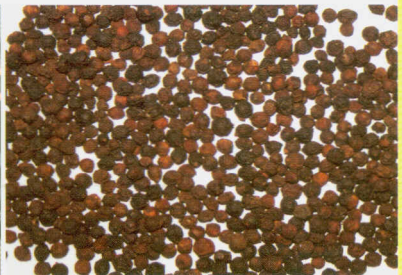


Management of Pepper Wilt Diseases in the Plantation



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अनुप

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India has been traditionally known as a land of spices and especially the Western Ghats region of the country is believed to be the centre of origin of many spices particularly, Black pepper, Cardamom and several zingiberaceous spices. In Goa, pepper is cultivated in 717 hectares area and the total production is 230 tonnes. Yield in black pepper (315 kg/ha) is very low compared to Malaysia (2925 kg/ha). Though many factors contribute towards the low yield, crop loss due to diseases, particularly foot rot in pepper is a serious concern in Goa. Loss due to the incidence of foot rot is severe if not addressed properly at appropriate time. The foot rot pathogen is very versatile and none of the single approach would be effective in the management. In some cases plant parasitic nematodes in association with foot rot fungus cause slow decline. Hence it is recommended to follow an integrated approach to manage the disease problem in the pepper plantations.

1. *Phytophthora* foot rot/ quick wilt (*Phytophthora capsici*)

Symptoms

- Appearance of one or more black spots on tender leaves which have fimbriate margins which rapidly enlarge and cause defoliation.



- Blackening of freshly emerging runner shoots and tender leaves trailing on the soil. The disease spread to the entire vine from these runner shoots during rainy season due to rain splash



- If the infection is at the basal stem region/ collar region, wilting of vines followed by shedding of leaves and spikes with or without black spots is observed. The branches of affected vines break off at the nodes and the entire vine collapses within a month.





- If the damage is confined to the roots, the affected vine exhibits gradual yellowing, defoliation, wilting and drying up of a part of the vine during the post-monsoon period. These vines might recover after the rains and survive for more than two seasons till the root infection leads to collar rot and death of the vine.



- Severe rotting in the root system of the affected plant.



Management

Phytosanitation

- Remove and destroy severely diseased vines along with the root system from the plantation.
- Collect planting material from disease free gardens and from the nursery preferably raised in fumigated soil
- Raise nursery cuttings in solarized / steam sterilized soil fortified with bio-control agents.

Cultural practices

- Provide adequate drainage to prevent water logging especially during the monsoon season.
- Regulate shade in the plantation by pruning with the receipt of pre-monsoon showers.
- Prune emerging runner shoots to prevent the infection spreading to the main stem of the vine.

Chemical control

- Drench plant basins with copper oxychloride 0.2% @ 5-10 lit/vine and spray Bordeaux mixture 1% on the new foliage with the onset of pre-monsoon showers during May-June. The spraying and drenching is to be repeated during August-September and if the monsoon is prolonged, a third round of drenching may be given during October.
- Alternatively, after receipt of pre-monsoon showers during May-June drench the vines with potassium phosphonate 0.3% @ 5-10 lit/vine along with spray of potassium phosphonate 0.3% or drench and spray with metalaxyl-mancozeb 0.125%. Repeat the spraying and drenching during August-September.

Calendar of chemical spray/ drenching

Option I

Spray	Period	Drenching	Spraying
First	May- June (Onset of monsoon)	copper oxychloride 0.2% @ 5-10 lit/vine	Bordeaux mixture 1%
Second	August- September	copper oxychloride 0.2% @ 5-10 lit/vine	Bordeaux mixture 1%
Third	October (In case of prolonged monsoon)	copper oxychloride 0.2% @ 5-10 lit/vine	Bordeaux mixture 1%

