

Enhancing farmers' income by growing disease-free coconut

Coconut is counteracted by many diseases, some of which are lethal, while others are debilitating in nature. A brief account of the important diseases of coconut and their management practices are summarized in this article.

DISEASE MANAGEMENT

Bud rot

Bud rot is a fatal disease and commonly occurs in almost all coconut-growing countries. This disease was first noticed in Grand Cayman in 1834. In India, bud rot was first reported from Madras state during 1906 by Butler. It occurs commonly in west and east coasts of India. Though the disease is generally sporadic in nature, recently severe outbreaks of epidemics have been noticed in many places in Kerala, Karnataka, and Tamil Nadu. Bud rot disease is caused by *Phytophthora palmivora*. Wilting of spindle region is the main symptom. The affected spindle can easily be pulled out as the basal portion of the spindle is completely rotten emitting a foul smell. 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. Climatic factors play a major role in the production of infective propagules of *Phytophthora*, multiplication,

dissemination and also in causing epidemics. The disease is generally noticed during both south west and north east monsoon periods when wet weather prevails. In general, the fungal infection and disease development were closely related to temperature and relative humidity. The disease was commonly observed one to two months after heavy rain and the young palms are more susceptible. While in low lying areas or where the rainfall exceeded 2,300 mm bud, rot affected palms of all ages. Rain water and the slug (*Deroceros* spp.) acts as a carrier for the infectious propagules and plays an important role in the spread of the disease.

Management

Effective management of bud rot can be achieved only if the integrated plant protection measures are adopted at the right time. Cut and removal of palms which are in the advanced stage of bud rot or palms dead due to the disease is very important for better control of the disease.

As a prophylactic treatment, Crown cleaning and application of 1% Bordeaux mixture to the spindle region of palms in disease endemic areas before the onset of monsoon preferably the first week of June. Repeat the treatment at bi-monthly interval till the end of December.

Placement of CPCRI developed Trichoderma enriched coir pith cake (TCPC) (2 numbers) in the innermost leaf axil of the coconut will also help in reducing the disease incidence.

Curative treatment: In early stages of the disease, when the spindle leaf starts wilting, cut and remove all affected tissues of the crown, smear with 10% Bordeaux paste and protect the treated



Bud rot affected coconut palm sporangia of *Phytophthora palmivora* causing bud rot (inset)



Transmission of spores of *Phytophthora palmivora*



Trichoderma enriched coir pith cake before activation (A) and after activation (B)

wound from rain by providing polythene covering till normal shoot emerges. The entire rotten portion removed from the crown should be destroyed by burning.

Fruit Rot/Immature Nut Fall

Immature nut fall in coconut has been attributed to several factors viz. characteristic feature of mother palm, high soil acidity or alkalinity, drought condition or water logging and sudden changes in soil moisture and also imbalance or deficiency of

nutrients. Poor pollination is also one of the major factors responsible for button shedding in coconut. Shedding of buttons is also caused by insect attack. Eriophyid mite attack also leads to immature nut fall to some extent and it provides way for entry of fungus. Two types of fungal pathogens, *Phytophthora palmivora* and *Lasiodiplodia theobromae* have been associated with Fruit rot disease.

