Agronomic and Nutritional Strategies for Managing Root (Wilt) Affected Coconut Gardens

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Coconut root (wilt) disease is a non-lethal, debilitating malady that affects the production potential of the palm. The disease is prevalent in all the districts of Kerala in varying severity, in districts of Tamil Nadu bordering Kerala, and in Goa. Phytoplasma, a vascular limited pathogen, has been found to be the causal organism. The disease is transmitted through insect vectors such as lace bug and plant hopper. There are no therapeutic control measures for the disease; however, research efforts have resulted in evolving viable technologies to increase the productivity of the diseased palms. In a situation where the coconut industry is threatened with recurring uncertainties, the need for a farm practice that augments the coconut farm income becomes clear and urgent.

1. Water Management and Drainage

Water plays an important role in growth and development of the palm and during summer months palm experiences mild to severe stress which affects the nut and copra yield. Depending upon the availability of water and cropping system practised in the garden, the following irrigation methods can be adopted.

Basin irrigation : This method can be adopted in a coconut garden under monocropping. Open a basin of 30 cm depth with a radius of 0.75 m, 1.0 m and 1.8 m for 1 to 2 years old seedlings, for 3 to 4 years old seedlings and adult palms respectively.

Drip irrigation : This method is effective for pure coconut garden in water scarcity area. For seedlings of 1 to 2 years old, place 2 emitters 50 cm away from the base of the seedling, whereas for 3 to 4 year old seedlings, place 3 emitters, 75 cm away from the base of the seedling. For adult palms, 4 emitters should be placed one metre away from the bole at equidistance by opening a small pit measuring 25 cm^3 in laterite and red sandy loam soils whereas, for littoral sandy soil use 6 emitters per palm placed at equidistance. This system of irrigation ensures water saving and higher water use efficiency in the field.

Perfo irrigation or Sprinkler irrigation : This system should be adopted under high density multispecies cropping system model for uniform distribution of water to all the crops. Irrigate the field to a depth of 20 mm once in 4 days.

Drainage: Drainage should be provided in water logged area for increasing aeration in the soil and more soil should be applied in basin to facilitate production of new roots.

II. Integrated Nutrient Management

Integrated application of balanced dose of chemical fertilizers, organic manures and biofertilizers and recycling of crop residues ensures availability of nutrients to crops and is necessary for maintenance of soil productivity and sustainable crop yields.

Organic manures : Application of organic manures improves soil physical, chemical and biological properties which ultimately enhances yield. Apply any of the following organic manures along with chemical fertilizers during post-rainy season (September-October) by opening a basin to a depth of 30 cm in 1.8 m radius from the bole.

Farm Yard Manure - 25 kg or Green leaves - 25 kg or Composted coir pith 25 kg or Vermicompost - 25 kg per palm per year.

Balanced dose of chemical fertilizers: In order to supply, 500

Cowpea as green manure crop in coconut basin

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Nitrogen, 300 g Phosphorus, 1000 g Potassium and 500 g MgO to each palm every year, apply 1.1 kg of urea, 1.5 kg mussoorie rock phosphate, 1.7 kg muriate of potash and 3 kg of $MgSO_4$. The above fertilizer should be applied in two splits, one-third during April-May and two-third during September-October under rainfed condition and in four splits during January, April, July and October under irrigated condition.

Green manure crops : Sow the seeds of green manure crops like cowpea, sunnhemp (*Crotalaria juncea),* mimosa (*Mimosa invisa)*, calapogonium (*Cal*apognium mucunoides), kudzu (*Pueraria phaseoloides*) etc. during April-May (after applying first dose of fertiliser) in basins and incorporate at the time of second dose of fertiliser application. Green manure crop acts as a cover crop which suppresses weed growth and under sloppy land, conserves soil during heavy rainfall.

The green manure crops fix atmospheric nitrogen with the help of root nodules. Such green manure crops produce 22-25 kg biomass in a basin area which, when incorporated into the soil, increases the organic matter.

Table 1. Quantity of water to be applied

System of irrigation	Age of the palm	Quantity of water (litre/palm)
Drip irrigation	1-2 years 3-4 years Adult	10 lit per day 20 lit per day 32-35 lit per day
Basin irrigation	1-2 years 3-4 years Adult	25-30 lit once in 2 days 75-80 lit once in 4 days 250-300 lit once in 4 days

Mulching with coconut leaves : Mulching the manuring basin with coconut leaves provides beneficial effects during summer months by reducing direct heating of soil surface and reducing evaporation of soil moisture. Coconut basins can be mulched during October - November and retained till April-May.

Boron Nutrition : Boron is an essential micronutrient for plants. In nature, its availability is moderately rare and occurs principally as borates of calcium and sodium. Its availability is maximum within the pH range of 5-7 and less available above the 7.5 pH. Excessive liming aggravates boron deficiency. Boron plays an important role in the division and multiplication of meristematic tissues. It helps in metabolism of protein, synthesis of pectin, maintenance of water relations, translocation of sugars, fruiting process, growth of pollen tube and in the development of flowers and fruits.

