MEETING THE FERTILIZER SHORTAGE IN COCONUT *

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Sri Lanka has been fortunate in getting uninterrupted supplies of fertilizers until a few years back. But, in the recent past, with the world production of fertilizer falling and the consequent rise in prices, irregular shipments and insufficiency of foreign exchange to finance these purchases, th- country is faced with the need to adopt ways and means of making the best use of the limited quantity of fertilizers available.

Before discussing the various methods of meeting this fertilizer sh- age in coconut it would be relevant to consider the pattern of fertilizer consumption by the coconut industry in Sri Lanka in the recent past. The patt of coconut fertilizer use up to 1970 is shown in Figure 1. It is evident from this figure that only about 250,000 acres have been manured in the late 1960's. This is about 22% of the total acreage under coconut. This shows that even during the period of availability of fertilizer only a small percentage of coconut lands was manured. If only such a low percentage of land was manured, when fertilizer was freely available at low prices, one cannot but be greatly disturbed at the prospect when the prices of fertilizers rise and the availability becomes limited. This being so, the time is not doubt opportune to consid- what steps should be taken to meet the present shortage of fertilizers.

This paper presents some of the methods that could be adopted in meeti- the fertilizer shortage. They are (i) setting priorities in the distribution of whatever avialable stock to various categories based on the urgency of fertilizer used, (ii) reducing the present recommended fertilizer dosage; (iii) application of fertilizer based on the nutrient level in the soil plant; (iv) substitution of locally available materials for the imported fertilizers.

Priorities for distribution of fertilizers

If only limited quantities of fertilizers are made available to the coconut industry, the first step should be to set priorities in respect of their distribution, which in decreasing order are as follows :-

(i) Young palms (up to bearing)

(ii) Hybrid palms

(iii) Adult palms (tall)in association with intercrop.

(iv) Adult palms (tall, monoculture)

Fertilizer experiments carried out by the Coconut Research Insitute have clearly demonstrated that manuring with a balanced fertilizer mixture containing the three major nutrients N, P, and K is very essential for the healthy growth of young palms. Young palms may be affected, even more than the adult palms, if fertilizer is withdrawn even for one or two years. There is evidence to show that young palms which are neglected during their initial growth stages would not recover even when sufficient fertilizer was applied during subsequent growth stages (1). It is estimated aht the annual fertilizer requirement of young palms would be of the order to 10,000 tons. This is only a small fraction (less than 5%) of the total fertilizer requirement of all coconut lands.

The second priority should be for hybrids. Because of the limited area available for expansion of the planting area, increase in production of coconuts has to be obtained by proper farming practices-one of which is planting of improved materials (hybrids) in place of senile and sub-standard palms. In any crop, hybrids are generally more sensitive to adverse conditions than the normal forms. This implies that correct management practices (including proper fertilizer usage) are a sine qua non to exploit their potential for higher yields. If fertilizer is reduced or withdrawn, the yields of hybrids may even be lower than from the talls. The estimated fertilizer requirement of hybrids is a very small fraction (less than 10%) of the total fertilizer usage on coconut lands. Therefore in allocating fertilizers, hybrid coconut could understandably receive second priority.

The third class is coconut grown in association with intercrops. In a mixed cultivation of this nature there is necessarily competition for nutrients by both crops. This implies that coconut grown in association with an intercrop will suffer a bigger set back than coconut grown as monoculture if fertilizers are reduced or withdrawn.

Field observations by the Coconut Research Institute suggest that the fourth class (viz tall palm in monoculture) would not be adversely affected if manuring was not done for one or two years. Therefore this class could receive the last priority in the distribution of fertilizers.

