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Coconut Research Institute

Leaflet No. 36

THE MANURING OF ADULT COCONUT PALMS

1. INTRODUCTION

This leaflet replaces leaflet No. 36 of November 1970 and is based on additional information obtained from several field experiments conducted by the Coconut Research Institute of Sri Lanka.

Investigations carried out have shown that the majority of coconut soils in Sri Lanka are deficient in the major essential plant nutrients – nitrogen (N), phosphorus (P) and potassium (K). In certain areas, particularly in the wet zone, magnesium (Mg) has also been found to be deficient.

Potassium has proved to be the dominant requirement of coconut palms. The response to potassium is reflected not only in increased nut production, but also in better copra out-turns. It has no effect on the production of female flowers, but improves their setting.

Nitrogen and phosphorus increase the production of female flowers and nuts, but they have little or no influence on copra out-turns and the setting of female flowers.

While significant yield responses have been obtained through the application of each of these deficient nutrients to the

soil, best results have been achieved by applying fertilizer mixtures containing all three major plant nutrient elements N, P and K (and also Mg where deficient).

There can be no reasonable doubt that the application of appropriate fertilizers to coconut results in large increases in nut production. Unfortunately, several causes have resulted in a very low consumption of fertilizers by the coconut sector. In the year 1968 which was the year of highest coconut fertilizer usage, 63200 tonnes were consumed. This still represented only 23.8% of what the usage should have been on the prevailing recommendations. The situation has steadily deteriorated through the succeeding years and the lowest utilization was in 1976 when only 20300 tonnes were used. The total all-island yields have ranged between 2903 millions in 1972 and 2050 millions in 1977.

The average consumption needs of the country are of the order of 1800 million nuts. It will accordingly be seen that unless fertilizer usage by the coconut industry is greatly increased, our exportable crop surpluses will continue to dwindle steadily and the provision of even the consumption needs of our population will become problematic.

Among crops producing commodities of World trade and raw materials of industrial use, coconut is perhaps the most neglected in terms of fertilizer input. Of the several factors that have held back fertilizer use, an important one is the steady escalation of fertilizer import costs. The present recommendations, therefore, endeavour to keep costs down to a minimum by recommending the smallest possible dosage consistent with obtaining the highest possible yield. It will be noted that the dosages recommended herein are lower than those recommended in 1970.

The release of this Leaflet may also be taken as an opportunity to stress the importance of adequately fertilizing young palms. It is acknowledged that proper fertilizer practices in the pre-bearing years have a strong influence in sustaining the production of crops subsequently. The attention of readers is drawn to C.R.I. Leaflet No. 8 – "Manuring of Young Palms."

In addition to fertilizer, weather conditions are also important in their influence on yields. The best responses to fertilizer

are obtained when rainfall and sunshine are not limiting. There is also clear evidence that the ill-effects of adverse climate (e. g. drought) are felt less on well-managed than on neglected lands.

It is not a wise policy to stop application of fertilizer on economic grounds as such a practice leads to further deterioration and leads to a vicious circle of reduced returns and hence less money available for fertilizers. Even under adverse conditions, fertilization of palms, if necessary at reduced rates, should be rigorously done.

It is hoped that the economies that the present recommendations will bring about and the State subsidies available, will be sufficient inducement for coconut growers to apply fertilizer to their palms.

2. FERTILIZER MIXTURES

The experiments at Madampe, Bingiriya, Pallama and Veyangoda indicate that the rate of nitrogen as recommended in 1970 could be considerably reduced and the rate of potassium increased. For the entire duration of the experiment at Veyangoda (1967 - 1977) the palms responded to doses of potassium, even as high as 1.82 kg of muriate of potash (60% K_2O) per palm per annum. The experiment at Pallama revealed the superiority of concentrated superphosphate over saphos for the sandy soils of the dry and semi-dry zones. The fertilizer mixtures given in this leaflet are based on the results of these experiments. Mixtures CU - 3 and CA - 3 contain concentrated superphosphate instead of saphos phosphate and are formulated for the sandy soils of the dry and semi-dry zones.

Coconut lands which have been neglected and not manured for a continuous period of 4 years or more should be given one and a half times the recommended fertilizer dosage during the first two years.

In addition to the NPK fertilizer mixtures recommended herein it is necessary that coconut palms be treated with magnesium fertilizers as well. The application of ground dolomitic limestone at the rate of 2 kg per palm once in 3 years in the wet zone, and 1.5 kg per palm once in 3 years in other areas, particularly on lateritic and sandy soils is recommended as a routine measure. This subject is dealt with in greater detail in our Advisory Leaflet No. 43 - "Magnesium deficiency in coconut palms".

