



Integrated Nutrient Management-key for productivity improvement

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Considering the importance of preserving the fertility of the soil, Food and Agriculture Organization (FAO) of the United Nations decided to observe 2015 as International Year of Soils (IYS), The objective is for raising awareness on the importance of sustainable soil management as the basis for food systems, fuel and fibre production, essential ecosystem functions and better adaptation to climate change for present and future generations. Degradation of soil fertility has been identified as one of the most serious problems in coconut gardens due to the continuous cultivation of this crop in the same soil for several years. Coconut palms have high nutrient requirements that have to be met throughout their long growing periods. Non-adoption of regular nutrient management practices to compensate nutrients uptake by the coconut tree has resulted in degradation of soil fertility. Coconut is a crop which removes large quantity of nutrients from the

soil compared to other perennial crops. For example, a cashew tree under good management condition producing 10-12 Kg. nuts per tree requires 125 grams of potash in a year where as the coconut tree producing 80 –100 nut per year requires 1200 grams of potash in an year to maintain the productivity of the soil and the tree at optimum level.

The maintenance of soil properties at a considerably optimum and sustainable level can be attributed to the continuous enrichment of nutrient pool coupled with minimum loss from the system. Enrichment of nutrient pool occurs from additions from the trees, crops, livestock and farm waste. Trees like cocoa raised as mixed crop in coconut contribute to the nutrient pool by way of litter fall. The residue from other under story crop components (banana pseudo stem, non edible vegetative portion of tuber and other herbaceous crops are recycled as mulches. A part of

nutrients locked up in these parts are returned to the nutrient pools.

Productivity in coconut is influenced by a variety of factors. However, adoption of Integrated Nutrient management (INM) is the key for the success of a sustained productivity. The major components of this package are balanced nutrient management with emphasis on organics and basin management with green manure crops. Integrated Nutrient management to ensure sustainability of physical, chemical and biological functioning of the soil is one the most important management practices promoted by the Board under the integrated farming scheme. It helps in enhancing the productivity of coconut palms. The response of coconut palm to different management practices proved that the yield of coconut palms can be doubled when compared to neglected garden. Regular manuring right from the first year of planting is essential for good

vegetative growth, early flowering and high yields. Integrated management practices involving application of organic manures in sufficient quantities to improve the soil health, conditioning of soil by application of liming materials and then fertilizer application @ 500gm Nitrogen, 320gm Phosphorus and 1200gm Potash are generally recommended for coconut garden, yielding 100 nuts/rec/ year.

Role of balanced nutrition in coconut garden

Potash, nitrogen, chlorine, phosphorus, magnesium and boron are the major fertilizer elements commonly recommended for successful coconut production. It is required for coconut palms in large quantities. In nature it is found in many compounds and minerals. For example, potash occurs in two forms vice muriate of potash and sulphate of potash. For better and profitable farming, balanced fertilization with nitrogen, phosphorus, potassium and also with chlorine is essential. Removal of nutrients from the soil include primary uptake by the trees which is either locked up in the vegetative parts mainly or exported to harvested produce. Nutrient removal through harvested produce is compensated by nutrient inputs through manure, fertilizer, recycled crop residues etc. In any land use system, the most direct and primary requirement for sustainability is to maintain soil fertility. The continued effect of lowering soil organic matter, deterioration of soil physical properties and lowering the nutrient content is commonly referred to as decline in soil fertility.

Organic manures and its importance

Organic manure is very essential in coconut nutrition. Organic manures are important as they contain several nutrients though in lower concentrations than inorganic fertilizers. Organic matter

promotes microbial process in the soil, improves the soil structure, aeration and water holding capacity. It has a regulating effect on soil temperatures, delays the fixation of mineral acid and supplies decomposed products which aid the growth of plants. More over it is a slow source of uniformly active nitrogen and consequently has a beneficial influence on the protein content of plants. Organic manures include both bulky and concentrated manures. Farm Yard Manure (FYM), compost and green manures are bulky organic manures where as oil cakes and fish manure are concentrated organic manures. About 25 – 50 kg of any bulky organic manure supplemented with required quantity of inorganic fertilizers is the best balanced combination of manures for an adult bearing palm.

Green manuring

Green manuring is one of the means to maintain organic matter status in the soil. It includes both green crop manures and green leaf manures. The leguminous green manure crops have been found to improve the nitrogen status of the soil. Further, the green manuring improves soil structure, release plant nutrients present in the soil in an available form, conserves nutrients from leaching losses, regulates soil temperature and minimizes the loss of soil due to erosion. Growing and incorporating green manure crops in soil helps to improve soil fertility. Application of nutrients like N increases morphological characters like leaf area and root length of the crops which are responsible for enhanced water use efficiency through improvement in water uptake, evaporation and transpiration. Extensive root proliferation occurs due to improved P supplies. The enhanced root activity explores soil volumes to greater depths.

Sunhemp (*Crotalaria juncea*)

wild sunhemp (*Crotalaria striata*) and daincha (*Sesbania aculata*) and *sesbania sp.* are the most suitable green manure crops for growing in situ in the coconut gardens. Plants like *Gliricidia maculate* and *Tephrosia candida* can be grown along the boundaries of the coconut garden and the green matter can be cut and applied to coconut palms. Leguminous crops like *Calapogonia Stylosanthes gracillis*, *Mimosa invisa* also fix nitrogen biologically with help of bacterium rhizobium present in root nodules. The nitrogen fixed by legume – rhizobium association becomes available to coconut palm by the decomposition of nodules and plant materials after incorporation. Among the green manure crops *Crotalaria striata* is the most suitable green manure crop for growing in situ and incorporating in gardens. This is because of its quick growth, giving good tonnage of organic matter, leaf material rich in nitrogen, tolerance to shade and stand up to heavy rains, producing seeds in abundance and is not eaten by cattles.