Reducing the present recommended fertilizer dose

Nutrient interactions : Fertilizer shortage (present or future) could involve one or more of the 3 major fertilizers. If only one of them is unavailable, it would be expedient to reduce, owing to interaction phenomena, the levels of the other two fertilizers in the mixture (even though they be freely available) so as to get the maximum benefit under such conditions. Such a situation is indicated in the NPK field experiment carried out at Bandirippuwa Estate (2). The 10 years data from this experiment show an NK interaction (Figure 2). The results indicate that the addition of N brings about the best response from K. It also shows the depressive effects of N on yields at low levels of K. At the beginning of 1974, the coconut Research Institute expecting an absolute shortage of N fertilizers, suggested the reduction by 27.8% of K and P fertilizers in order that the yield could be the maximum under the reduced supply of N fertilizers. The above suggestion, based on the results of the experiment mentioned earlier, is illustracted as follows :

(a) N = 0; K 115 lb/muriate of potash/acre (present recommendation):

P = 120.12 lb saphos phosphate/acre (present recommendation):

Yield = 1748 lb Copra/acre

(b) N = 0; K = 83.48 lb Muriate of potash/acre (27.8% less than present recommendations); P = 120.12 lbs Saphos Phosphate/acre (27.8% less the present recommendation); Yield = 1809 lb Copra/acre

Economics of fertilizer usage : Fertilizer recommendation (currently) for coconut in Sri Lanka has been made with the view of obtaining maximum production. In the past, when the prices of fertilizer were cheap and the price of copra was high, planters were encouraged to apply fertilizers to achieve maximum production. Now when the cost of fertilizers is high, the recommended level of fertilizer for coconut should be that for optimum production (maximum profit) rather than for maximum production. Fertilizer dosage for optimum yield is always low than that for maximum yield (Figure 3). Calaculations, based on the results of the field experiment carried out at Bandirippuwa Estate (2) and the present price of copra and fertilizers (Copra Rs. 600/candy; sulphate of ammonia, Rs. 5655/ton; muriate of potash, Rs636.5/ton;

Saphos phosphate Rs.438/ton shows that the optimum fertilizer dose is 5.37 lb/palm and the dose for maximum production is 6.36 lb/palm. If the fertilizer prices increase further and the Copra price remained the same or decreased, dose for optimum yield would be even lower than 5.37 lb/palm. The above fi... are based only on one field experiment carried out at Bandirippuwa Estate. At present there are many other field experiments being carried out on different soil and climatic conditions and when the results of these experiments are satistically analysed the Coconut Research Institute would be in a better position to revise the present fertilizer recommendation, based on optimum dosage rather than dosage for maximum production.

Fertilizer applidation based on the nutrient level in the soil and plant

Several estates have been applying large quantities of fertilizers for a long time and there could be a build up of the nutrients, especially P over this period. Analysis of the plant materials such as leaf or nut water (3) and soil my give indication of the need to the application of fertilizer based on the nutrient level in the plant and soil. Fertilizer application based on these analysis may cut down the unnecessary application of fertiliz... in many estates. At the moment, however, there are no established standards of nutrient levels in the plant and soil to base fertilizer recommendation on these principles.

Locally available materials as substitutes for imported fertilizers

Another method of meeting the shortage of fertilizers is to use locally available materials as substitutes for the imported fertilizers. Several locally available organic materials of manurial value, along with the NPK nutrient contents, are shown in Table 1. The selection of a particular organic manure should be determined by its availability in close proximity to the estate where they are to be used and by the cost of the manure, transport and handling operations.

Two common organic substitutes that are avilable in large quantities are cattle dung (fresh and dry) and farmyard manure. The main plant nutrients in all these manures are N and P. The other major plant nutrient K is low and therefore the above manures should be supplemented with K containing materi... Three types of organic manure mixtures that could be used in place of the imported inorganic fertilizers are shown in Table 2. In these mixtures the N and P requirements are completely satisfied by the materials in Column I. The K requirement apart from the materials in coluumn I is satisfied by coconut husk ash. One acre of coconut produces husks to give approximately 1 cwt could be entirely obtained from the Coconut Land itself.

