# NUTRIENT MANAGEMENT FOR SUSTAINED PRODUCTIVITY OF ARECANUT

Ravi Bhat[1], S. Sujatha[2], Bhavishya[3] and K. S. Karthika[3]

Arecanut is predominantly grown in poor fertile acidic laterite soils characterized by heavy rainfall leading to leaching of Ca and K, rapid depletion of organic matter, low CEC, presence of kaolinite clay mineral, and P and Zn fixation. Areca palm is having adventitious root system and thus have to absorb water and nutrients from small soil volume. Higher trunk biomass (70% of the total biomass), low nutrient use efficiency and susceptibility to water stagnation and water stress are the main crop constraints for higher yield levels in areca palms. In this condition, deprived management practices of irrigation, nutrition and other cultural operations would result in low productivity. The farmer's practices are having low input use efficiency especially for key inputs like water and nutrients which result in low yield. Cropping system is followed imperatively in arecanut. Cultivation of exhaustive crops in mixed/multiple cropping system continuously on the same land results in soil fertility depletion. Thus, it is essential to replenish nutrients regularly through organic and inorganic source. Improper management in the cropping system would affect the yield of component crops including arecanut as it creates competition for applied nutrients and water.

Soil testing is very essential in arecanut and the component crops in areca based cropping system as soil test based nutrient application helps to sustain the soil fertility and judicious use of nutrients. Soil sampling should be done in the crop basin at 50-60cm distance from the trunk/stem of arecanut palm on two sides up to a depth of 30 or 45 cm using auger or spade. This should be done at least in 3-4 palm basins covering entire garden. If soil test values of phosphorus and potassium are below 30 kg $P_2O_5$ and 300 kg $K_2O$ per ha in arecanut basins, P and K are reaching deficit level and yields might reduce if nutrients are not applied sufficiently at this stage. Leaf sampling is required if deficiency or toxicity or disorders are seen in few palms of the entire garden. Leaf samples should be collected from middle of the 4$^{th}$ leaf on either side.

## 1. Quantity, method and time of nutrient application

Nutrient management strategies need to be planned for arecanut considering the soil fertility, leaf nutrient status and yield level. In laterite soils, application of 100 g N, 40 g $P_2O_5$ and 140 g $K_2O$ is found to be optimum (Abdul Khader, 1990) and is recommended as a general

[1]ICAR-Central Plantation Crops Research Institute, Kasaragod-671 124, Kerala
[2]ICAR-Indian Institute of Horticultural Research, Hessaraghatta-560 089, Bengaluru, Karnataka
[3]ICAR-Central Plantation Crops Research Institute, Regional Station, Vittal-574 243, Karnataka

dose of fertilizer every year in two splits. In addition, application of 12 kg each of green leaf and compost per palm is also recommended. In heavy soils, general recommendation of nutrients is 50 g N, 40 g $P_2O_5$ and 140 g $K_2O$ along with green manures. However, high yielding varieties yielding >3 kg chali palm$^{-1}$respond well to double dose of recommended quantity of fertilizer (Sujatha *et al.*, 1999). In the first year of planting, 1/3$^{rd}$ of the recommended dose of fertilizer should be given. In the second year, 2/3$^{rd}$ of the recommended dose and from third year onwards full dose of fertilizer should be given.

Application of only organics or chemical fertilizer may lead to imbalance in nutrition of arecanut. Thus, nutrient management strategies need to be planned for arecanut taking in to account the soil fertility status. It is advisable to consider nutrient deficiency/toxicity before the development of visual symptoms with the help of plant and soil analysis. Fertilizers and organic manures should be applied when the soil has sufficient moisture but not during heavy rainfall and dry periods. If grown as rain fed crop, fertilizers can be applied just before monsoon coinciding the months of May-June and after monsoon (September-October) (Bhat and Sujatha, 2004). When the crop is irrigated, the pre-monsoon application can be advanced to February-March. As far as possible, the fertilizers should be applied during flowering, fruit set and nut formation period during December-May. The organic manures are applied during September-October in basins around the base of each palm.

Basin opening is an important operation for application of manures and fertilizers wherever soil hardens after monsoon to provide soil aeration. Soil aeration is most important for production of fine roots, which are required for uptake of nutrients and water. Majority of the feeding roots of arecanut are concentrated within 30 cm depth and 60 cm distance from the trunk. Only fine roots of less than 1 mm thickness will take up water and nutrients. The basins of the palms may be covered with thick layer of soil or forked for incorporation of manures and fertilizers with the soil.

In soils with acidic pH of below 6.0, the fertilizer may be applied in the form of urea, rock phosphate and muriate of potash. In soils with pH above 7.0, single super phosphate or DAP can be used as source of phosphorus. It is important to note that organic manure application alone can't meet K demand of arecanut. For high yielding arecanut palms with dry kernel or *chali* yield more than 2.5 kg per palm per year, double dose of fertilizers especially N and K can be applied. Lime application is needed only if soil pH is below 5.

## 2. Organic matter recycling

On an average, 5.0 to 8.5 tonnes of leaf wastes are available from one ha of areca garden per year. Direct application of these wastes in the garden will take long time for decomposition and will not meet the nutrient demand of the crop immediately. Hence, these materials can be effectively composted using earthworms and used as organic manure in areca gardens (Chowdappa *et al.*, 1999). To prepare vermicompost, areca wastes are chopped into small pieces of 10 cm and heaped. The heap is sprinkled with water daily and kept for two weeks. Then the chopped material is arranged in beds of one metre width and convenient

length. Cement tanks or trenches can be used for this purpose. A layer of 10-15 cm waste material is alternated with 2 cm layer of cow dung over which earthworms are released at the rate of 1000 numbers per square metre. Two species of earthworms *Eudriluseugeniae* and *Eiseniafoetida* can be used. The wastes are converted into fine granular, odourless vermicompost within 60 days. About 80% recovery of vermicompost from these wastes is expected. During this period, the earthworm population is doubled. Vermicompost is rich in N, P, Ca, Mg and micronutrients (Chowdappa *et al.*, 1999). About 4 kg of vermicompost per palm per year meets the N and P nutrient demand of arecanut. Potassium needs to be supplemented through other sources like MOP, arecanut husk or *gliricidia*.