Option II

Spray	Period	Drenching	Spraying
First	May- June (Onset of monsoon)	potassium phosphonate 0.3% @ 5-10 lit/vine or metalaxyl-mancozeb 0.125% @ 5-10 lit/vine	potassium phosphonate 0.3% or metalaxyl-mancozeb 0.125%
Second	August-September	potassium phosphonate 0.3% @ 5-10 lit/vine or metalaxyl-mancozeb 0.125% @ 5-10 lit/vine	potassium phosphonate 0.3% or metalaxyl-mancozeb 0.125%
Third	October (In case of prolonged monsoon)	potassium phosphonate 0.3% @ 5-10 lit/vine or metalaxyl-mancozeb 0.125% @ 5-10 lit/vine	potassium phosphonate 0.3% or metalaxyl-mancozeb 0.125%

Biological control

- Apply bio-control agents such as *Trichoderma harzianum* after receipt of pre-monsoon showers during May-June around the base of the vine
- Apply *Trichoderma* @ 50 g/vine (containing 10^8 CFU/g of formulation).
- Repeat the application during August-September.
- *Pseudomonas fluorescens* @ 50 g/vine (10^8 CFU/g of formulation) may also be applied along with *T. harzianum*.
- Add organic mulches, farmyard manure and oil cakes in the basins.
- Spray of potassium phosphonate 0.3% or Bordeaux mixture 1%.
- In case bio-control agents are applied, drenching with copper oxychloride is to be avoided.

2. Slow Decline (*Radopholus similis*, *Meloidogyne incognita* and *Phytophthora capsici*)

Symptoms

- Foliar yellowing, defoliation and die-back of vines during the post-monsoon season. The diseased vines exhibit foliar yellowing from October onwards coinciding with depletion of soil moisture. With the onset of south west monsoon during May-June, some of the affected vines recover and put forth fresh foliage. However, the symptoms reappear in subsequent seasons after the cessation of the monsoon and the diseased vines gradually lose their vigour and productivity.
- The root system of diseased vines shows varying degrees of necrosis / lesions / galls due to infestation by plant parasitic nematodes leading to rotting of feeder roots.

Management

- Follow all the management practices suggested for foot rot disease as both foot rot pathogen and nematode combination cause slow decline. In addition practice the following methods for nematode control.
- Use nematode-free planting material in the plantation.
- Exclude nematode susceptible intercrops and supports to minimise nematode infestations in the field.
- Apply neem cake @ 2 kg/vine during May-June and August-September.
- Apply bio-control agents such as *Pochonia chlamydosporia* after receipt of pre-monsoon showers during May-June around the base of the vine @ 50 g/vine (containing 10^8 CFU/g of formulation). Repeat the application during August-September.
- In case the nematode infestation is severe, apply carbofuran 3G @ 100g/ vine or phorate 10G @ 30 g/ vine after receipt of pre-monsoon showers during May-June and repeat application during August-September.

Bordeaux mixture (BM) preparation for its use in plantation crops

Preparation of 1 per cent Bordeaux Mixture (1:1:100)

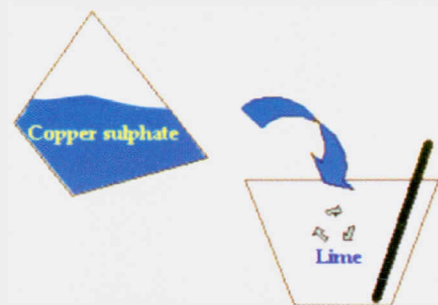
1. Dissolve one kilogram of copper sulphate in fifty litres of water in a plastic bucket.
2. Dissolve one kilogram of quick lime in fifty litres of water separately in a plastic bucket.
3. Pour copper sulphate solution into the lime water slowly with constant stirring using a wooden stick.
4. The mixture is to be tested before use for the presence of free copper which is toxic to the plants. Dip a polished blade/ knife in the mixture. If the blade shows a reddish colour, add lime to the

mixture till the blade does not show staining on dipping.

5. Bordeaux mixture should be sprayed while fresh.
6. Don't store it on standing; it loses its fungicidal property. However the mixture may be stabilized by adding sugar or jaggery at the rate of 1Kg in 100 Litres of mixture. The stabilized mixture can be used within 3-4 days.

Precautions

- The solution should be prepared in earthen, wooden or plastic vessels. Avoid using metal containers for the preparation as it is corrosive to metallic vessels.
- Always copper sulphate solution should be added to the lime solution, reversing the addition leads to precipitation of copper and resulted suspension is least toxic.



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