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ROOT WILT DISEASE OF COCONUT PALM AND WATER BALANCE

Introduction

Coconut palms in Kerala are afflicted by a serious malady characterized by wilting of the crown and is popularly described as root wilt disease (RWD) or Kerala wilt. This disease is wide spread in the eight southern districts of Kerala, with sporadic occurrences in some northern districts and also in some districts in the adjoining Tamil Nadu. In Kerala the disease is prevalent in all the major soil types. Relatively higher incidence is seen in water-logged, low-lying areas adjacent to rivers and canals. Palms of all ages are found to be susceptible to the disease.

The RWD is only a debilitating disease with marked decline in nut yield. However, palms in early stages of the disease respond favourably, both in terms of decrease in disease intensity and nut yield, to a set of management practices in the field.

Disease symptoms

The disease is characterized by flaccidity of leaflets of middle and outer whorl of leaves as the primary symptom. To begin with, the upper whorl of leaves shows flattening and bending of leaflets, progressively leading to drooping or wilted appearance by the time the leaves reach middle whorl. In the advanced stage of the disease, the bending of leaflets from two sides of the midrib gives the appearance of ribs of a human skeleton. Premature yellowing of older leaves, drying up of spadices and premature shedding of nuts are the associated symptoms.

Intensity of the symptoms varies according to age of the palms. Trees below ten years rarely exhibit yellowing, but with advancement in age yellowing and necrosis become prominent. Softening and whitening of the central shoot is another symptom. The root system of diseased palms gets damaged with significant reduction in the number of active roots and diameter of the bole. The percentage of dead roots is higher in diseased palms than in healthy ones. The roots of the diseased palms also exhibit poor regeneration capacity. Majority of diseased roots are characterized by deranged permeability. Root sap from diseased palms contains more dry solids than that from healthy palms.

Water uptake

The uptake of water is affected in RWD palms. While a single root of a healthy palm could absorb 250 to 500 ml per day, that of a diseased palm could take upto 150 ml or less per day. The uptake and upward transport of water through the trunk in diseased palms is much less than that of healthy palms. Roots of diseased palms show greater depletion of carbohydrates, reduced C/N ratio and increased respiration rate as compared to roots of healthy palms. Higher activities of polyphenol oxidase and peroxidase, cellulase and pectinylase have also been recorded in the roots of RWD palms than in those of healthy palms.

Leaf characteristics

In the diseased leaf, degeneration of chloroplasts, less cuticular deposition and reduced lignin content in the cell wall have been reported by many investigators. Mature leaflets of diseased palms are thinner than those of healthy palms. There are differences in the rates of cell division in the transverse and longitudinal planes. This results in the slight downward curling of leaflets. There is also reduction in the wall thickness of cells in mechanical sclerenchymatous fibres and bundle sheaths, leading to loss of rigidity in hypodermis of the leaflets of diseased palms. RWD palms also show higher stomatal frequency than the healthy palms. An abnormal stomatal opening in the infected palms with impaired regulation leading to excessive water loss, irrespective of time of the day or season or growing conditions has also been noticed.

Stomatal regulation

The water balance of palms is more protected in the 'dry' than in the 'wet' season. Healthy palms usually exhibit relatively high stomatal resistance in response to dry weather. However, the disease has been found to affect the stomatal regulation in both the seasons, though with greater magnitude in the dry than in the wet season. This indicates that the diseased palms could be distinguished from healthy palms better during the dry than during wet season. The differences in the relative humidity between the two seasons also influence the stomatal regulation. It could be inferred that healthy palms develop a protective mechanism, in response to the prevailing dry conditions, to regulate their water

balance through an effective stomatal system, while this protective mechanism appears to have been impaired in RWD palms. With the advancement of the disease there is greater disturbance in stomatal regulation resulting ultimately in excessive transpiration.

Leaf water potential

As a consequence of impaired stomatal regulation, the leaf water potential components of infected palms are affected. Diseased palms have consistently lower leaf water potential than the healthy palms at any given time. The nature of symptoms on the leaflets of different whorls of leaves i.e., of different physiological ages, reflects the changes in leaf water potential. Although the most perceptible symptom of the disease viz., flaccidity occurs on middle whorl leaves, changes in leaf water potential begin early in the spindle leaf. This shows that changes in leaf water potential precede foliar symptom expression.

Relationship between water balance and the flaccidity symptom

Changes in the overall water relations of diseased palms appear to be associated with the development of flaccidity symptom. In palms affected by RWD, excessive transpirational water loss through abnormal stomatal opening is not replenished adequately. This happens because the uptake of water by roots is significantly affected and the water trans-

port hindered. The imbalance in the water economy of palm caused by deranged root system and impaired stomatal regulation ultimately culminates in an irreversible flaccidity symptom of leaves through changes in leaf water potential components.

The appearance of distinct flaccidity on the middle whorl leaves is not a consequence of any sudden event, but rather the result of progressive changes beginning at the spindle leaf stage. There is only little difference in leaf water potential between the leaves of middle and outer whorls.

Evidences show that the overall disturbances in the water relations definitely precede the manifestation of flaccidity symptom. The uniqueness of RWD is the impairment

caused to both aspects of water transport i.e., absorption and transpiration, leading to internal water stress, the degree of which depends on the intensity of the disease.

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