

Integrated disease management in coconut

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Coconut palm is affected by a number of diseases, some of which are lethal while others gradually reduce the vigor of the palm causing severe loss in the yield. Managing the diseases affecting coconut has become a problem in the recent years due to the escalating cost of inputs and labour and low market price for coconut. A brief account of the important diseases of coconut and their management is highlighted here.

1. Bud rot

Bud rot disease is caused by the fungus *Phytophthora palmivora*. In India, bud rot was first reported by Butler in 1906. In the recent years, the disease has attained a serious proportion in some of the localities especially in hilly tracts of southern India. Since coconut is a perennial crop the loss due to the disease is very high.

Symptoms

The earliest symptom is



Initial stage

withering of the spindle leaf marked by pale color and the spindle leaf turns brown. The affected spindle leaf can easily be pulled out as the basal portion of the spindle is completely rotten emitting a foul smell. Symptoms are later observed in younger leaves next to the spindle. Later the inner leaves also fall away one by one leaving only outer whorl of matured leaves in the crown. Ultimately the palm succumbs to the disease with the death of the growing bud.

Integrated management practices

Integrated disease management strategies should be adopted in three seasons especially in endemic areas for effective management of the disease.

I. Before the onset of rainy season

- Remove all disease advanced and dead palms
- Crown cleaning



Middle stage

- Field hygiene
- Adopt management practices recommended for rhinoceros attack
- Improve drainage, if necessary
- Control other pests and diseases
- Integrated Nutrient Management
- Apply mancozeb solution (5g mancozeb in 300 ml water) / phosphorous acid solution and keep 2 perforated mancozeb sachets each containing 5 g mancozeb in the two innermost leaf axils just before the onset of rainy season (May end).

II. During rainy season

- Repeat the prophylactic fungicide treatment at 2 months interval
- Observe all the palms at 15 days interval
- Identify bud rot incidence, if any, in the initial stage
- Remove infected tissues completely in the early stage of disease
- Immediately after removing the infected tissue, pour mancozeb solution (5g mancozeb in 300 ml water) to the wound and inner most leaf axils. Keep 2 perforated mancozeb sachets each containing 5 g mancozeb in the two innermost leaf axils
- Cover the wound with a polythene sheet to prevent entry



Advanced stage

of rain water. The protective covering has to be retained till normal shoot emerges

- Destroy the infected tissues removed by burning or deeply burying in the soil.

III. Post-monsoon

- Continue prophylactic fungicide treatment bi-monthly till the end of December.
- Observe all the palms at 15 days interval and take up curative treatment, if necessary
- Integrated Nutrient Management

Trichoderma Coir Pith Cake (TCPC)

CPCRI has developed a biocontrol formulation named as Trichoderma coir pith cake (TCPC) for control of Phytophthora disease of coconut and cocoa. The Trichoderma coir pith cake formulation has more shelf life compared to other commercially available talc based Trichoderma formulations. The shelf life of TCPC is up to 10 months and dried TCPC could be activated by moistening with water and incubating for 2 days at room



Dead palm

temperature. After 2 days of incubation period, the TCPC was covered by thick growth of Trichoderma which appeared as white to green color fluffy growth. TCPC was found effective against bud rot disease of coconut and stem canker of cocoa.

2. Root (Wilt)

Root (wilt) (RWD) disease caused by phytoplasma and it was first observed in Kerala during 1882. The disease is prevalent in a contiguous manner in all the 8 southern districts of Kerala starting from Trivandrum to Trichur and in isolated patches in the remaining 6 northern districts of the state. Apart from this the disease is also prevalent in the districts of Tamil



Yellowing of leaves

Nadu and Karnataka adjoining to Kerala State.

