# THE RELATION BETWEEN SOIL TYPES AND MANURING

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As extensive planting took place in the Island, the coconut palm has been established on a variety of soil conditions, some of which were by no means ideal for its successful growth and productivity. In its original home restricted to the coastal littoral of archipelogoes and islands, coconuts in Ceylon have been grown under an ubiquitous environment. It is, therefore, not surprising to expect a range of productivity and yield and a corresponding array of manurial and cultural problems.

It is not proposed to discuss the manurial needs of all the soil types, but the main types on which fairly extensive planting has been carried out, will be considered.

These may be broadly classified as follows :—

| *Good Soils* : | *Poor Soils* : |
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| (1) River Alluvium | (1) Laterite (cabook) |
| (2) Estuarine deposits | (2) Lateritic gravels |
| (3) Limestone derived soils | (3) Cinnamon sands |
| | (4) Estuarine clay soils |

The coconut palm thrives on deep loams or well drained sandy loams with a water-table that is not too low during dry weather. River alluvium and estuarine deposit that do not contain a high percentage of clay, or which are deep and do not overlie clay comprise such soils. The best estates are situated on the ideal loams of the alluvia deposited in the river valleys of the Ma Oya, Deduru Oya and their tributaries in the North Western Province. The richness of these alluvial deposits is proverbial and the high yields of Marawila, Rajakadaluwa and Puttalam Estates are well-known. On such soils yields of 4,000 nuts per acre per annum are obtained without manuring by cultivation alone, provided rainfall is satisfactory. The Marawila chocolate loam extending along a narrow strip from the mouth of the Ma Oya up to Kudawewa represents this type of soil in its ideal condition.

Mention should be made of an area of very fertile soils in the Matale and Kurunegala districts, derived from dolomitic limestones. The soils are of a deep chocolate colour. Excellent crops are produced with no manuring, if only the rainfall is satisfactory.

The response of such soils to manuring is poor. When price of copra is low manuring is uneconomic, and a judicious policy would be to maintain yields by cultivation aimed at conserving soil moisture. It may sound paradoxical but it is certainly a truism that in this case water is the most important manure—not only a well-distributed rainfall, but its judicious conservation. It is unfortunate that nature has restricted these fertile soil areas to regions of low rainfall.

At the present price of copra, and prospect of high prices for a reasonably long period it is advisable to manure even the fertile soils.

While the good soils on which high yields can be maintained form a small extent of the total acreage, the manuring of the poor soil types demand our immediate attention. There are considerable areas, particularly in the Western and Southern Provinces, where coconuts have been planted under soil conditions and on suspension of systematic manuring, yields drop down to very low levels.

It has been shown by our manurial experiments at Veyangoda and Ahangama that manuring of such lands bring in an immediate and profitable return. Manuring is economic even at low prices of copra. Even a manuring cost of Rs. 1/50 per palm brings in a small return at Rs. 50/- a candy, and with copra at Rs. 100 a candy, the profit is nearly Rs. 100 per acre biennially. Further, the capital value of such lands is improved by manuring. The manuring of the different types of poor soil will now be considered.

*Laterite (Cabook).*—This soil type comprises an extensive areas, under which coconuts have been planted particularly in the Western and Southern Provinces and is restricted to areas of high rainfall. Mineral nutrients have been leached out and the residual soils are of poor fertility. The top soils is very shallow, barely six inches and the coconut roots rarely reach below one foot from the surface. The lay of the land is hilly or undulating and subject to considerable erosion.

The soils are deficient both in potash and phosphoric acid. Nitrogon and potash in combination produce no response in the absence of phosphoric acid. In this case the phosphoric acid applied may be small, about 0·6 lbs. per palm, the equivalent of 2 lbs. saphos phosphate.

Without manuring the yields are very poor, as low as 500 nuts per acre per annum. On the other hand, manuring with mixtures supplying 0·5 lbs. Nitrogen, and 0·6 lbs. phosphoric acid and 1 lb. potash per palm the increase due to manuring was about 1,000 nuts per acre per annum. In our experiments manuring at high levels has not been carried out yet, and it is proposed to examine this point in one of our new experiments.

It should also be mentioned that by manuring not only is the number of nuts per palm increased also the copra out-turn (nuts per candy) is improved substantially, amounting to as much as 130 to 150 nuts per candy, showing an improvement of nut size.

Lateritic soils do not stand drought, particularly when the original bedrock from which the laterite is derived is close to the surface, and palms growing on such soils are particularly susceptible to nut fall. In order to get the best effects of manuring, cultivation methods aimed at conserving soil moisture such as catch-water drains, biennial ploughing and burying of coconut husks, should be adopted.

*Lateritic Gravels.*—In contrast to the typical laterite that occurs in the wet zone, lateritic gravels are restricted to areas of medium rainfall of about 60" to 70". The mineral constituents of these soils have not been leached to the same extent as laterite and these soils are more fertile and form a considerable area in the hinterlands of the Chilaw and Kurunegala districts.

Without manuring, by cultivation alone, a yield of about 1,000 nuts per acre per annum may be obtained. These soils respond remarkably to manuring and cultivation and yields up to 3,500 nuts per acre per annum can be obtained.