Nutrient Management

The general recommendation for fertilizing adult bearing palm is to apply 500g N, 320g P₂O₅ and 1200g K₂O/palm/year. To supply this quantity of nutrient it is required to apply 1.1 kg urea 1.5 kg murexiphos and 2 kg muriate of potash. Wherever yellowing due deficiency of magnesium is noted, application of 500g Magnesium sulphate is essential. Deficiency of micro nutrient like boron commonly noticed in coconut gardens. Application of borax @50-200 gram per tree depending on the intensity of deficiency symptoms is to be given to such palms. In inland areas, application of common salt @1kg per palm is recommended when the soil is having sufficient moisture to reach out the salt from the root zone. Fertilizers should be applied under optimum soil moisture

conditions. Fertilizer applications is usually recommended in two splits a year. One third of the recommended dose must be spread around the palms within a radius of 1.8 m and forked in immediately after the pre-monsoon showers. Remaining two third fertilizer doses should be applied in September when the monsoon rain recedes along with 30 kg of green matter or 25 kg of FYM. This enables the farmer to get higher crop yields.

Fertigation, a widely adopted practice in Israel and other advanced countries, is an efficient method of fertilizer application through drip system. Drip fertigation increases the fertilizer use efficiency, saves fertilizer costs, reduce labour requirement and supply nutrients according to crop demand during varying physiological stages. It also ensures uniform, precise and direct application to root zone, correction of micronutrient deficiencies etc. Soluble fertilizers viz., urea, DAP and potassium chloride can be combined and supplied through drip irrigation. The other possibility is to use liquid fertilizers which are highly soluble, hence there will be no interference and no clogging. But the cost of these fertilizers is very high.

In an year, fertilizers can be applied four times in equal splits depending on the rain fall period. It is not practiced by the farmers due to the higher labor charges for application. Hence it is recommended to apply the fertilizers in one or two splits depending on the rainfall periods in order to ensure sufficient moisture in the soil for uptake of nutrients supplied through the fertilizers. However fertilizers should not be applied during heavy rainfall season. Studies conducted by research indicated that 50 % of the recommended dose of fertilizer when applied through drip fertigation is sufficient to produce 100 % of the recommended yield.

Phosphorus application can be

skipped in areas where the available phosphorus in soil is more than 20 ppm/ha. Here, fertigation can be practiced with urea (nitrogen) and muriate of potash alone (potassium). However phosphorus need to be applied once in two years or once the soil phosphorus reaches less than 20 ppm. Soil and leaf analysis could be a useful tool for making fertilizer recommendations and to identify the deficient nutrient elements. The requirement of micronutrient for coconut for different coconut growing area are Boron, copper, Zinc, Magnesium and Manganese. However it depends on the area where coconut is grown. Besides, adequate quantity of bulky organic manure at 50 Kg per palm is generally advocated. This not only provides some of the micronutrients needed by the palms but also improves the soil physical conditions including water holding capacity.

Integrated farming scheme of CDB to promote INM

In order to motivate farmers to adopt Integrated Nutrient Management practices, Board is providing technical, financial assistance @ Rs.35,000 per hectare, @ Rs.17500 each in two annual installments under the scheme 'Laying out of demonstration plots'. The area selected for implementing scheme will be given critical inputs like micro-nutrient mixtures, bio-fertilizers and chemical fertilizers free-of-cost as stated above and technical knowledge on how to maintain soil fertility at optimum levels will also be imparted. Each of the beneficiary farmer will be given recommended fertilizers for cultivation at the rate (almost 175 trees under a hectare), 1.0 kg of urea, 2 kg of super phosphate and 2 kg of potash per palm in the demonstration area. Besides, other fertilizers like borax, magnesium and intercrop planting materials are also being given on need basis.

Apart from this hand-operated and power sprayers to combat insect and pest attacks, and carrier vehicles for transportation of inputs under the community operation component of Integrated farming scheme are also supplied to the farmers. The scheme is being implemented in sixteen states and three Union Territories through the State Agriculture or Horticulture Departments and also directly by Coconut Development Board through the Farmer Producer Organizations. The scheme is implemented on the basis of the action plan prepared for the farmers groups. Community approach is adopted for procurement and application of inputs. The maximum eligibility of a farmer for financial assistance under the scheme shall be limited to one hectare. The Board also support the farmers for production of quality vermi compost or coir pith compost. Board will meet 100% of the cost subject to a maximum ceiling of Rs.30,000 per unit under another component programme of Integrated farming scheme for productivity improvement.

Conclusion

One of the most important management practices promoted by the Board under the integrated farming scheme for productivity improvement is maintaining the fertility of the soil of coconut gardens by adoption of integrated nutrient management practices. Critical inputs for supply of major nutrients required for the palm is arranged to supply under the scheme. In general, number of nuts, nut size and kernel content are higher in palms applied with both fertilizers and organic manures. By adoption of integrated nutrient management practices, soil health as well as health of palms could be improved over the years and maintained without further deterioration and obtain potential yield from coconut on sustainable basis ■