

# Enhancing Productivity of Coconut through Soil Health Management:

## Experiences of Dr. K.M. Nair

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Farmers seldom realise the market price for their produce commensurate with the cost of production. A major share of the land in Kerala is occupied by long duration perennial crops. Surmounting problems associated with the periodic slump in prices of agricultural commodities is not an easy task for perennial crop production system. It is practically impossible to frequently shift from one perennial crop to another with the changing markets. Compounding the problem is the link of prices of most perennial crops in Kerala with international markets. The strategy for escaping the periodic downturn of market for agricultural commodities is diversification of crops. For the state of Kerala the path to follow is mixed cropping system with multiple perennials and annuals. The combination will enable farmers to sustain profitability even when prices of few commodities slump. Monocrop rubber plantation is a best example of the consequences of

ups and downs of market and its effect on domestic economy. Most rubber plantations in Kerala are on small and marginal holdings. The small holder farm households have limited resources and consequently suffered immensely in the face of prolonged slump in rubber prices. Recent small spurt in rubber price is rekindling the hopes of rubber planters.

During the present prolonged market slump of rubber, many small holders have cut down the trees and turned to other crops, many opting for coconut. Coconut based mixed cropping is a viable option in most agro-ecosystems of Kerala except lowlands, high hills and hill plateaus. However, in the light of climatic aberrations and indifferent soil health, it is necessary to enable farmers realise high productivity and profitability through scientific management of coconut based mixed cropping system.

In this context it is worth presenting an instance of scientifically managed coconut based



mixed cropping system by Dr. K. Madhusoodanan Nair in his three and half acre plot of laterite upland at Palamattom, Karukachal, Kottayam district. The plot, under rubber since 1982, was cleared off rubber and other trees in early 2017 and planted with coconut in April/May.

Dr. Madhusoodanan Nair, born and brought up in a small farming family in Kottayam district, obtained his graduate and post graduate degree from College of Agriculture, Vellayani. After completion of studies in 1978 he worked as a Research Assistant in the then Soil Survey Unit of Department of Agriculture for three years. In 1982 he joined the National Bureau of Soil Survey and Land use Planning (ICAR) as a scientist. He had served the Bureau in Jorhat, Assam (1982-86), Nagpur (1986-91) and Bangalore (1991-2016). Dr. Nair who had published numerous research papers in national and inter-national journals is a renowned soil scientist. The last 12 years of his service (2004 to 2016) were devoted to research projects in Kerala on invitation from Kerala State Planning Board. Dr. Nair who retired in 2016 after an illustrious scientific career spanning 34 years decided to be a farmer for the rest of his life.

Kottayam is the land of rubber and most farmers depend on rubber to meet their livelihood needs. When Dr. Nair decided to replace rubber and go for coconut based mixed cropping system his friends and relatives raised their eyebrows and tried to dissuade. The experience gained from more than a decade of research in the state on agro-ecology, soil qualities and in particular coconut based mixed cropping systems instilled in him adequate confidence to face the challenges in his new venture. The last project he led was to demonstrate the feasibility of substantially enhancing coconut productivity through alleviation of soil related constraints to the palm.

For decades, rubber had ensured financial security to Dr. Nair's family as well as lakhs for rubber planters in the state. But with the current focus on sustainable agriculture development and biodiversity, rubber the monocrop, subjected to frequent price slump, ceased to be a viable option. In small holdings multiple mixed cropping systems ensure adequate income for farmers. This was the reason behind Dr. Nair's decision for replacing rubber with coconut based mixed cropping system.