Potash is the dominant requirement on this soil type. Absence of potash produces characteristically poor crowns, and yellowing of leaflets.

Palms growing on lateritic gravels show distinct vegetative characters—the girth of trunk is narrow, and the vertical growth of trunk is slow. The fronds are short and leaf bases narrow. The bunch stalks are long and where bunches are heavy propping becomes necessary. Drought effects are severe and tend to cause a heavy incidence of nutfall, and cultivation methods aimed at moisture conservation should be carried out as with lateritic soils.

*Cinnamon Sands.*—The cinnamon sands on which coconut forms the main crop extend over a large area in the Negombo District and in isolated patches in the Madampe District. The soil consists of pure sand of varying depth overlying an impermeable clay subsoil. Sometimes the subsoil consists of an impermeable black iron pan formed by the cementing of colloidal iron, organic matter and clay washed down through the open soil.

Owing to the nature of the subsoil these soils tend to remain water-logged, and the results of manuring are not fully realised unless an adequate system of deep drains are provided to drain off water wherever possible and lower the water-table.

The content of organic matter is also low, and in extreme cases the soil consists of pure white sand. As much as manuring it is important that the system of cultivation should be aimed at conserving organic matter; debris such as fronds should not be burnt but allowed to decay; overgrazing should be avoided; and husks buried both in pits between palms and in manure trenches during manuring.

These soils are intrinsically of very poor fertility, but show a remarkable response to manuring. Palms growing on such lands show good vegetative growth, with trunks of wide girth, large fronds with broad leaf bases, and broad crowns.

As the palms may be said to be growing in a sand culture, the manures are readily assimilated. It is not rare to find unmanured estates with scarcely a nut showing a cumulative response to manuring after two or three biennial cycles of manuring and producing crops of even 4,000 nuts per acre. Here too potash is the dominant requirement and applications of 1·5 to 2 lbs. potash per palm biennially should not be considered excessive.

A characteristic feature of this type of soil is that the copra out-turn of the nuts is very satisfactory, and out-turns as low as 900 nuts to a candy of copra are not unusual.

*Estuarine Clays.*—Estuarine clays have been formed from the silting up of estuaries or lagoons. Though intrinsically rich in plant food, particularly potash, these soils are of poor physical conditions not favourable to the successful cultivation of coconuts. Water-logged during rains, the soils get baked and cracked during dry weather. In fact there are areas on which coconuts should not have been planted.

When young, palms appear to do well, but as they come to bearing tapering commences.

These soils show little response to manuring, but improve with deep ploughing, draining and husk burying.

Between these two categories of soils there remain a range of soil types of medium fertility on which coconuts are cultivated that should respond to manuring. With the present copra market and world fat shortage it is sound policy to embark on programmes of systematic manuring and increase production.

*Limiting Factors to Manuring Response.*—Besides the nature of soil that determines the response to manuring, there are certain limiting factors which prevent the realisation of maximum response, and include : (*a*) drought ; (*b*) water-logging.

The only way to minimise effects of droughts is by cultivation methods aimed at conserving soil moisture. Adequate catch-water drains to prevent run off, and conserve rainfall on the land ; biennial ploughing to make the soil open and absorbent ; and particularly the burying of coconut husks form essential corollaries to successful manuring.

Similarly water-logging is a limiting factor. No amount of manuring of water-logged land will improve the palms unless the land is drained and the water-table lowered. Deep wide drains should be provided and the soil dug out should be heaped round the palms to form a platform and raise the ground level. It is a common sight to find water-logged land particularly round Chilaw and Madampe, where the drains are filled with husks or coir dust. As the object of drains is to remove excess water and lower the water-table, refilling with husks would only defeat the purpose of draining.

### Method of Application of Manure in relation to Soil Type

We have no experimental data on the value of different methods of application of manure. An experiment has been laid down last year to compare circular manuring with broadcasting manure at Marandawila Estate, Bingiriya, and until the results of this experiment are available the following provisional recommendations can be made.

Circular manuring is the common method. Today when there is so much talked about " placement " of manures, circular manuring close to the base of the palm where the root system is concentrated, seems to be quite sound.

This method is no doubt costlier than broadcasting and ploughing, where manuring and ploughing are done in one operation. On light sandy soils and sandy loams, in order to avoid the cost of cutting the manure circle, manure may be broadcast round the palm, soil turned over with mammotties to cover up the manure and finally mulched with a layer of husks. This method cannot be recommended for hard gravelly and lateritic soils.

Broadcasting and ploughing of manure cannot be recommended on sloping lands subject to considerable run off ; even on flat lands it should be adopted only on soils with an open texture with a well distributed system of roots.

### Soil Analysis and Manurial Recommendations

Many requests are made for analysis of soil samples of estates for purposes of recommending manure mixtures. There seems to be a considerable amount of popular misunderstanding in the use of soil analysis. No reliable recommendations can be based on soil analysis until data correlating such analytical figures with accurately designed field experiments are available for coconut soils. So far we have some data on the phosphate needs of coconut soils as shown by such analysis, but it has severe limitations when applied to our requirements.