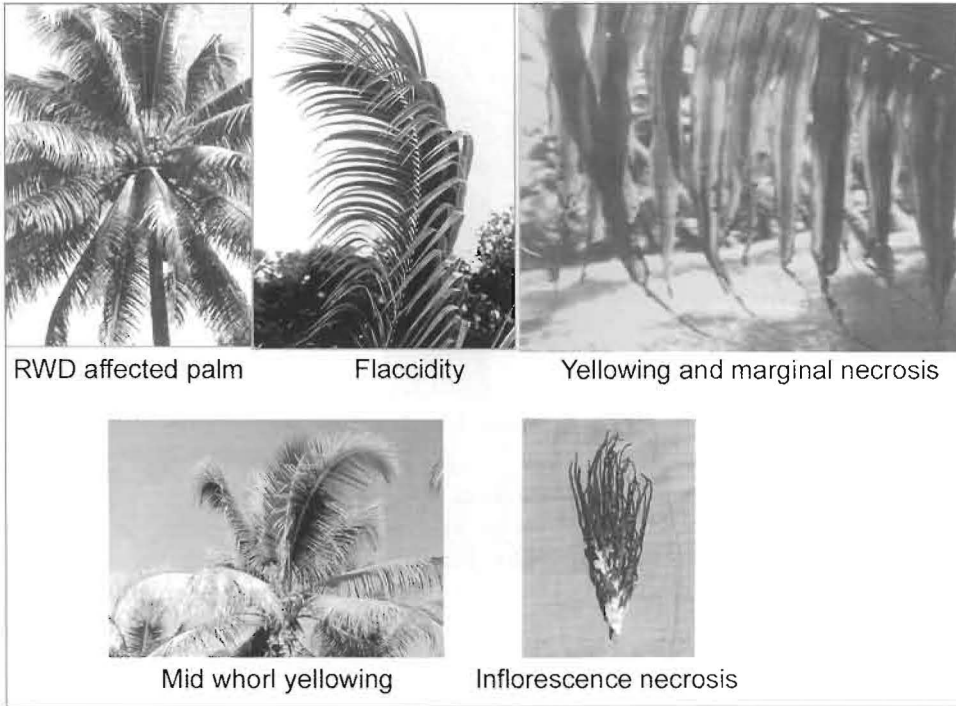
Rotting starts from the point of mite infestation on the nut surface near the perianth as dark brown to black discolouration and gradually extends to the entire surface area. The lesion also spreads deep into the internal tissues. As the lesions spread to about 30% surface area near the perianth region or 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. Fruit rot disease is common in high rainfall areas during monsoon season.

Management

Removal and destruction of infected nuts from the bunches helps to reduce the inoculum load in the garden. This disease can be controlled by spraying with 1% Bordeaux mixture to bunches at 45 days interval for one to two times depending upon the severity of disease. If coconut is cultivated under the organic farming system, spraying of garlic



Phytophthora infection on coconut causing nut fall



Root (wilt) disease of coconut

bulb extract (10%) can be recommended for the management of the disease.

Root wilt

Root (wilt) disease (RWD) 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 Nadu and Karnataka adjoining to Kerala state. Phloem bound mollicute, *Phytoplasma* has been identified as causal organism of the disease.

Management

Root wilt is not a lethal disease but a debilitating malady and responds to good management. In mildly disease affected areas, disease can be eradicated by the removal of affected palms and replanting with resistant/ tolerant varieties viz., Kalparaksha (selection from Malayan Green Dwarf), Kalpasree (selection from Chowghat Green Dwarf) and the hybrid KalpaSankara (Chowghat Green Dwarf × West Coast Tall).

Diagnosis

The most diagnostic symptom of the disease is abnormal inward bending or ribbing of the leaflets in mid whorl termed as flaccidity. The other associated symptoms are foliar yellowing, marginal necrosis, rotting of root system, drying of spathe and necrosis of spikelets. 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. Root (wilt) disease was observed on all soil types and varying ecological conditions ranging from the high ranges of the Western Ghats to the coastal plains. A systematic inventory of all insect visitors to coconut garden, plant hopper (*Proutista moesta* West wood) and lace bug (*Stephanitis typica*) have been reported as vectors of *Phytoplasma*. The potential of these insects to acquire the organism was verified using electorn microscopy and *Phytoplasma* was observed in brain and salivary glands of lace bug given an acquisition plus incubation period ranging from 18-23 days.

of the century, it is well established that the palms affected by root (wilt) are generally superimposed by leaf rot disease. The palms weakened by *Phytoplasma* might result in the breakdown of

In heavily disease affected areas, removal of all the severely affected and uneconomic palms (yield < 10 nuts/palm/year) and all diseased palms in the prebearing age is important. Yield of the palms can be sustained by following below mentioned management practices.