Dr. Nair planted coconut as the main crop with subsidiary perennials areca nut and pepper. For decades farmers in midland laterite had followed

the combination before their replacement by mono-cropped rubber plantations. During the gestation period (pre-bearing years) of the perennials intercrop of annuals like banana, ginger, tapioca and other tuber crops ensure income, if not adequate, at least to meet farming expenses. In order to promote biodiversity spice trees like clove and nutmeg and fruit trees like jack, mango, avocado etc. were also planted. Current perennial population is 250 coconut palms and 300 each of areca nut and pepper vine. Additional planting of perennials other than coconut shall continue in ensuing years. On borders and the numerous stone pitched bunds, put in place for soil and water conservation, gliricidia was raised for green manure and fodder grass for cattle. Since Dr. Nair is not rearing cattle, the fodder grass is meant for the cattle of his permanent labourer. Rainwater is collected from roof top and collected in tanks and ponds constructed for the purpose. The rainwater so collected and well water is used for life saving irrigation of crops. All the crops are fertilized according to the recommendations in the Package of Practices of Kerala Agricultural University. However, they were modified in the light of soil test results for the plot. A major problem was faced by Dr. Nair in ginger cultivation. The first two crops were devastated by pests and diseases. During the current season, instead of planting ginger on long raised beds, four seed ginger were planted on mounds formed akin to the ones used for tapioca planting. Four seeds were placed at four corners of slightly flattened top of the mound. The method allowed for adequate plant to plant spatial distance and effectively contained spread of diseases as and when they occurred. Widely spaced planting allowed good aeration and sunlight and consequent profuse tillering and rhizome yield.

### Enhancing coconut productivity

Dr. Nair who had made extensive studies on soil qualities, especially of laterite soils, has definite views about managing the soils for high crop productivity. He had tested the soils of the entire plot for its physical and chemical properties. The soils of the plot as in most midland laterite terrain has gravelly clay soils underlain with plinthite at places. The soil test conclusively revealed very strong acid reaction of surface and subsoil and subsoil aluminium toxicity. Three decades of rubber plantation with no input of liming materials and only NPK fertilizers alone was responsible for the strong acid reaction and deficiencies of secondary nutrients calcium and

magnesium and micro-nutrients zinc and boron. The situation called for modification of fertilizer inputs recommended by POP of KAU. The modified soil and palm management followed by Dr. Nair is as follows.

- After clearing the rubber and miscellaneous trees the soil was ploughed using an excavator. Along with ploughing 12 tonnes of dolomite and 5 tonnes of gypsum were incorporated in the soil. The liming materials were to reduce the surface and subsoil acidity. In order to correct the temporary magnesium deficiency developed by heavy input of calcium 200 kg of magnesium sulphate was spread on surface.

- After conditioning the soil of the entire plot pits of size 5x5x5 feet were excavated at a spacing of 9x9x9 meters. Larger spacing was employed to facilitate profuse mixed cropping.

- The soil excavated from the pit was mixed with 25 kg dolomite and two third of the pit was refilled with the dolomite mixed soil. The approximate cost of preparation of the pit was Rs.700/-.

- Coconut seedlings were planted in April/May of 2017. The varieties of coconut used were West Coast Tall (WCT) 100; TipturTall (Karnataka) 25; TxD hybrid 100 and NCD 25.

- Chemical fertilizers were applied according to recommendations of KAU. In addition, dolomite, magnesium sulphate, zinc sulphate, copper sulphate, borax and common salt were annually input for the palms.

- External inputs for three year and older palms are as in the following table. A third of the inputs were given in first year and two third in second year.



Micro-nutrients: Zinc, Copper, Boron, Chlorine	Zinc sulphate: 100 g Copper sulphate: 100 g Borax: 100 g Sodium chloride (common salt) 1 kg	Broadcast over the mulch 15 days after the input of amendments.
<b>During North-east monsoon (October)</b>		
Major Nutrients: N, P and K	Urea: 500 g Factamphos: 500 g Muriate of Potash: 1 kg	Broadcast over the mulch deposited around the palm base, after receipt of a soil soaking monsoon rain in October.
Micro-nutrients: Zinc, Boron, Chlorine	Zinc sulphate: 100 g Borax: 100 g Sodium chloride (common salt) 1 kg	Broadcast over the mulch 15 days after the input of NPK fertilizers.