Symptoms

Characteristic symptoms are yellowing of the outer whorl of leaves, marginal necrosis and abnormal inward bending or ribbing of the leaflets termed as flaccidity. However, yellowing of foliage is virtually absent in seedlings and juvenile palms but flaccidity is noticed. In the early stage of disease the root system is apparently normal and the percentages of rotten roots are few. While, with the progress of the disease, extensive rotting of roots is observed. The main roots and rootlets start drying from tip to backwards. The capacity of the palms to regenerate fresh roots is drastically reduced. Shedding of immature nuts if the tree is bearing at the time of disease contraction is yet another symptom observed in some cases. Drying up of spathes and necrosis of spikelets from tip downward in unopened inflorescence is noticed in certain cases. The vitality of the diseased palms is so adversely affected that they produce small spathes with fewer female flowers.



Flaccidity



Marginal necrosis



Inflorescence necrosis

In the advanced stage the crown gets very much reduced in size and ceases to produce flower bunches. The nuts from diseased palms have thinner husk and fibers are definitely weaker and less firm. The kernel is thinner and never dries up into hard brittle copra but remains soft and flexible. The tender coconut water of diseased palm is insipid. The oil content is very much reduced and also losses its flavor. The insect viz., lace bug (*Stephanitis typica*) and plant hopper (*Proutista moesta*) have been identified as vectors for transmitting the disease in nature.

Integrated management practices

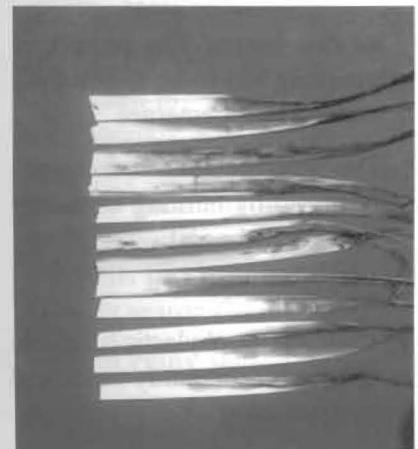
Management strategies for root (wilt) disease have been formulated separately for heavily diseased area and mildly diseased area.

In the heavily diseased area, the yield of palms can be sustained or improved through adoption of integrated management practices-removal of disease advanced and juvenile palms, balanced fertilizer application, addition of organic manures, raising of green manure crops in the basins and incorporation, irrigation during summer months, practicing plant protection methods and adopting inter and mixed cropping. Mixed farming in the diseased gardens involving the raising of fodder crops in the inter spaces, maintaining milch cows and recycling of organic waste has helped in increasing the yield of palms.

In mildly diseased area, eradication of disease-affected palms and continuous monitoring for occurrence of the disease and uprooting of diseased palms can be done in the very initial stage of the disease.

3. Leaf rot

About 65 % of root (wilt) diseased palms are affected by leaf rot disease caused by fungi. *Curvularia lunata*, *Pestalotiopsis palmarum*, *Exserohilum rostratum*, *Alternaria* spp. *Theilaviopsis paradoxa* and *Colletotrichum gloeosporioides* etc. Among these *Exserohilum rostratum* and *Colletotrichum gloeosporioides* are the major pathogens causing leaf rot.



Blackening of the distal ends of the leaflets

Symptoms

The first visible symptom of the disease is blackening and shriveling up of the distal ends of the leaflets in the central spindle and in some of the younger leaves. Later the affected portion breaks off in bits giving the infected leaves a fan like appearance.

Integrated management practices

- Cut and remove rotten portions of the spindle and the adjacent two innermost fully opened leaves, if affected by leaf rot.
- Mix Contaf 5 EC (Hexaconazole) 2 ml or Dithane M-45



Leaf rot infected palm



Exudation of reddish brown liquid from stem cracks



(Mancozeb) 3 g in 300 ml water and pour into the well around the base of the spindle leaf.

- The innermost leaf axils may be filled with powdered neem cake/marotti cake (*Hydrocarpus* sp.) @ 250 g/palm + fine sand (250 g per palm) for the prophylactic control of insect pests.
- Treat all palms in the garden (healthy and diseased) twice a year, i.e. in April-May and October-November. To make this operation more economical the treatment should be given along with harvest of nuts before and after south - west monsoon.

