

B. Srinivasulu, K. Vijay Krishna Kumar, K. Aruna and D.V.R. Rao

Integrated disease management of basal stem rot in coconut

Biocontrol of diseases in plantation crops is the order of the day owing to ecological disturbances posed by chemical management practices. Moreover, biocontrol of basal stem rot disease in coconut with potential biocontrol agent, *Trichoderma viride*, fortified in neem cake offers a solution. The BSR-IDM package with biocontrol as main component has been developed, costing Rs 2,700/acre.

IN India, coconut is grown in 1.84 million ha, predominantly in Kerala, Tamil Nadu, Karnataka and Andhra Pradesh with a production of 12,597.3 million nuts and a productivity of 6,847 nuts/ha annually. Its palms are normally affected by various insect pests and diseases resulting in reduction in yields. Among fungal diseases, basal stem rot (*Ganoderma* wilt) caused by *Ganoderma applanatum* and *G. lucidum* is most destructive especially in light soils of Andhra Pradesh. The disease is also reported from Tamil Nadu (Tanjavur wilt), Karnataka (Anabe roga), Kerala, Maharashtra, Gujarat and Orissa.

Though, several control measures have been reported, the results are inconsistent and not much work has been done relating to ecological sustainability. Hence, present investigation was taken up to develop biocontrol-based integrated disease management (BSR-IDM) package against basal stem rot disease in coconut.

Basal Stem Rot

The pathogen first infects root system and during the early stage of infection no external disease

symptoms are clearly visible. Decay and death of fine roots is first underground symptom of disease. The first characteristic visual symptom of disease is exudation of reddish-brown viscous fluid from basal portions of stems. The bleeding patches begin from base and extend up to 3 m above the base with discolouration of stem as disease progresses. In crown, leaflets of outermost whorls exhibit wilting symptoms. Later on, leaves of one or two outer whorls turn yellow. They exhibit light to moderate browning followed by drooping.

As disease advances, remaining leaves also droop down in quick succession leaving only the spindle with a new unhealthy leaves around. As the disease progresses, normal development of flowers and bunches is arrested, leading to button shedding and nuts become barren. Finally, all the leaves droop and fall leaving the decapitated stem. Stem shrivels and dries up. Sporophores of the fungus appear at the base of the trunk in some palms prior to wilting or just after the death of the palm.

The disease incidence is generally intense in light soils than in heavy

soils. The spread of the disease is found to be more during summer months and the disease spread is positively correlated with mean maximum soil temperature, and negatively related with, rainfall and rainy days. The vertical spread of the disease on coconut is completely arrested by stagnation of water under field conditions. Further, it is observed that the disease incidence is predominantly more in sandy soils and red soils while it is almost negligible in coconut palms raised in black soils.

Management: Among different chemicals screened under *in-vitro* conditions against basal stem rot pathogens, Bordeaux mixture (1%), copper oxychloride (0.3%), Bitertanol (0.1%), Tridemorph (0.1%) and Triademifon (0.1%) are found inhibitory to both the species of the pathogen. Field experiments conducted with different fungicides and neem cake, soil drenching with 1% Bordeaux mixture (40 litres/palm) and root feeding with Tridemorph (6 ml/palm) are also effective in reducing the disease. However, all the aforesaid chemicals are found inhibitory to the native isolates of *Trichoderma* spp. *In-vitro*

studies further proved that neem cake is a suitable substrate for mass multiplication of native *Trichoderma* spp. Further, neem cake has an advantage of inhibiting the growth of *Ganoderma* spp. Field studies with different treatments evaluated against the disease revealed that a combination of 50 g talc powder formulation of *T. viride* and neem cake @ 5 kg/palm/year, is an ideal ecofriendly IDM strategy in combating the disease on coconut. Based on the studies an IDM package against BSR disease of coconut is evolved.

The BSR-IDM package

- The diseased part of the garden should be isolated from healthy area by digging isolation trench (1 m and 0.5 m width).
- Remove and burn diseased and dead palms along with roots. The pits for replanting should be filled with a mixture of soil and farmyard manure in equal quantities along with 50 g of *T. viride*, talc powder + 1 kg neem cake.
- Injury or damage to roots and pruning or cutting of roots should be avoided to prevent the chances of soil-borne pathogen gaining entry through injured roots.
- Since the disease is more severe in light soils with poor water-holding capacity, raising and ploughing *in situ* green manuring crops like sunhemp, *Sesbania* and *Dhaicha* is advised to increase soil organic matter and antagonistic microflora.
- Seedlings from *Ganoderma* infected gardens should be avoided for new gardens.
- Frequent watering/irrigation should be done during summer months. Care should be taken to avoid flow of water from diseased trees to healthy ones. Basin irrigation to individual palms is recommended.

- Application of talc formulation of *T. viride* (50 g) in combination with 5 kg neem cake/palm/year is recommended in a garden where diseased palms are noticed.
- To manage this disease, care should be taken that even if one diseased palm is noticed in a garden, the treatment, i.e. talc formulation of *T. viride* (50 g) in combination with neem cake (5 kg)/palm/year should be imposed to all the palms in the garden.
- The biocontrol agent (*T. viride*) should not be applied in combination with fungicides especially with Bordeaux mixture.

On-farm demonstration

The developed IDM package was demonstrated at farmers' gardens in five villages—Gannavaram, Vodalarevu, Munjavarapukottu, Appanapalli and Uppalaguptam—of East Godavari District. Coconut gardens with *Ganoderma* sick soil were selected in villages and the IDM package was imposed to the diseased as well as to the apparently healthy palms. Over a period of two years, the palms did not show further progress of the disease and no spread to the healthy palms was noticed. Economic analysis was carried out to the developed package.

The economic analysis of the important components of IDM package shows that for isolating the diseased palms from healthy palms, destruction of severely affected/dead palms and for application of talc formulation of *T. viride* @ 50 g in 5 kg neem cake for 60 palms in an unit area (acre), an amount of Rs 2,700 has to be incurred. Since the package/treatment has to be adopted for three consecutive years, the total cost to be incurred amounts to Rs 8,100 (2,700 × 3). If management practices are not adopted, death of the palms in the garden is the ultimate manifestation

of this debilitating disease, resulting in total loss of the palms.

In contrary, the palms can be saved by application of the IDM package for three consecutive years. The following is the economic analysis of a neglected garden, which would have yielded had timely ameliorative measures have been taken up with the developed IDM package against this disease: (i) in a garden the number of palms would be 60 (per acre); (ii) the approximate potential bearing period of each tree would be 25 years; (iii) the average number of nuts produced by palm would be 80 per annum; (iv) the cost of each nut would be Rs 3. So the projected benefit over a period of 25 years in an unit area of one acre would be 60 × 80 × 25 × 3, i.e. Rs 360,000. On the other hand, the IDM package if implemented in time, the net projected benefit would be Rs 351,900 (360,000–8,100). Moreover, in the IDM package neem cake is an important component, which is an ideal natural product in controlling several other pests and diseases.

SUMMARY

The BSR-IDM package was demonstrated to farmers. It proved its effectiveness in managing basal stem rot in coconut economically. It is ideal for growers.

For further interaction, please write to: Drs B. Srinivasulu, K. Vijay Krishna Kumar, K. Aruna and D.V.R. Rao, (Scientists), Acharya N.G. Ranga Agricultural University, Agricultural Research Station, Ambajipeta 533 214, East Godavari district, Andhra Pradesh.