<b>Table 1. Soil amendments and fertilizers for an adult palm (three year and older)</b>		
Inputs	Fertilizer and Quantity	Mode of application
<b>Pre-monsoon (April-May)</b>		
Major Nutrients: N, P and K	Urea: 500 g Factamphos: 500 g Muriate of Potash: 1 kg	Broadcast over the mulch deposited around the palm base, after receipt of a soil soaking pre-monsoon shower in April or May.
Soil amendments: dolomite (or lime) and Magnesium sulphate.	Dolomite or lime: 2 kg (if quick lime 1.2 kg) Magnesium sulphate: 2 kg	Broadcast over the mulch 15 days after the input of NPK fertilizers.

- No organic matter inputs from outside like cow dung, poultry manure, or compost are input for the palm or other crops. In order to ensure adequate organic carbon in soils dry fronds and other palm debris were deposited around the base of the palm.



Also added are debris from other crops. In the farm complete recycling of the crop residues are followed. Amelioration of soil acidity through liming materials and thereby ensuring high levels of calcium in soils promoted abundance of earth worms in the soil. The earth worms and associated macro and micro flora and fauna decomposes the organic debris rapidly. Gliricidia leaf mulch in abundance is the major green manure component.

- The annual ritual of opening and closing of basins around the palm is not followed. Dr. Nair says the process is not necessary in sandy and laterite soils which are highly porous and water permeable.

- Life-saving irrigation is provided during summer months.

The palms in the plot are perfectly healthy and are growing vigorously. No symptoms of nutrient deficiencies are exhibited by palms, except boron. Borax application to the tune of 300 g per year had to be input to some palms to ensure no deficiency symptoms. Dr. Nair is extremely happy these days since at the age of three and half year few tall palms (WCT and TipturTall) had put out spadices. The tall varieties normally do so after five or six years.

The threats faced are from two pests, rhinoceros beetle and red palm weevil. Attack from the beetle started from the very first day of field planting. None of the methods suggested to control the menace of the beetle and weevil were found to be satisfactory. So for three years, every day the palms were examined and the beetles boring into the tissue were extracted and killed. The weevils turned out to be more elusive and lethal. Placing of used fish nets



cut to approximate size of 2 square feet at last proved to be an effective means of trapping the beetle without causing damage to the palm. Dr. Nair could also trap few red palm weevils by placing the fish net. It was a farm innovation which was improvised by Dr. Nair. The weevil is turning out to be the Achilles heel in the absence of any fool proof method for early detection.



### Regaining lost glory of coconut productivity in the state

Soil chemical degradation and the consequent very strong surface and subsoil acidity and deficiencies of mineral nutrients have led to the decline of coconut farming in the state. Following scientific management to regain soil health can increase the productivity of coconut palm and reduce the cost of production. The result of a multi-institutional project initiated by the Kerala State Planning Board and lead by Dr. Nair involving scientifically laid out experiments and demonstrations in farmer's fields at six locations across the state had conclusively proved that coconut yield can be nearly doubled by alleviation of soil related constraints to the palm. Shift in the share of livelihood income of farmers from agriculture to other occupations meant waning interest in agriculture. This the main reason for neglect of small holder coconut based mixed cropping systems and consequent low productivity of the palm. Group farming is a viable option under the situation. Another option is leasing out the holding to interested farmers. Scientific management of the palm based mixed cropping system, value addition of the products and innovative marketing can substantially increase the income from farming. Necessary policy interventions, administrative actions and extension strategies should be put in place by concerned development departments to overcome farmer apathy and increase overall agricultural GDP of the state. Local farmer groups should be formed and encouraged for removing supply side constraints for the external inputs, post-harvest product processing and for community action for control of pests and diseases. Dr. Nair is keen on sharing his farming experiences with fellow farmers. Central/State agencies involved in coconut development and extension can very well use the garden of Dr. Nair for setting up model Farmer Field School. *For additional information*

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