There is a belief that organic manures are superior to inorganic fertilizers. A field experiment on a sandy loam soil showed no difference in effect between organic and inorganic fertilizers. Organic manures are relatively low in plant nutrients and therefore large quantities would be required. This would increase transport and handling charges and therefore the cost of manuring. While total substitution of inorganic fertilizers with organic materials is impractical, the latter could be useful supplements if available in sufficient quantity close to the plantation. Those interested in the use of organic manures are referred to Advisory leaflet No. 9 – "The use of locally available organic materials for manuring coconuts."

MIXTURES*

Source of Nitrogen — Urea

		Rate of application (kg/palm/year)
CU–1		
Urea (46%N)	0.7 parts by weight	3
Saphos phosphate (27.5% P_2O_5)	0.7 „ „ „	
Muriate of potash (60% K_2O)	1.6 „ „ „	
Approx. composition : 10–6–31		
CU–2		
Urea (46%N)	0.5 parts by weight	2
Saphos phosphate (27.5% P_2O_5)	0.6 „ „ „	
Muriate of potash (60% K_2O)	0.9 „ „ „	
Approx. composition : 11–8–26		
CU–3		
Urea (46%N)	0.6 parts by weight	2
Concentrated super – phosphate (42% P_2O_5)	0.3 „ „ „	
Muriate of potash (60% K_2O)	1.1 „ „ „	
Approx. composition :	13–6–32	

* **Note deviation in notation from the 1970 Leaflet.**

MIXTURES*

Source of nitrogen — sulphate of ammonia

		Rate of application (kg/palm/year)
CA–1		
Sulphate of ammonia (20.6% N)	1.5 parts by weight	3¾
Saphos phosphate (27.5% P_2O_5)	0.7 „ „ „	
Muriate of potash (60% K_2O)	1.6 „ „ „	
Approx. composition: 8–5–24		
CA–2		
Sulphate of ammonia (20.6% N)	1.1 parts by weight	2½
Saphos phosphate (27.5% P_2O_5)	0.6 „ „ „	
Muriate of potash (60% K_2O)	0.9 „ „ „	
Approx. composition: 9–6–20		
CA–3		
Sulphate of ammonia (20.6% N)	1.3 parts by weight	2¾
Concentrated superphosphate (42% P_2O_5)	0.3 „ „ „	
Muriate of potash (60% K_2O)	1.1 „ „ „	
Approx. composition: 10–5–23		

*** Note deviation in notation from the 1970 leaflet.**

FERTILIZER MIXTURE RECOMMENDATION ACCORDING TO SOIL TYPE AND CLIMATE

Soil Type and Climate	Mixture
1. *a.* Lateritic loams and lateritic gravels (boralu or cabook soils) of the wet zone (districts of Colombo, Kalutara, Galle, Matara, Kandy, Matale South, Ratnapura, Kegalle).	CU–1 or CA–1
b. Lateritic loams and lateritic gravels of the intermediate rainfall zone in the districts of Chilaw, Puttalam and Kurunegala.	
c. Cinnamon sands of Chilaw and Negombo districts, coastal marine sands and lagoon sandy deposits of Chilaw and Negombo districts and the sandy soils of the Southern coastal belts.	
2. *a.* Deep reddish brown loams, sandy loams and clay soils of the districts of Chilaw, Puttalam, Kurunegala, Hambantota, Mannar, Anuradhapura, Vavuniya, Mullativu, Dambulla and Melsiripura in the intermediate and dry zones.	CU–2 or CA–2
b. Limestone derived chocolate brown loamy soils of Matale, Dambulla and Jaffna districts.	
c. Deep alluvial loams in valleys and flood plains of rivers and estuarine and lagoon clay soils.	
3. Coastal marine sands and lagoon sandy deposits of Puttalam, Batticaloa, Mannar and Jaffna districts.	CU–3 or CA–3

Urea mixtures

Urea is a concentrated source of nitrogen and a mixture containing urea would cost less per palm than a mixture containing sulphate of ammonia. The transport cost would also be less.

Experiments have shown that the performance of urea is as good as sulphate of ammonia. With the completion of the urea factory, sulphate of ammonia will not be freely available in the country and urea could be the only available source of nitrogen.

Since urea has a high capacity for absorbing moisture, fertilizer mixtures containing urea should not be kept in storage after preparation, particularly if one of the components is concentrated superphosphate. Urea should be mixed with the other components only at the time of application. Prilled urea stored in polythene lined bags keeps in good condition as long as the bags suffer no damage. For those who desire to purchase them, unmixed fertilizer ingredients could be purchased from the trade, to be appropriately mixed on the plantation itself immediately prior to use.