Another point to note from the table is the compartively large bulk (10 to 20 times) of organic materials required because of their very low nutrient content. Hence the availability, transportation, handling and application costs should be studied before switching to organic manures.

Recently an apatite despsit was discovered at Eppawela in Sri Lanka and feasibility studies are being conducted to see whether this could be used as a P fertilizer instead of the imported Saphos phosphate. At present there is no experimental information on the performance of Eppawela apatite compared to the improted Saphos phosphate as a source of P for coconut. But a preliminary pot experiment with Paspalum commersonii carried out at Coconut Research Institute showed that Saphos phosphate is superior to the Eppawela phosphate (5). However when Eppawela phosphate was applied at a higher rate it was found to be comparable to the imported one. The Coconut Research Institute is of the opinion that the P requirement of coconut which is about 25% of the total fertilizer requirement of coconut could be met by using Eppawela phosphate in some processed form, if not in the raw form.

In addition to the N, P and K fertilizer Mg fertilizer are also becoming necessary in coconut estates. Hitherto out recommendation of Mg fertilizers have been kieserite or Epsom salt when Mg deficiency has already set in the need quick remedial action; and Dolomite as a long term preventive measure. Since the imported Kiessertie and Epasom salt, would not be easily available the locally available Dolomite if ground to finer size could be used as the sole Mg fertilizer for coconut.

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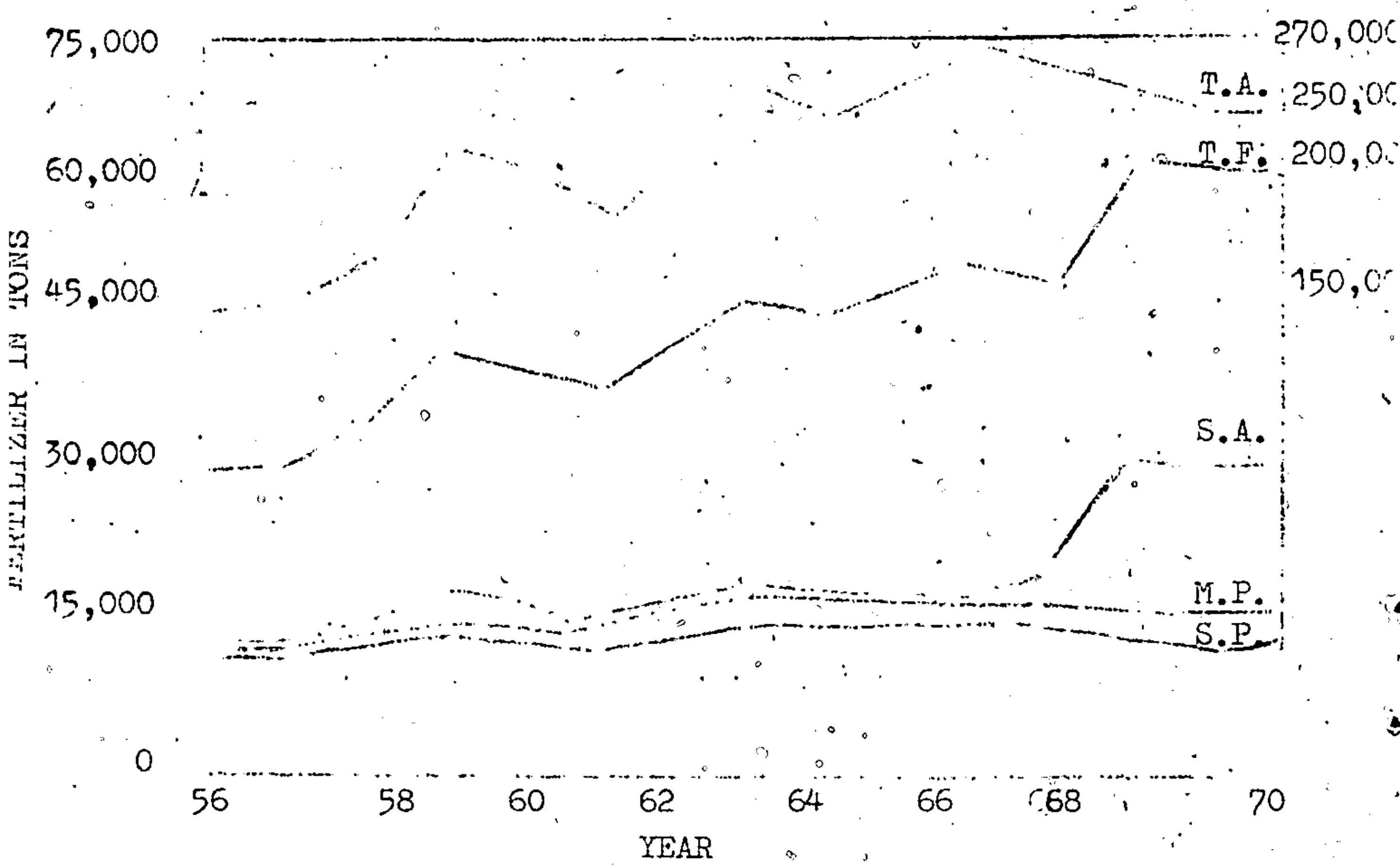