4. Stem bleeding

Stem bleeding disease is caused by fungus *Thielaviopsis paradoxa* (de Seynes). The disease was first reported from Sri Lanka by Petch in 1906 and in India by Sundararaman during 1922. In the early stages of the disease, there is not much yield loss. However, in later stages, there is a steady yield decline causing considerable loss and in advanced stages even death of affected palms occur.

Symptoms

The most diagnostic symptoms are development of dark brown patches at the basal portion of the trunk and then progresses upwards. A dark reddish brown liquid exudes from the longitudinal growth cracks present on the stem bark and form irregular streaks of exudation. These streaks may coalesce and form larger lesions. The exudates eventually dry up to form black encrustations with brownish orange margin. The tissues beneath the discolored patch show decay. The internal decay can be observed even in areas beyond the margins of external lesions indicating that the internal decay is not confined to the area of external symptoms. As the decay progresses, the tissues become black and fibrous and this process is fast in young palms. As a result of this, cavities are formed from which liquid comes out, when the bark is pressed or punctured. In the crown region, outer whorl of leaves becomes yellow rather prematurely, droops and finally dries up. The trunk gradually tapers towards the apex and the crown size is reduced.

Integrated management practices

Stem bleeding disease can be effectively managed if control measures are adopted in early stages of infection.

- The affected tissues should be completely removed using a chisel and smear the wound with 5% Contaf/Hexaconazole (5 ml in 100 ml of water) and drench the basins @ 25 lit. of 0.1% solution.
- Smearing of talc powder paste of *Trichoderma viride* or *T. harzianum* on the bleeding patches on the stem (The paste can be prepared by adding 50g of *Trichoderma* talc powder to 25 ml of water).
- Soil application of 5 kg neem cake fortified with 50g of *Trichoderma* talc formulation per palm per year along with second dose of fertilizers during Aug-Sep.
- Root feeding with 100 ml of 5% Carbendazim/ Bavistin at quarterly intervals and basin drenching with 40 liter of 0.1% Carbendazim.

5. Basal Stem rot

Basal stem rot or *Ganoderma* disease caused by fungus *G. applanatum* and *G. lucidum*. It was first observed in Thanjavur district of Tamil Nadu during 1952 hence termed as Thanjavur wilt. In Karnataka it is known by the popular Kannada name 'Anabe roga' and in Andhra Pradesh, *Ganoderma* wilt. Though it was reported from Kerala during 1987, the disease was not that severe as in other states. However, reemergence of *Ganoderma* disease in severe proportion has been noticed in Kannur and Kasaragod districts for the last two years.

Symptoms

In the initial stage of disease development symptoms are characterized as, yellowing of the leaves of lowest leaf whorl and decay and death of fine roots. Later bleeding patches appear at the base of the stem near the ground level, the lesions gradually extend upwards, roots decay extensively

and there is no new bunch production. As the disease advances bleeding patches extend in the stem, leaves droop in the outer whorl followed by heavy button shedding and barren nuts. As stem decay traverses upwards, outer leaf whorl dries and drops off; other leaves also droop except the spindle leaf and surrounding two or three young leaves which remain erect and healthy. Ultimately all the leaves droop and fall off leaving the decapitated stem.

In the middle or late stages of disease sometimes the scolytid beetle, *Xyleborus perforans* and the weevil, *Diocalandra stigmaticollis* are found infesting the stem in large numbers at the bleeding patches from which powdery mass is thrown out. The insects accelerate the death of the palm.

Integrated management practices

- Removal of dead palms, palms in advanced stages of the

disease and destruction of the bole and root bits of these palms.

- Isolation of diseased palms from healthy palms by digging isolation trenches of 1 m deep and 30 cm wide.
- Regular basin irrigation during summer months or moisture conservation by coconut husk burial (250 husk/palm).
- Avoid flood irrigation or ploughing in infected gardens to prevent spread of the inoculum.
- Addition of 50 kg of farmyard manure or green leaves or 200 kg tank silt per palm per year.
- Soil application of 5 kg neem cake fortified with 50g of Trichoderma talc formulation per palm per year along with second dose of fertilizers during Aug-Sep.
- Raising banana as intercrop wherever irrigation is possible.
- Soil drenching with 40 litre of 1 per cent Bordeaux mixture thrice a year for one year.