- Application of recommended dose of fertilizers (N:560, P:320 and K:1200g), 3 kg magnesium sulphate and 50 kg organic manure/palm. Apply the fertilizers 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 conditions.

- Adoption of mixed farming by growing fodder crops (guinea grass or hybrid napier) as mixed crops in coconut garden coupled with dairy enterprise.

- Growing of suitable intercrops like banana, nutmeg, pineapple, pepper and tuber crops like elephant foot yam etc.

- Basin management with green manure/cover crops such as cowpea, sunhemp calopogonium etc.

- Irrigation during summer months with 250 to 300 litres of water once in 4 days for adult palms; 75-80 litres once in 4 days for 3 to 4 year old seedlings; 25 to 30 litres once in 2 days for 1 to 2 years old seedlings.

Leaf Rot

The Root (wilt) disease affected palms succumb to infection by leaf rot disease and about 65% of root (wilt) diseased palms are affected by leaf rot disease. Since beginning

defense mechanism leading to susceptibility to leaf rot disease. Leaf rot disease incidence can be noticed on palms of all ages especially in palms below 25 years of age. Leaf rot disease is caused by fungi, *Curvularia lunata*, *Pestalotiopsis palmarum*, *Exserohilum rostratum*, *Alternaria* spp. *Theilaviopsis paradoxa* and *Colletotrichum gloeosporioides* etc. Among these, *Exserohilum rostratum* (Drechler) and *Colletotrichum gloeosporioides* (Penz.) are major pathogens causing leaf rot.

Leaf rot starts as minute, water soaked lesions on the emerging spindle with different colour and shade. These lesions enlarge, coalesce freely leading to extensive rotting. The rotted portions dry up, turn black and fall off. Tips of leaflets and midribs often become blackish and shriveled. The inner whorls of leaves are vulnerable to the disease. Continuous attack of newly emerging spindle leaves results in the gradual exhibition of similar symptoms in all the leaves in the crown. Sometimes the decayed leaflets are glued together so that spindle does not open out. Though the disease does not kill the palm outright, its slow progress in the crown causes steady decline in the yield. Palms of all ages are susceptible to the infection. High humidity (>90%) and low temperature (22-25°C) favours the leaf rot disease development. Disease incidence is high during monsoon season especially during June to September months. Disease incidence was positively correlated with rainfall and relative humidity and negatively correlated with maximum temperature and sunshine hours.

Management

Leaf rot disease can be controlled by the removal of rotten portions of the spindle and two successive leaves in case of severe incidence of the disease and pouring of 300 ml of fungicidal solution containing 2 ml of hexaconazole or application of 10% solution of talc based formulation of *Pseudomonas fluorescens* and *Bacillus subtilis* consortium of both (50 g talc based formulation in 500 ml water). Prophylactic treatment with hexaconazole (2ml/l) twice in a year (April-May and October-November) in disease endemic areas.

Stem Bleeding

It was first reported from India in 1922 and it is a debilitating disease and prevalent in almost all coconut growing areas of India. In the early stages of the disease there is not much yield loss. However, in later stages there is a steady yield decline causing



Stem bleeding on coconut trunk

considerable loss and in extreme cases, the palms become barren and die. Stem bleeding disease is caused by the fungus, *Theilaviopsis paradoxa* (von. Hon). It is a soil borne weak pathogen and enters the trunk through wounds/growth cracks.

Spread of Pathogen

The pathogen can spread from soils to coconut stems by splashing rain or irrigation water. Development of growth cracks, poor drainage, soil moisture stress, hard pan formation in soil, imbalanced nutrition, excessive soil salinity, stem injury, lightning attack are the predisposing factors responsible for disease development. More disease severity was observed during July to November, when high relative humidity and optimum temperature prevails. The disease has been found to occur in all soil types, but more in laterite soils and sandy soils on the seashore or backwater areas. Infestation with *Diocalandra stigmaticollis* weevil quickens the deterioration.

