

of bark on the stem near ground level shows internal discoloration of tissues.

Favourable factors

Very low and high soil temperature for long duration, poor physical conditions of soil, moisture stress on account of low rain fall, inadequate shade and wounds on the roots are the factors favouring the disease development.

Integrated disease management

- ❖ Uproot and destroy the infected plants.
- ❖ Provide balanced nutrients, apply organic manure and agricultural lime (once in three years) to boost the vigour of the coffee bushes and to maintain the soil health.
- ❖ Protect the coffee plants from exposure to high winds by developing proper wind belt. Maintain adequate overhead shade.
- ❖ In diseased area, supply/replanting must be taken up with grafted plants (robusta root stock and arabica scion).
- ❖ For the infected plants, drench the soil in drip circle with fungicide propiconazole 25% EC 2 ml/liter @ 15 to 20 liters per plant (based on the age and spread of the root system) which are showing partial wilting symptoms.
- ❖ Treat the neighbouring plants with bioagent *Trichoderma* enriched compost/farmyard manure (100 kg compost enriched with 10 kg *Trichoderma harzianum*) twice in a year when sufficient soil moisture exists.



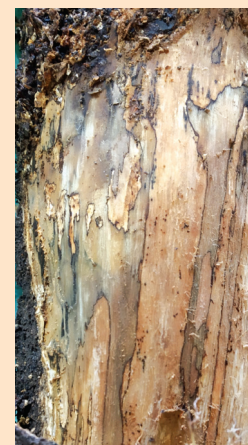
Yellowing of leaves



Wilting of coffee plant



Brown encrustation below collar region
- Brown root disease



Interwoven brown wavy lines of fungal growth
- Brown root disease



Red root disease



Brown to pinkish discoloration at pith region (Santavery root disease)

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INTEGRATED MANAGEMENT OF ROOT DISEASES



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Brown, red and Santavery are the three types of root diseases noticed in coffee plantations. The first two are geneally observed in both Arabica and Robusta coffee, while Santavery root disease is specific to Arabica coffee. All the root diseases are caused by fungal pathogens. The occurrence of root diseases are sporadic in nature but are important as it causes the death of coffee plants as well as valuable shade trees in coffee plantations. Even though Santavery root disease incidence is confined to Arabica coffee in certain rain shadow areas, the damage is considerable in the affected regions due to sudden death of several coffee plants at prime age of yielding.

Symptoms of Brown root disease (Causal Organism: *Phellinus noxius*)

- ❖ Aerial symptoms of infected plants shows gradual wilting, yellowing of leaves and defoliation followed by death of entire plant.
- ❖ At later stage, stem portion near the ground become soft and spongy.
- ❖ Thick brown encrustation of the pathogen adhered with small stones is noticed on the tap root and secondary roots just below the collar region.
- ❖ Infected roots will be very brittle and easily break off.
- ❖ Close observation of the infected root reveals the presence of closely interwoven brown thread like fungal growth.
- ❖ Interior of the roots show dark brown to black wavy lines formed by fungal growth.

Symptoms of Red root disease (Causal Organism : *Poria hypolateritia*)

- ❖ Diseased plants show gradual yellowing of leaves, wilting of branches and defoliation followed by death of the entire plant.

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- ❖ Root system of dying or dead coffee plants shows red coloured encrustation of the fungal growth covered with soil and gravel mostly adhering at collar region.
- ❖ The surface of freshly infected bark of affected root appears deep red colour when washed under running tap water.
- ❖ In advanced stages of the disease, reddish encrustation turns to black colour.
- ❖ Profuse growth of fungus is generally confined on the outer surface and internal bark region.

Favourable factors for brown and red root diseases

- ❖ The fallen wooden logs and felled shade tree stumps in coffee plantation serve as substrate for the multiplication of the pathogen.
- ❖ Disintegrating debris of the infected coffee plant, shade tree stumps, wooden logs of shade tree serve as primary source of inoculum in coffee plantations.
- ❖ Soil with low pH and low organic matter content favours the multiplication of the pathogen and its spread.

Integrated disease management

- ❖ Uproot and destroy the infected shade trees and coffee plants to reduce the inoculum.
- ❖ After timber extraction, the cut ends of the stumps must be immediately smeared/pasted with coal tar or waste oil two to three times in a year.
- ❖ Remove the fallen logs and felled shade tree stumps at the earliest from the coffee plantation instead of allowing for decomposition.
- ❖ Isolate the affected area including one row of apparently healthy adjoining plants all around with 2 ft deep and 0.5 ft wide trenches.
- ❖ Soil taken out from the trenches should be placed inside the affected area. The trenches should be cleaned at least once in three months.
- ❖ Apply 2 to 3 kg of agricultural lime and turn the soil in the pits where infected coffee plants and shade trees were uprooted.

- ❖ Also apply the agricultural lime to the affected areas inside the trench and take up the cover digging during the dry period to expose the soil to sunlight.
- ❖ Planting in the affected areas must be done only after exposing the pits to sunlight for 6 to 8 months. Apply *Trichoderma* enriched compost/farmyard manure (100 kg compost enriched with 10 kg *Trichoderma harzianum*) to the pits before supply planting and to the neighbouring healthy coffee plants in the affected area twice in a year when sufficient soil moisture exists.
- ❖ Drench the base of plants showing initial wilting symptoms with propiconazole 25% EC @ 2 ml/liter twice in a year (pre- and post-monsoon). The fungicide solution should be drenched @ 15 to 20 litres per plant each time based on size and age of the bush.

Santavery root disease

Santavery root disease is caused by the fungus *Fusarium oxysporum f. sp. coffeae*. Generally, *Fusarium* spp. are known to cause vascular wilts and root rot of several economic crop plants including coffee. This is a soil inhabiting saprophytic fungus and can survive on the plant debris. This disease is confined to certain localities of Eastern Giri, Upper Giri and Mallandur zones of Chikkamagaluru district, Karnataka and Yercaud region of Tamil Nadu. The disease causes considerable damage in the endemic areas as it kills several plants at their peak yielding age.

Symptoms

- ❖ Sudden wilting, yellowing of the leaves followed by defoliation and death of aerial parts of infected plants are the characteristic symptoms of the disease.
- ❖ Transverse section of root shows brown to pinkish discoloration at pith region. Scraping

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