S.P. = SAPHOS PHOSPHATE
M.P. = MURIATE OF POTASH
S.A. = SULPHATE OF AMMONIA
T.F. = TOTAL FERTILIZER USED
T.A. = TOTAL ACREAGE FERTILIZED

FIGURE 4 COCONUT FERTILIZER USE IN SRI LANKA (TONS) (6)

TABLE 1 CHEMICAL COMPOSITION OF SOME COMMON LOCALLY AVAILABLE ORGANIC MATERIALS OF MANURIAL VALUE (4)

Material	% Moisture	%N	$\%P_2O_5$	$\%K_2O$
Cattle dung (fresh)	45-55	0.4-0.8	0.2-0.4	0.3-0.6
Cattle dung (dry)	8-12	0.7-1.5	0.35-0.7	0.55-1.1
Cattle urine	-	1.1	trace	1.5
Goat dung	10-15	2-3	0.4-0.7	1-1.5
Buffalo dung	1 -	1.15[illegible]	0.8-1	0.3[illegible]5
Poultry droppings	30-60	1 -1-5	0.5-1	1-1.5
Pig dung (fresh)	-	0.55	0.55	0;4
Farmyard manure	5-8	0.7-1.6	0.34-0.65	1.1-1.5
Composts	-	0.[illegible]-1.6	0.3-0.6	0.2-0.8
Salvinia weed (fresh)	85	0.13	traces	0.28
Fish refuse and dired fish	-	2-4	2-4	traces
Animal as (from municipal incinerator)	-	nil	7	traces
Kitchen or wood ash	-	nil	-	3
Cocnut husk ash	-	nil	2	20-30
Ash of butt-ends and fronds		nil	3.5-5.5	2
Paddy husk ash	-	nil	1	2
Citronalla grass ash	-	nil	-	7
Salvinia ash	-	nil	traces	8
Cinnamon leaf ash	-	nil	-	1.5
Bone meal	-	3	22	-

Blanks indicate that the figures are not available

TABDE 2 ORGANIC MANURE EQUIVALENT OF C.R.I. B. MIXTURE

Nitrogen			Phosphorus			Potassium		
Material	lbs/palm/year	cwt/acre/year	Material	lbs/palm/year	cwt/acre/year	Material	lbs/palm/year	cwt/acre/year
1. Fresh catte dung	200	120	-	-	-	Coconut husk	1.7	1
2. Dry cattle dung	100	60	-	-	-	C[illegible]onut husk ash	1.7	1
3. Farmyard manure	100	60	-	-	-	Coconut husk ash	1.7	1

