Achieve bigger nut size and higher copra output for better price realization

Remany Gopalakrishnan
Deputy Director, CDB, Kochi

Maintaining balance between the nutrient requirements and soil nutrient reserves is essential for achieving higher yield in coconut. But, for most of us, coconut is a lazy man's crop. We never think of the nutritional requirement of this incessantly fruit bearing palm. We, on the other hand, are more concerned about the low yield, low productivity and pest and disease problems. Most of us never even bother to know about the relationship between fertilizer management and yield out put. Very few realizes the underlying fact that absence, deficiency or unavailability of any of the essential elements lead to decline in production and productivity. In reality coconut is a highly exhaustive crop that removes for its growth and yield considerable quantity of nutrients from the soil round the year. This continuous removal of nutrients eventually depletes the soil of its nutrient reserves. The capacity of a land for sustaining higher productivity is governed by the inherent soil fertility, other soil physical and chemical characteristics and management practices followed. Fertility of coconut soils on the other hand can be maintained only through a balanced programme of manuring coupled with other agronomic practices. The vital aspect of mineral nutrition of a plant is to ensure the availability of the essential mineral elements in the soil at the required levels and in the right proportions for its maximum productivity.

Coconut requires regular and balanced nutrition to maintain its vegetative and reproductive growth and uninterrupted bearing. Of the various elements required by the palm, some are required in relatively large quantities and some are in minute quantities. The former category is known as major nutrient elements and the latter the micronutrient elements. A clear understanding of the various deficiency symptoms along with the mineral requirements of the palm is very much necessary for the evaluation and effective control of field disorders associated with mineral deficiencies. Timely diagnosis and correction of mineral deficiencies can play a very important role in the successful management of the palm. Let us have a clear understanding of the essential elements in coconut nutrition.

Nitrogen, Phosphorous and Potassium (NPK) are major nutrient elements in coconut nutrition.

Nitrogen is needed for the growth and productivity of the palm and it promotes growth and facilitates early flowering and also the production of more female flowers. It encourages the vegetative growth of plant and imparts deep green colour to the leaves and helps in nut formation. Deficiency of nitrogen in coconut manifests as yellowing of foliage in varying degrees and stunted growth. In the initial stages the tree loses its normal healthy green colour and the whole foliage exhibits a slight and continuous yellowing. As the deficiency advances, the older leaves develop a uniform golden yellow colour while the younger leaves turn pale green giving the leaflets a dull appearance. This is accompanied by the abortion of most of the inflorescences. The number of female flowers in the inflorescence dwindles. The size of the leaves gradually gets reduced and the number of functioning leaves becomes less. In the advanced stages the stem below the crown narrows down to a *'pencil point'* with a few short leaves on the crown. In this case the inflorescence fail to emerge and if at all they emerge will have very few or no female flowers. Ultimately the palm turns barren.

Phosphorus plays an important role in the activities of meristematic tissues and cell division. It is a constituent of cell nucleus. A good supply of phosphorus is said to hasten plant maturity. Plants deficient in phosphorus have a poor root system and smaller leaves and their growth becomes stunted. The phosphorus requirement of coconut is comparatively very small, and phosphorus deficiency in coconut are rarely seen. However the symptoms of slowing down of growth and shortening of fronds are found to be associated with phosphorus deficiency. When the deficiency is severe, leaflets become yellowish green and get hardened. Correction of phosphorus deficiency improves overall nutrition of the palm and produces beneficial effects on the number of nuts and yield of copra per nut.

Potassium is the key element in coconut nutrition and it plays vital role in the formation of amino acids and proteins and in the photosynthetic activities of the plant. It is essential for starch formation and the translocation of sugars and also in the development of chlorophyll. Coconut palm is a heavy consumer of potassium. Deficiency of potassium is found to be one of the limiting factors in the economic production of coconut. Potassium increases leaf area, improves leaf angle and leaf colour which result in better utilisation of sunlight and ultimately causes increased number of fronds, inflorescences, female flowers, nut set and weight of copra per nut. Beneficial effect of potassium is highly manifested in better production and productivity of palm. The growth of the potassium deficient palm in general, is reduced, the trunk becomes slender, leaflets become short, and the number of inflorescences, nut set and nuts per bunch get reduced.

