interpret the results. A field trial, on the other hand, shows exactly how the palms react to the different fertilizers in the soil where they are being grown.

The purpose of the trial reported here was to determine a suitable fertilizer mixture for an artificial soil-mix used to grow coconut plants on from the age of 5 months post-sprouting (up to which time nutrients

are normally adequately provided by the endosperm in the nut) for a further 12–18 months. The reason for reporting it was to demonstrate how growers can test fertilizers with their own palms. The desiderata for this procedure are (a) possession of some preliminary knowledge of probable suitable fertilizers, (b) test plants with some botanical feature that enables their growth to be monitored easily, and (c) sufficient of these plants to enable the trial to give reliable and analyzable data.

## Materials and Methods

The trial was carried out at Romney Farm, South Dade County.

The plants under test comprised Malayan Green-fruited Dwarfs, Malayan Yellow-fruited Dwarfs and Maypan Hybrids (F1 hybrids between yellow-fruited Malayan Dwarf mother-palms and Panama Tall pollen parents) (Harries and Romney 1974). All seeds were obtained from Jamaica, harvested from palms which have shown their resistance to lethal yellowing disease for many years in the diseased area. The seeds were set to sprout in July, 1988, and transferred to 7-gallon black polybags in August and September, 1988. The plants were approximately 2 ft. above soil level by January, 1989, when they were moved to 25-gallon polythene tubs.

The soil-mix used in both polybags and tubs consisted of stable sweepings and fine calcareous sand in the approximate proportions of 9:1 by volume. The soil surface was treated with Ronstar granular herbicide. No fertilizer was used prior to the trial.

Fertilizer treatments were used as follows:

A. 3 ounces of 8-8-8 applied per palm on 3/2/89, 3/17/89 and 5/16/89.
B. 1 oz. potassium nitrate (15-0-45) applied per palm on 3/2/89, 3/17/89 and 5/16/89.
C. No fertilizer used until 6/15/89, when 2 ounces of potassium nitrate were applied per palm to encourage the latter to catch up with treatments A and B fertilized since 3/2/89 (15 weeks previously).

Each fertilized "plot" comprised 2 palms, and there were 3 such plots for each fertilizer treatment, i.e., 3 replicates. Thus 18 palms were used for each of the varieties. The partition of degrees of freedom in the statistical analysis of variation was therefore:

| | Source of variation | Degrees of freedom |
|---|---|---|
| 3 | Replicates | 2 |
| 3 | Varieties | 2 |
| 3 | Fertilizers | 2 |
| | Interaction (Var. × Fert.) | 4 |
| | Error | 16 |
| | Total | 26 |

For readers not familiar with statistical analysis of data, it should be explained that this analysis investigates whether the differences between palms treated differently (e.g., fertilizer) are significantly greater than the natural differences between palms treated alike (error). In the analysis of the data in this trial, a difference was considered to be significant if it could be expected at least 5 out of every 100 times that the trial was carried out. The least difference for this level of significance (LSD) is shown in the table for each measurement period. Any difference less than the LSD is considered to be due to chance variation.

Growth was assessed every 2 weeks by measuring the height above ground level of the tip of the spike (the central youngest leaf); such growth is linear during its most active period (Romney 1964). When a new spike appeared, its length was measured and it took the place of the previously measured leaf.

*Table 1. Mean spike growth (inches/week).*

| Fert./ Var. | Period 3/22–4/5 | 4/5–4/19 | 4/19–5/3 | 5/3–5/17 | 5/17–5/31 | 5/31–6/14 | 6/28–7/12 |
|---|---|---|---|---|---|---|---|
| 0 | 2.5a | 2.6b | 3.3b | 2.8b | 3.9b | 4.5b | 6.4a |
| 8-8-8 | 2.7a | 2.7b | 3.7a | 3.2a | 4.8a | 6.0a | 6.2a |
| 14-0-45 | 2.9a | 3.1a | 3.9a | 3.4a | 5.0a | 6.2a | 6.4a |
| LSD | .4 | .4 | .3 | .3 | .4 | .4 | .5 |
| M.Gre.D | 2.4b | 2.4b | 2.9c | 2.2c | 3.3b | 4.1c | 5.3c |
| M.Yel.D | 2.5b | 2.7b | 3.8b | 3.3b | 4.6a | 5.7b | 6.2b |
| Maypan | 3.2a | 3.3a | 4.3a | 3.8a | 4.9a | 6.9a | 7.5a |

Note: means followed by the same letter (a, b, c) are not significantly different.