3. FERTILIZER PLACEMENT

It appears that the main reason for adopting the system of circular trench manuring is that it has been a traditional practice. In a field experiment carried out on a lateritic gravelly soil at Nattandiya, it was found that the much cheaper method of surface application of fertilizer round the palm and digging it over into the soil is as effective as the traditional circular trench system. This experiment also showed that broadcast application of fertilizer in the entire area of the plantation is less efficient than placement round the palm.

Experiments with radioactive isotopes have shown that even on light, well drained soils which offer no impediment to the development of extensive root system, the density of active absorbing root surface is highest in the area immediately surrounding adult coconut palms up to a distance of about 1½ meters from the bole. Placement of fertilizer in close proximity to the rooting zone would help to maximise the efficiency of fertilizer uptake by the palm. The experiments with radioactive isotopes showed that fertilizer application in the entire area round the palm up to a distance of 1½ meters from the bole can lead to 100% more efficient fertilizer utilization by the palm than application in centres of squares or in a 1 meter wide ring 1 meter away from the palm (the latter method has been hitherto commonly practised). It was also found that application in full circles is about 40% more efficient than half circle application.

RECOMMENDATIONS

On the basis of these recent experiments we recommend that for maximum economy and efficiency of utilization, fertilizers should be applied in the entire area round the palm up to a distance of 1½ meters from the bole in full circles on the soil surface and then dug over into the soil with mammoties or mammoty forks. Unless weed growth is excessive, it is not necessary to weed round the palm before fertilizer application. The area on which fertilizer has been applied may be given a surface mulch of dried fronds or husks. This will help to keep down subsequent weed growths.

Basin or trench manuring should be adopted on very steep lands which are subject to considerable surface run-off due to inadequate soil and moisture conservation measures. This will help to reduce the risk of fertilizers being lost through surface wash-off.

4. TIME OF APPLICATION

Fertilizers should always be applied in wet weather, when the soil is moist, after the heavy rains are over.

5. FREQUENCY OF MANURING

Generally, fertilizer applications to adult palms should be carried out annually. In areas where both monsoons prevail, and particularly on coarse sandy soils, biannual manuring during each monsoon may be adopted with advantage. This would help to reduce loss of fertilizer through leaching and hence increase the efficiency of fertilizer utilisation by the palms. For biannual manuring use half the annual fertilizer dosage.

6. IMPORTANCE OF CULTIVATION

It is essential that adequate attention be paid to the various soil management practices leading to soil and moisture conservation if the maximum benefits of manuring are to be achieved. The following points should be particularly noted:-

(*a*) Control excessive weed growth by disc harrowing or manual labour towards the end of the rainy seasons. This would

help to reduce loss of soil moisture through transpiration by actively growing weeds, and also reduce moisture losses by evaporation as a result of the dry mulch of dead weeds which would cover the soil surace. Harrowing or soil turning should not be done in the middle of a long spell of dry weather.

(*b*) Gravelly and heavy textured soils will benefit from annual ploughing to a depth of about 20 cms in alternate rows. Ploughing should always be carried out early in the rainy season and against the slope of the land. This helps to conserve more rain-water falling on the land by increasing the moisture holding capacity of the soil through better infiltration. Rain-water falling on smooth hard soil surface tend to flow away along the surface of the land instead of penetrating into the soil.

There is no danger of regular cultivation causing adverse effects due to root damage as the coconut root system is such that rootlets are developed from the damaged root ends. Furthermore cultivation will help to develop a deeper root system thereby making available to the palm a bigger volume of soil for nutrient and moisture absorption.

Ploughing should not be done on soils where the vegetative cover is sparse (e. g. coastal marine sands) and the water table is near the ground level. Ploughing should not be done at the tail end of rainy seasons, or in dry weather.

(*c*) Systematic burying of husks should be carried out as a moisture conservation measure in accordance with the detailed instructions given in our Advisory Leaflet No. 5.

(*d*) An adequate system of catch water drains (contour drains) or bunds and other soil and moisture conservation measures should also be taken.

(*e*) Lands with poor vegetative cover (such as the marine coastal sands) and those with problems of excessive weed growth can benefit from the establishment of leguminous cover crops. Details regarding the establishment of cover crops are given in our Advisory Leaflet No. 17.

7. ADVISORY SERVICES

Advisory services are provided by the Coconut Cultivation Board, P. O. Box 1388, 1st Floor, Y. M. B. A. Building, Colombo 1. General advice on coconut cultivation can be obtained from the above Board.

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