Calcium is a constituent of cell walls. It is essential for the growth of meristems, particularly for the growth and functioning of root tips, and for bud formation. In coconut, calcium plays a dual role. Apart from the role of a nutrient, it acts as a soil ameliorant, especially under acidic conditions. Clear cases of calcium deficiency in coconut are not common. The symptoms are yellowing of leaflet tips with yellow to orange ring shaped spots spread on the leaflets. Later they turn necrotic. Gradually the leaf dries up. These symptoms appear in the middle leaves earlier than in the older leaves. Regulated additions of calcium through calcium bearing fertilizers like rock phosphate, super phosphate, bone meal or light additions of liming materials may be followed to supply the calcium requirement of the palm.

Magnesium is the only metal constituent of chlorophyll, the green colouring matter of plants. It plays an important role as a *'carrier'* in the transport of phosphorus in plants. In a variety of enzyme reactions magnesium acts as a most effective activator. It also plays an important role in the production of carbohydrates, proteins and fats. One of the most common mineral deficiency symptoms seen in many of the coconut growing countries is due to magnesium deficiency. It is more common in young palms and seedlings and is usually manifested as yellowing of the outer whorls of leaves. When magnesium deficiency gets worse, yellowing intensifies and necrosis sets in at the tip of the leaflets, and numerous brown blotches develop on the yellow surface. Application of magnesium sulphate corrects the deficiency very well resulting in the re-greening of the chlorotic foliage which subsequently brings about improvement in growth and yield.

Sulphur is a constituent of protein and it aids in the formation of chlorophyll. It helps in the development of dark green leaves and an extensive root system in plants. Chlorosis and necrosis increase with the age of the leaves, and in severe cases, second or even the first leaf may show yellowing. In the advanced stages, the crown loses most of the leaves and severe necrosis is found on the older leaves. The yield of nuts is reduced in number and the nuts are usually small with normal kernel thickness, but on drying the kernel collapses into a soft flexible and leathery copra, often brown in colour which is usually referred to as *"rubbery copra"*, possessing very poor physical and chemical characteristics, particularly with a very low oil content. Sulphur deficiency in coconut can be prevented by the regular use of sulphur containing fertilizers like Ammonium Sulphate, Super Phosphate, Magnesium Sulphate etc.

Chlorine is normally considered as a micronutrient element for higher plants. Its importance in the nutrition of coconut has been emphasized recently. Since the chlorine requirement of coconut is comparatively very high, it is considered as a major nutrient for the crop. It enhances the growth of young palms and increases the yield of bearing palms. The effect of chlorine is manifested more on the thickness of the kernel and the copra out turn. Sodium Chloride (common salt) can be used for supplementing the chlorine requirement of the palm, particularly in the case of plantations situated away from sea coast.

Micronutrients required for the growth/productivity of the palm are iron, manganese, copper, zinc, boron, molybdenum and probably cobalt. They are required for the activities of various enzyme systems in plants. Micronutrient deficiency symptoms are rarely noticed in coconut. Deficiency of iron and manganese are noticed in coral soils, their important symptom being chlorosis of the younger leaves. Application of iron and manganese salts in soil is not effective as these metals are made unavailable to the palm due to the presence of calcium carbonate in such soils. Boron deficiency has been reported to a limited extent from different coconut growing countries of the world and the problem is commonly known as *'crown rot/chocking'* disease of coconut. This disease is usually prevalent in young palms, especially between three and six years of age and seedlings in the nursery. The symptoms are the emergence of shorter leaves with deformed, crinkled and rudimentary leaflets associated with severe tip necrosis. The outer whorls of leaves remain normal throughout. The palm affected by *'crown chocking'* symptom respond well to the application of borax. The dose of borax may be varied from 100 to 500 g per palm or even a smaller dose can be used depending upon the age and size of the palm. If it is applied during dry months, irrigation should be followed for quicker response.