## Results

## Discussion and Conclusions

For leaf growth (Table 1), by the 2-week period ending 4/19 (7 weeks after the first fertilizer application), potassium nitrate had caused significantly greater growth and, from 4/19 onwards, both fertilizers gave more growth than control yet were not significantly different from each other. Evidently the phosphate in the 8-8-8 had no effect. Possibly the faster response from potassium nitrate was due to faster solubility of the nutrients. A larger and therefore more accurate trial might have detected a significant benefit of potassium nitrate over 8-8-8, but the present results simply show a response from fertilizer of 19% by 7 weeks after the first application increasing to 33–38% by 6/14. The 3 oz. 8-8-8 is approximately equal to 1 oz. potassium nitrate in cost and nutrient content.

By 7/12, the fertilizer applied to the control palms on 6/15 had caused their leaf growth to increase to a level not significantly different from those fertilized since 3/2, demonstrating how quickly the palms can be shown to respond if the measurements are sufficiently sensitive. The much greater growth as the experiment proceeded was due to the increasing ambient temperature (the relationship between coconut growth and temperature will be reported in a later paper).

In none of the time periods measured was the interaction significant between fertilizer treatment and coconut variety, i.e., the response to fertilizer was not different between varieties.

In terms of the number of new leaves produced from 3/8 to 6/14 (Table 2), both fertilizers were again significantly better than control. It is interesting to note that, if annual leaf production proceeded at the same rate as during the 14-week period 3/8–6/14, then fertilized palms would produce 12.9 leaves for this first year of life of the palm and unfertilized trees would produce 10.9 leaves.

Leaf production of MYD was significantly greater than for Maypan or MGD. However, 14 weeks is a rather short period over which to measure leaf production if meaningful results are to be obtained.

It is believed that palm growers could

*Table 2. Mean no. new leaves per palm (3/8–6/14).*

| | | | | | |
|---|---|---|---|---|---|
| Fertilizer | 0 | 2.94b | Variety | MGD | 2.89b |
| | 8-8-8 | 3.39a | | MYD | 3.83a |
| | 14-0-45 | 3.56a | | MP | 3.17b |
| | LSD | .4 | | LSD | .4 |

carry out their own field trials to compare fertilizers, varieties, degrees of shade, types of soil, pesticides, etc. Leaf lengths and number of leaves are easy to measure. Some preliminary advice may be needed on the design of the trial and on the statistical analysis of the data, but trials in the grower's own field can give directly applicable results.

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# The Botanical Gardens of the University of the South Pacific

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In September, 1988, the President of Fiji, Ratu Sir Penaia Ganilau, officially opened the Botanical Gardens at the University of the South Pacific in Suva, Fiji.

Some two years previously, a small group of people mainly from the University started to meet regularly to see what could be done to upgrade the gardens on the University campus. The Chairman was Dr. John Miller, an American botanist with the Department of Biology, School of Pure and Applied Sciences. The writer was the only non-university member. In the beginning, not a lot of progress was made although some improvement in the University gardens could be seen. Attempts were also made to get the students to take pride in their campus and to realize that, when they needed leaves and flowers for cultural or social occasions, they should not simply strip the closest trees and gardens. Students at the University come from the island nations of the South Pacific from the Cook Islands to the Solomon Islands, from Tonga to Kiribati.

The situation changed somewhat with the arrival of Ian Banner as the Director of Buildings and Grounds. He had previously been in Papua New Guinea and was enthusiastic about the appearance of the grounds. At about the same time, I realized that I would have to find a permanent home for many of my palms, cycads and hibiscus—most of these were reaching the stage when they could not stay in containers any longer. My garden was also overfull and I needed more space for the younger and smaller plants in my collection.

A small valley near the entrance to the University was chosen as an area where we could start. It had been used for many