### 3. Nutritional disorders

Crown choking, crown bending, oblique nodes and nut splitting are the common nutrient disorders in arecanut. These problems are seen majorly in paddy converted lands and areas with excess soil fertility and water stagnation leading to lack of fine root development. Crown choking can be identified at initial stages with appearance of dark green colour of leaves and reduction in size of old leaves. Zinc deficiency is mainly responsible for development of disorders (Bhat and Sujatha, 2014). Soil application of zinc sulphate @ 10 g per palm is ideal if disorder symptoms are in initial stages. In case of severe reduction in leaf size and crown choking, spraying of 0.5% zinc sulphate (5 g per litre of water) mainly on fresh foliage can be done so that new leaves will emerge normally. Nut splitting is due to less potassium and boron deficiency. The problem can be managed with identifying the cause and regular application of required nutrients.

Crown choking

Crown bending

Oblique nodes

Nut splitting

### 4. Drip-fertigation

The application of nutrients through irrigation water is called as fertigation. With adoption of ferti-drip irrigation, the advantages are reduced labour charges on fertilizer application, weeding and irrigation and diesel charges due to less operational hours. Drip fertigation in arecanut improves root distribution particularly in terms of fine root biomass which absorbs water and nutrients (Sujatha and Abdul Haris, 2000; Bhat and Sujatha, 2008) apart from improving the mobility of P and K (Bhat *et al.*, 2007). This technology can be profitably adopted in arecanut, which can save fertilizer up to 25-50%. The fertilizers can be injected into the system by different methods. Important techniques are using the main pump, using a separate small pump or by using a fertilizer tank. These techniques can be used when area is large. When area is small, vacuum injection (venturi) technique can be followed.

## 5. Sources of nutrients and fertigation time and frequency

Liquid fertilizers are readily soluble in water and can be used for fertigation. However, easily available fertilizers like urea, diammonium phosphate (DAP) and potassium chloride (MOP) are water soluble and cost effective sources of NPK. Fertilizers should be applied during post-monsoon season from December to May. The fertilizers can also be applied preferably once in 10 or 20 days, but can be applied once in 30 days. Application of fertilizers should be avoided during monsoon season. Total quantity of fertilizer to be given is to be split into 9 or 18 parts and each part will be applied once in 20 or 10 days respectively.

For pre-bearing palms 50% of recommended fertilizer is sufficient when supplied through drip irrigation (Sujatha *et al.*, 2000). For bearing palms, 75% of the recommended fertilizer dose is sufficient (Bhat *et al.*, 2007). Recommended nutrient dose to be given through fertigation is 75:30:105 g N, $P_2O_5$, $K_2O$ per palm per year. Quantity of fertilizer required to supply recommended dose per palm per year is 136 g Urea, 65 g DAP and 175 g MOP.

## References


Abdul Khader, K.B. 1990. Manurial experiments in arecanut. *Journal of Plantation Crops*.**17:** 39-50.

Bhat, R and Sujatha, S. 2014. Soil fertility status and disorders in arecanut (*Areca catechu* L.) grown on clay and laterite soils of India. *Communications in Soil Science and Plant Analysis*.**45**: 1622-1635.

Bhat, R. and Sujatha, S. 2004. Crop management. In: Balasimha, D. and Rajagopal. (Eds.). *Arecanut.* Central Plantation Crops Research Institute, Kasaragod, pp. 76-102.

Bhat, R. and Sujatha, S. 2008. Root distribution of arecanut (*Areca catechu* L.) as influenced by drip fertigation in a laterite soil. *Indian Journal of Agricultural Sciences*.**78**(9): 804-807.

Bhat, R., Sujatha, S. and Balasimha, D. 2007. Impact of drip fertigation on productivity of arecanut (*Areca catechu* L.). *Agricultural Water Management*.**90**(1–2): 101-111.

Bhat, R., Sujatha, S., Upadhyay, A. K. and Ashalatha, B. V. 2007b.Effect of ferti-drip irrigation on nutrient mobility in a laterite soil in arecanut basin. *Journal of Plantation Crops* .**35**(2): 68-72.

Chowdappa, P., Biddappa, C.C. and Sujatha, S.1999. Efficient recycling of organic matter in arecanut and cocoa plantation through vermicomposting. *Indian Journal of Agricultural Sciences* **69**: 563-56.

Sujatha, S. and Abdul Haris, A. 2000. Root distribution pattern as influenced by different irrigation methods in young arecanut (*Areca catechu* L.) palms. *Journal of Plantation Crops*.**28**(2): 117-122.

Sujatha, S., Balasimha, D. and Bhat Ravi. 2000. Fertigation requirement of arecanut (*Areca catechu* L.) during pre-bearing stage. Presented in PLACROSYM-XIV (International Conference on Plantation Crops), Hyderabad, India, December 12-15, 2000.

Sujatha, S., Bhat, R., Reddy, V. M. and Haris, A. A. 1999. Response of high yielding varieties of arecanut to fertilizer levels in coastal Karnataka. *Journal of Plantation crops.* **27**: 187-192.


***