Nutrient removal of coconut palm

Coconut palms (Tall variety) removes annually 49 kg N, 16 kg P_2O_5, 115 kg K_2O, 5 kg Ca, 8 kg Mg, 11 kg Na, 64 kg Cl and 4 kg S from one ha of moderately fertile soil(Table 1). The yardstick taken is average 150 palms per ha with 12-14 leaves per palm producing 100 nuts / palm /year. Of the palm parts, husk alone contains 60% of the K_2O, 40% of Cl, 18% of N and 26% of Mg. This reveals the importance of coconut husk as a renewable source of potential nutritional element. Digging of trenches and depositing husks in the basins and between rows of palms in trenches or leaving husks and fronds in the field to undergo decomposition and mineralization is the best practice to plough back the nutrients.

Why coconut needs continuous care?

In coconut the primordium of the inflorescence (flower bunch) begins to develop in the leaf axil about 32 months before the opening of the inflorescence and the primordia of the branches (flower bearing spikelets) develop about 15 months before and of the male and female flowers about 10 to 12 months before opening of the spathe (Satyabalan, 1993). Male and female flowers are not differentiated until 26 months after the first detection of the primordium. It takes about a year for the fully grown spathe to open. The

Table 1. Nutrient uptake/exhaust of nutrients by coconut (kg)

Yield	N	P_2O_5	K_2O	Mg	Ca	S	Na	Cl
100 nuts/palm	49	16	115	8	5	4	11	64
6.71 T copra:	108	39	232	15	9	9	20	125
Nuts only	174	46	299	39	70	30	54	249
I Ton copra	16.2	5	36	2	1.4	1.3	2.5	19.7

Source: *(IFA, 1992)*

period between the primorium formation of the inflorescence till its opening is very crucial and important as that of its subsequent management.

The effect of fertiliser application is manifested only after two years of the treatment. Similarly the effect of drought during the formation of the inflorescence results in the abortion of the young inflorescence especially during the early stages of its development and the adverse effect lasts for two years till the bunches are harvested.

It has been observed that in almost all coconut growing countries maximum yield is obtained during summer months when the bunches which open during summer and develop during the rainy season are harvested. On the west coast of India, poor yields are usually obtained during October-November months. The reason for this could be attributed to abortion of bunches during development in summer months two years ago.

The impact of the influence of climatic factors during the development of nuts is noticed in the variation in the ratio of the constituents of the nut. These proportions may vary depending on the seasons and variety of cultivars.

There are three distinct phases in the development of the nut. The first is the slow progressive growth for about three months after fertilization, then rapid growth for about four months and finally the rapid decline for about two months. The rate of growth during the second phase which is the active period of development is highly correlated with the final volume and weight of fruit, husked nut and copra content. The palm completes the development of the female flower after 3 ½ years of the initiation of its first tissue. Any adverse seasonal factor during the critical period adversely affects the rate of growth and final size of nut and copra content.

Profitability of higher yield and better price realization

In any cropping system, there is removal of plant nutrients from the soil. Based on soil types and intensity of farming nutrient uptake varies. Increase in biomass production results in higher plant nutrient uptakes. Biomass production can be improved by improving organic waste recycling, intercropping with seasonal and annual intercrops like banana, cocoa, vegetables and perennials like nutmeg, cloves and fodder crops.

Interactive beneficial effects of practices like fertilizer application, weeding, irrigation etc. have been made clear through field level experiments and from farmers experience. Therefore management of palms encompassing all essential practices results in better output; bigger nut size and higher copra content, which in turn, will achieve better price for the harvested nuts.

Average yield of coconuts in various coconut growing countries varies considerably depending on the cultivar grown, agro climatic factors, and the management practices adopted. Similarly copra content also varies in different cultivars resulting in variation in the number of nuts required to make a tonne of copra. In India, 6800 nuts were estimated earlier to make a tonne of copra while only 4500 nuts are required in Philippines and Indonesia. At present more number of nuts are required for one tonne copra owing to smaller nut size. It ranges from 7500 – 8000 nuts. When the size of nuts is bigger, copra content will be more and therefore price realization improves. The maximum yield of coconut in a year is obtained in the hot weather period of the year. More than one third of the total production in a year on the west coast of India is during March to May. Water stress during the period of maximum growth of seed coat-endocarp system can severely limit the size of the seed.