Drying and drooping of lower leaves



Bleeding patches at basal portion



Fructing body at basal portion

- Root feeding of 2 g of Aureofungin solution+ 1 g of Copper sulphate in 100 ml of water thrice a year at quarterly interval. Alternatively root feeding of hexaconazole @2% (100 ml solution per palm) at quarterly intervals for one year and soil drenching @0.2% (40 l solution per palm).
- If *Xyleborus* attack is found in the stem, smear with heptachlor may be done.

6. Immature nut fall

Immature nut fall is a major problem in coconut and several factors are associated with this problem. Selection of good yielding mother palm is very important for collection of seed nuts since characteristic feature of mother palm is one of the prime reasons for button shedding in coconut. Poor pollination is one of the major factors responsible for button shedding in coconut. It has been reported that in some coconut palms the production of plant growth

regulators was below optimal and in such palms, the nut fall was high when compared to other palms. Very high soil acidity or alkalinity, drought condition and sudden changes in soil moisture also leads to high



Fungal Infection of mature nut

percentage of button shedding and immature nut fall. Imbalance or deficiency of nutrients also leads to nut fall. Eriophyid mite attack leads to immature nut fall and also provides entry points for pathogenic fungi such as *Phytophthora palmivora*, *Thielaviopsis paradoxa* and *Lasioidiploida theobromae*.

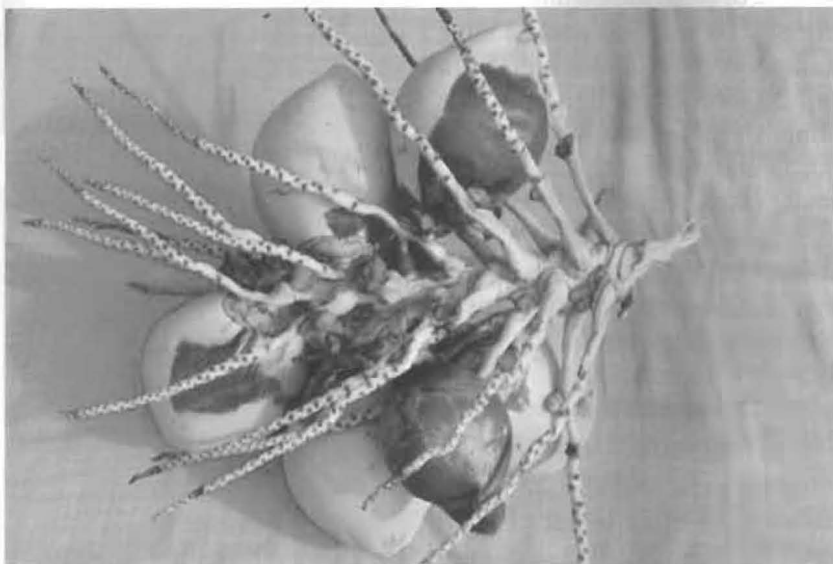
Symptoms

Rotting starts from the point of mite infestation on the nut surface near the perianth as dark brown to black discoloration and gradually

extends to the entire surface area. The lesion also spreads deep into the internal tissues and when the lesion encircles the perianth region, the nut gets detached from the bunch and shed or remains on the bunch in between other nuts. The slight injury caused by mite paves way for the pathogen to enter and cause severe rotting. Thus in COD variety mite infestation is comparatively low but the incidence of rotting and immature nut fall due to fungal infestation is frequently observed. The fungal infection spreads to the kernel and leads to grayish black discoloration and rotting. In certain cases when the fungal infection starts in nearly mature nuts, it continues even after harvest and storage.

Integrated management practices

This disease can be controlled by spraying mancozeb 0.2% or carbendazim (Bavistin 0.1%) to bunch of the affected palms. If coconut is cultivated under organic farming system, spraying of garlic bulb extract (10%) can be recommended for the management of the disease.



Fungal infection of tender nuts