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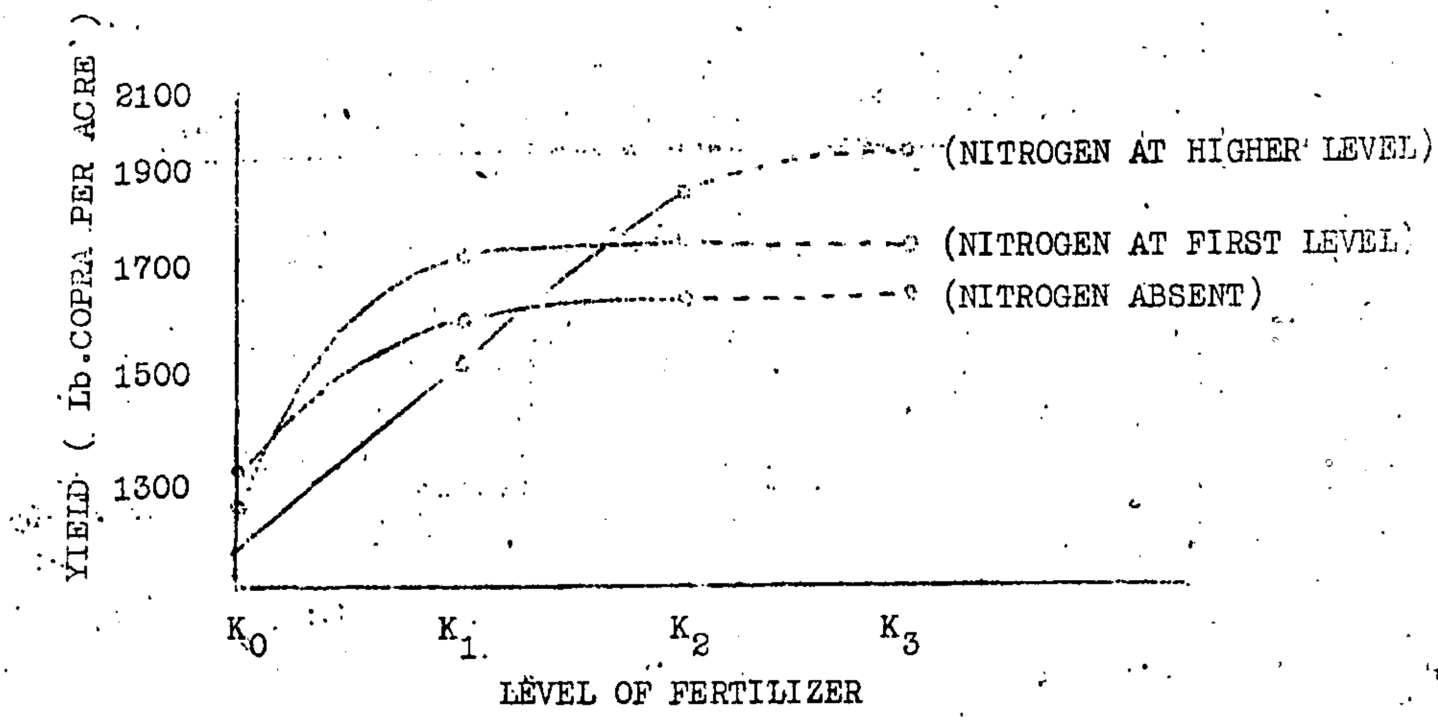
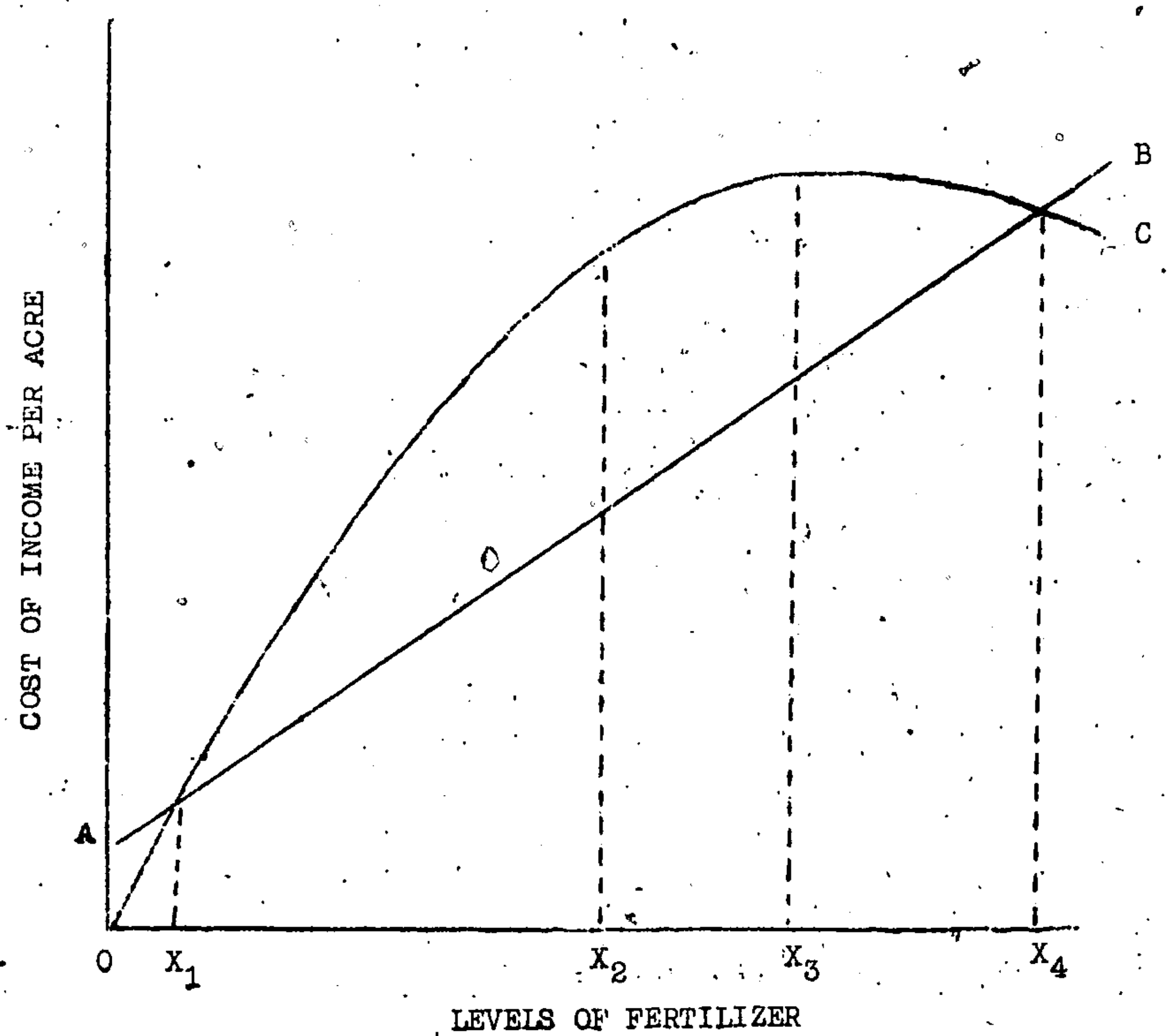


FIGURE 2 POTASH-NITROGEN INTERACTION IN THE 3^3 NPK EXPERIMENT AT BANDIRIPPUWA ESTATE (MEAN OF DATA 1941-1950) (7)



A - B = COST OF FERTILIZER APPLICATION
O = C = INCOME FROM COCONUT YIELD
X_2 = FERTILIZER LEVEL FOR OPTIMUM YIELD
X_3 = FERTILIZER LEVEL FOR MAXIMUM YIELD
X_1, X_4 = FERTILIZER LEVEL FOR NO PROFIT

FIGURE 3 ECONOMICS OF FERTILIZER USE