We are now witnessing a period where coconut and coconut products fetch good price. The concurrent estimation of coconut production for 2013-14 and the production forecast for 2014-15 made by the Board reveals that there will be fall in production at various degrees. This is an indication that there will not be a quick set back to this encouraging price trend. The present practice is that green coconut is sold on nut weight (nut with water) basis. Present rate varies from Rs. 30-35/kg or even more.

Average weight of a dehusked nut of West Coast Tall variety with water is estimated at 446 g. Copra recovery from coconut varies in different cultivars and hybrids (Table 2 & 3). Recovery of copra from a nut weighing 446 g is estimated at 133 g (30 % of dehusked nut - Table 4). The number of nuts required for making one MT of copra is 7499 nuts. At this rate 2.24 coconuts make 1 kg and taking average price of coconut @Rs. 35/ per kg, the per nut income is Rs. 15.625/-. If the weight of nut increases by 200 g, 1.55 nuts will make 1 kg and the farmer gets additional income of Rs. 7/- per nut and the number of nuts required for making one MT of copra will come down to 5177 nuts (Table 4). Thus a palm which yields 100 nuts per palm will bring in an additional income of Rs. 700/- if the weight of nut is increased by 200 g per nut. This message should be percolated down to the coconut farmers through their Farmer Producer Organizations (FPOs). The scope of fetching higher income by producing quality nuts with more weight and higher copra content shall be an encourangement to them for continued maintenance and fertilizer application. The better price being realized now has to be sustained also, so that there will be

Table 2 : Fruit analysis data of some Tall cultivars grown in India

Cultivars	Weight of fruit (g)	Weight of husked nut (g)	Weight of kernel (g)	Weight of water (g)	Weight of shell (g)	Weight of copra (g)	% of Husked nut in fruit	% of Kernel in husked nut	% of copra in husked nut
West Coast Tall	1262.2	582.1	300.0	122.8	159.0	173.5	46.1	51.6	29.9
East Coast Tall	1211.0	462.0	227.0	108.0	127.0	108.0	38.1	49.1	23.4
Laccadive Ordinary	795.2	482.5	255.4	94.7	132.4	147.6	60.7	53.0	30.6
Laccadive Micro	645.6	341.4	206.5	39.2	95.7	116.8	52.8	60.6	34.3
Benaulim	881.9	524.8	251.2	128.1	145.5	158.1	59.5	47.8	30.1

Source :Satyabalan K, 1993

strong coming back to coconut cultivation by many, who have cornered this crop, alleging many negatives.

Scientific management of palms brings about tangible improvement in the size of nuts and weight of nuts/ kernel and therefore, systematic and regular application of fertilizer and adoption of plant protection measures and other management practices will definitely result in production of good quality nuts with bigger size and higher copra content. This will ensure better and sustained price realization.

Reference:-

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Table 3 :
Percentage share of different components of husked nut to the total

Female parent/Hybrid	Weight of husked nut (g)	Percentage weight of		
		Nut water	Kernel	Shell
West Coast Tall X Chowghat Green Dwarf				
West Coast Tall	518.38	19	53	28
West Coast Tall X Chowghat Orange Dwarf	587.02	21	53	26
Increased weight of the hybrid over the female parent	68.84			
West Coast Tall X Gangabondam				
West Coast Tall	518.38	19	53	28
West Coast Tall X Gangabondam	612.06	22	53	25
Increased weight of the hybrid over the female parent	93.68			

Source :Satyabalan K, 1993

Table 4 Increase in nut weight vis-a-vis price realization

Weight of nut (g)	Expected yield of copra (g)	No. of nuts required to make 1Kg coconut	No. of nuts required for 1 ton copra	Price realization @ Rs. 35 /Kg
446	133.35	2.24	7499	15.61
496	148.30	2.02	6743	17.36
546	163.25	1.83	6125	19.11
596	178.20	1.68	5612	20.86
646	193.15	1.55	5177	22.61