Unopened crinkled leaf due to boron deficiency

In coconut palms, deficiency of boron causes malformations of various types and shapes in the leaf as well as inflorescence and nuts. The deficiency symptoms common to both seedlings and adult palms are :

- Unopened crinkled leaf
- Crinkled leaf- lamina
- Crinkled leaf showing the crinkled petiole
- Petiole without any leaflets
- Hooked leaf with gummosis
- Fan like appearance of leaf
- Fully necrotic terminal bud
- Aborted inflorescence
- Necrosis of inflorescence
- Cracking on the husk
- Nut without any kernel

The deficiency could be corrected by applying 300 and 500 g of borax for

seedlings and adult palms respectively in 2 split doses along with the recommended dose of fertilizers.

III. Adoption of Appropriate Cropping/Farming System

In coconut holdings with palms spaced at 7.5 x 7.5 m apart, only 25% of the land is being utilized by the palm and with palms of more than 25 years of age only 45-50% of the sunlight is intercepted and the remaining is infiltrated on to the ground. In order to utilize this natural resources efficiently along with soil nutrients and water, farmers are adopting inter/mixed cropping, though not in a proper scientific way. Intercropping in coconut garden with suitable crops increases the productivity as well as the net returns from a unit area.

Suitable intercrops/mixed crops may be selected depending on the soil type and agroclimatic condition. Following crops can be grown in coconut garden without affecting the yield of coconut.

1. **Tuber crops :** Cassava, elephant foot yam, greater yam and lesser yam,
2. **Fruit crops :** Banana and pineapple.
3. **Fodder crops :** Pusa Giant, hybrid napier-NB-21 and BH18, guinea grass, stylosanthes and fodder cowpea.
4. **Beverage crop :** Cocoa
5. **Spices :** Ginger, turmeric, black pepper, nutmeg and clove

Multistoreyed Cropping/ High Density Multi Species Cropping System

In this system different stature crops are grown in the same field, which ensures utilization of natural resources to the maximum extent and higher yield per unit area.

Example : Coconut, pepper, cocoa, nutmeg, clove, banana, pineapple, and tubercrops (cassava, amorphophallus, dioscorea).

In cropping system, care should be taken to add recommended organic and inorganic fertilizers for component crops separately. In cropping system wastes of different crops can be converted into suitable organic manure and recycled in the garden.

In India, there is no scope for horizontal expansion of land for cultivation, therefore the alternative is diversification in agriculture and adoption of integrated mixed farming system. Adoption of such system ensures increased food supply, recycling of crop/farm residues, restoration of soil fertility and conserving environment increased employment, etc.

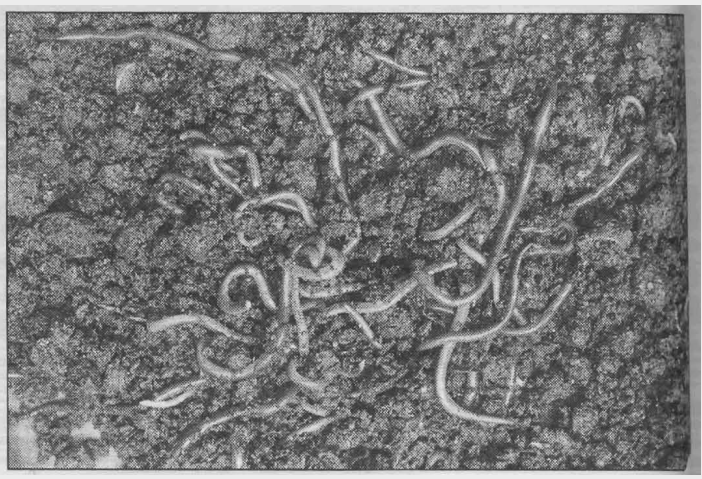
Integrating dairy enterprise in root (wilt) coconut garden ensures additional employment and income for a coconut farmer along with restoring soil fertility.

Future Strategies

Fertigation : There is a need to study the impact of fertigation (supply of chemical fertilizer through drip irrigation) on growth and yield of root (wilt) affected coconut.

Ecofriendly Vermicompost technology : The dried coconut leaves and other wastes in coconut plantations can be effectively converted into vermicompost using epigeic, pigmented earth worm, *Eudrilus* spp. Coconut leaves and other wastes can be vermicomposted by heap method or pit method or in coconut basin itself. The length and breadth of the vermicompost unit in tanks or pit can be as per convenience but the depth should be less than one metre. For compost preparation, coconut leaves weathered for 2-3 months are to be used. The leaves can be used as such or after chopping

HDMSCS model for coconut root (wilt) garden



Earth worms for vermicomposting coconut