The typical symptoms are exudation of reddish brown fluid from growth cracks and the trunk, which becomes black on drying. In the initial stages of infection, bleeding symptoms appears only one or two longitudinal cracks at the base and later spreads upward on the stem. The longitudinal patches may coalesce to form large patches and the tissue beneath the bleeding

patches decay. As the decay progresses, the tissues become black and fibrous. 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 and the trunk gradually tapers towards the apex and the crown size also reduced. Though nut fall is noticed in later stages of disease, it is more in palms exposed to drought conditions.

Management

Since wound and the trunks predispose the palms to infection, care should be taken not to injure the palms while doing cultural operations. Removal of dead and disease advanced palms is foremost important to avoid the spread of the disease. The disease can be effectively controlled by following integrated management practices as mentioned below:

- Application of recommended dose of fertilizers (N:560, P:320 and K:1200 g) in two equal splits during (June-July and December-January) and provide irrigation (45 to 50 litres/palm/day) during summer.



Ganoderma wilt on coconut

- Application of talc based formulation of *Trichoderma harzianum* (CPTD28) paste on bleeding patches and basal application of neem cake (5 kg) enriched with *Trichoderma harzianum* (CPTD28) per palm, provide irrigation followed by mulching around the palm basin. This treatment has to follow at quarterly intervals up to one year.

Or

- Removal of the bleeding patches using a chisel and smearing with Carbendazim 50WP (5%). Root feeding with 100 ml of 5% Carbendazim 50WP at quarterly intervals and basin drenching with 40 litres of 0.1% Carbendazim 50WP.

Basal Stem Rot/*Ganoderma* Wilt

Basal stem rot disease also known as Thanjavur wilt or *Ganoderma* wilt or Anabe roga is one of the major disease limiting the coconut production in many of the coconut growing areas of Tamil Nadu, Karnataka and Andhra Pradesh. Two species of *Ganoderma*, *Ganoderma applanatum* (pers.) Pat., and *G. lucidum* (leys) Karst., have been reported as causal agent for basal stem rot disease.

The characteristic symptoms are yellowing of leaves in the lowest leaf whorl, decay and death of fine roots. Later bleeding patches appear at the base of the stem near the ground level, roots decay extensively and there is no new bunch production. As the disease advances, leaves droop in the outer whorl followed by heavy button shedding and barren nuts. Normal development of flowers and bunches is arrested. Ultimately all the leaves droop and fall off leaving the decapitated stem with the formation of fruiting body near the base of palm. Generally the disease is prevalent in sandy or sandy loam soils in coastal areas where coconut is grown under rainfed conditions and also in neglected plantations. Lack of soil moisture during summer months, water logging in rainy seasons, presence of old infections in the gardens and neglect

of cultural operations were found to be conducive for spread of the disease. The disease incidence was more between March and August and hence it was positively correlated with the mean maximum soil temperature and not correlated with minimum temperature, rainfall and relative humidity. Trunk infestation with the scolytid beetle, *Xyleborus perforans* and the weevil, *Diocalandra stigmaticollis* accelerate the death of the palm.

Management

Removal of dead palms, palms in advanced stages of the disease and destruction of the bole and root bits of these palms is important to reduce inoculum build up in the garden. The disease can be effectively controlled by following integrated management practices as listed below during early stage of the disease:

- Application of recommended dose of fertilizers (N:560, P:320 and K:1200 g) in two equal splits during (June-July and December-January) and provide irrigation (45 to 50 litres per palm per day) during summer.
 - Avoid flood irrigation or ploughing in infected gardens to prevent spread of the inoculum.
 - Isolation of diseased palms from healthy palms by digging isolation trenches of 1m deep and 30cm wide.
 - Basal application of neem cake (5kg) enriched with *Trichoderma harzianum* (CPTD28) per palm, provide irrigation followed by mulching around the palm basin. This treatment has to follow at quarterly intervals up to one year.
- Or
- Root feeding with 100 ml of 2% hexaconazole 5EC and basin drenching with 40 litres of 0.2% hexaconazole 5EC or 1% Bordeaux mixture at quarterly intervals up to one year.

For further interaction, please write to:

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