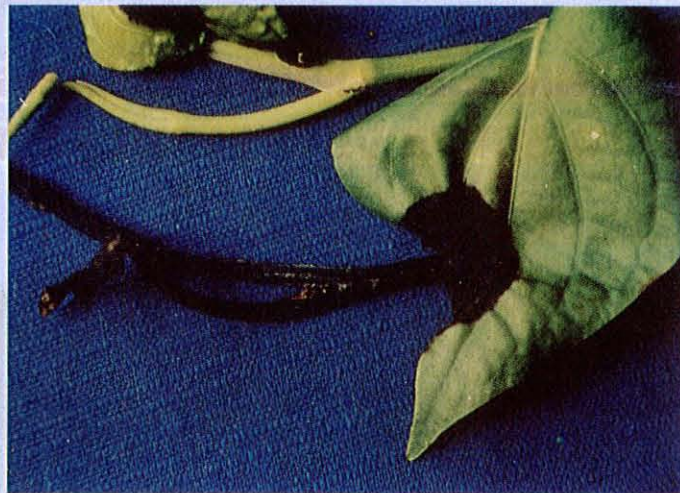


## Managing Phytophthora on black pepper

Since Phytophthora infects all parts of black pepper, to prevent its aerial infection, fungicidal spray is required, whereas to suppress soil populations, biological control may be adopted. Biological control organisms are multiplied on inexpensive carrier media such as tea waste, coffee husk etc. As the biological control organisms survive on the organic matter in soil, application of organic matter enhances their population and suppresses the population of Phytophthora in soil.



The dark spots enlarge rapidly, causing shedding of leaves



Blighting of tender shoots takes place in severe condition



Black spots appear on spikes and at their points of attachment

**B**LACK PEPPER cultivation is threatened by the onslaught of diseases and pests. Among diseases, Phytophthora foot-rot and slow decline which were earlier referred to as 'quick wilt' and 'slow wilt' respectively are very important. It is also a common knowledge that 'quick wilt' is caused by Phytophthora and 'slow wilt' by plant parasitic nematodes. Recent studies indicate that 'slow wilt', now known as slow decline, is the result of feeder root damages caused by *Phytophthora capsici* and plant parasitic nematodes, *Radopholus similis* and *Meloidogyne incognita* either alone or in combinations. The infections caused by *P. capsici* and its management on black pepper have been discussed.

### Symptoms

The fungus *P. capsici* infects all parts of black pepper vine. One or more dark spots with characteristic fimbriate margins develop on leaves during the rainy season. These spots enlarge rapidly within 2 or 3 days. The leaves are shed before the entire leaf is covered by these spots. Spikes of all maturity are affected, black spots appear on spikes at the point of attachment or anywhere on the length of the spike and are shed. The tender shoots arising at the base of the vines and trailing on the ground are affected causing blighting of the tender shoots. The fungus produces its spores on the affected portion which form a white coating on the lesions. Infection may also occur on the main branch or lat-

ral branch, resulting in yellowing and defoliation of the branches beyond the point of attack.

Feeder roots and main roots are also affected, the symptom expression is delayed till a considerable portion of the roots is damaged. The typical wilting symptom is expressed when the collar portion is affected. The collar may be infected through the runner shoots or roots. Infection reaching the collar either through the runner shoots or roots of the upper tier which are closer to the soil level results in sudden wilting of the vine hence it was referred as 'quick wilt' earlier. Whereas, the infection of collar through the roots of the lower tier of roots results in yellowing preceding wilting.

When *P. capsici* infection is confined to feeder root system, gradual yellowing of leaves and defoliation occur. Since the activity of *Phytophthora* is confined to the wet monsoon period, such yellowing vines may remain for more than one season, showing varying degrees of yellowing and defoliation. Such symptoms were previously attributed to unfavourable soil conditions and also to infestation by plant parasitic nematodes, it was referred to as 'slow wilt' which is now called as slow decline. Several years of experimentation have established that slow decline is due to feeder root damages. Infestation by nematodes followed by infection by *Phytophthora* results in rapid death of vines showing slow decline symptoms. Correct diagnosis is essential to take appropriate control measures.

### Management

An integrated management strategy has been developed which includes phytosanitation, cultural practices, chemical and biological control methods. Often the disease is introduced inadvertently through planting materials to new areas. The first and

foremost is the avoidance of the introduction of the disease to new plantations. This could be achieved by collecting disease-free planting material from healthy gardens.

**Phytosanitation:** The fungus takes several years to build up its inoculum. Being a wet weather pathogen, it multiplies only during monsoon period. During the inter-monsoonal dry period, it survives on dead plant debris in soil. The dead vines and severely yellowing vines are the potential source and focus of spread. The moment the disease is noticed on a few vines, such vines must be removed along with root system and destroyed. This would reduce the inoculum for the next season.

**Shade regulation:** At the onset of monsoon, the branches of shade/support trees should be lopped to allow better penetration of sunlight. This would reduce moisture build-up and alter the microclimate under the canopy, reducing the incidence of foliar infections.

**Pruning:** The tender runner shoots which trail on the ground are infected first. These runner shoots are meant for vegetative propagation and may be kept coiled around the basins and removed as and when required or may be tied back to the supporting trees so that these may grow as orthotrophic shoots. If it is not required, it may simply be removed.

**Drainage:** Water stagnation, even if it is temporary for a short period, has adverse effect on the vine as this predisposes the vines to infection by *Phytophthora*. Providing adequate drainage and preventing water stagnation are important aspects of disease management.

**Organic materials:** Organic manures such as farmyard manure and oil cakes like neem oil cake and groundnut cake may be applied @ 1kg/vine. These oil cakes besides serving as nutrient source also support

saprophytic microbial activity. This in turn reduces *Phytophthora* populations as it has a low competitive saprophytic ability and could not compete with saprophytic organisms.

**Minimum tillage:** In black pepper, more than 50% of feeder roots are confined to the top 60 cm of the basins. Care must be taken to avoid damage to the feeder roots during various cultural operations.

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**Chemical control:** Wherever foliar infections are severe, Bordeaux mixture (1%) may be sprayed once during June and next in August-September. To prevent the soil population build-up of *Phytophthora*, drenching with copper oxychloride (0.2%) may be done. Systemic fungicide like potassium phosphonate (0.3%) may be applied both as a foliar spray and soil drenching @ 5 litres/vine twice during the monsoon period. Application of Bordeaux paste (10%) on the vines up to 1m was a practice earlier. Based on the investigations and the information available on the collar infection, the recommendation of application of Bordeaux paste to the collar portion is discontinued as it does not serve any useful purpose.

**Biological control:** As the *Phytophthora* inoculum is soil-borne, the population build-up could be reduced by the use of antagonistic fungi such as *Trichoderma* and *Gliocladium*. Efficient strains of these organisms have been identified and are multiplied in large quantities and supplied to farmers.

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