

results in spike shedding. The affected berries shows brown sunken patches, the discolouration gradually increases and the berries show the characteristic cross splitting. The infection is noticed during the time of spike emergence (June).



Management

- Premonsoon prophylactic spray with 1% Bordeaux mixture will control the disease.

4. Yellow mottle disease/ stunted disease

This disease is caused by pepper *yellow mottle virus* and *cucumber mosaic virus*. The leaves become small and narrow with varying degrees of deformation and appear leathery, puckered and crinkled. Chlorotic spots, yellow flucking, dark green vein banding are also seen on the leaves. Internodes/ vines become abnormally short. Affected vines seldom die but continue to decline



Management

- Regular monitoring and removal of infected vines and burning.
- Raise cuttings from disease free vines and avoid even normal vines from infected garden.
- Control insect vectors by spraying and drenching of *Lecanicillium lecanii* @ 1 kg/ 100 l or by spraying dimethoate @ 0.15% (1.5 ml/l)

5. Phyllody

It is a phytoplasma disease. The affected vines show varying degrees of malformation of spikes and flowers. The stalks of spikes get elongated and floral buds in the spike show abortion and get transformed narrow leaf like structures.



Management

- Infected vines must be uprooted and destroyed and planting material should be collected from disease free vines

6. Little leaf

This is a viral disease. The affected plants exhibit shortening of the nodes and internodes. The leaves appear very small and narrow, thick and leathery with chlorotic spots.

Management

- Do not collect planting material from diseased vines
- Remove and destroy the affected vines to prevent further spread of the disease

7. Yellowing disease

This is a serious problem prevailing in the highranges. The occurrence of this disease may either be due to the infection of *Phytophthora* and attack of root mealy bugs or nematode infestation coupled with moisture stress and malnutrition. Regular monitoring and proper management of the above causes can curtail the disease.



Published by:
Kerala Agricultural University &
Indian Council of Agricultural Research

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AICRP ON SPICES
INDIAN COUNCIL OF AGRICULTURAL RESEARCH



Black Pepper Integrated Disease Management



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Black pepper is known as “King of Spices” and is the most widely used spice in the world. Yield of black pepper is adversely affected by diseases in the nursery as well as in the main field. Yield loss can be minimized by the proper management of these diseases. Major diseases of black pepper and its management measures are given below.

NURSERY DISEASES

1. Foot rot (*Phytophthora capsici*)

This disease can be seen in nurseries as well as in the main field. The fungus *Phytophthora capsici* is the causal organism and initial symptoms start as appearance of irregular black lesions with the concentric rings on the leaves which rapidly enlarge. Infection of collar region and root results in rotting of roots, foliar yellowing and heavy defoliation.



Management

- Use *Trichoderma* enriched potting mixture for raising rooted pepper cuttings
- Foliar application of 1% Bordeaux mixture and drenching with 0.2 % copper oxy chloride (2 g/litre) could effectively manage the disease
- Spray and drench with 2% *Pseudomonas fluorescens* is also effective against the disease

2. Anthracnose (*Colletotrichum gloeosporioides*)

The fungi infect leaves causing angular to irregular leaf spots (yellowish brown to dark brown in colour) with a chlorotic halo.



Management

- Alternate spraying with 1 % Bordeaux mixture and 0.1 % carbendazim (1 g/litre) is effective
- Spraying with 2% *P. fluorescens* is also effective against the disease

3. Leaf rot and leaf shedding (*Rhizoctonia solani*)

This disease is noticed during April- May. The fungus attacks the leaves and shoots resulting in deep ash to brown spots which later wither and finally leads to death of rooted cuttings.



Management

- As a curative measure spray with 1.0% Bordeaux mixture.

Other diseases

Several fungal pathogens like *Pythium*, *Sclerotium rolfsii* and nematodes like *Radopholus similis* and *Meloidogyne incognita* also affect seedlings in the nursery resulting in ill health and death of the vine.

Management

- Infected vines must be uprooted and destroyed
- Select quality disease free vines for raising pepper cuttings
- Field Sanitation and timely plant protection measures need to be followed in nursery

MAIN FIELD DISEASES

1. Foot rot (Quick wilt)- (*Phytophthora capsici*)

This is the most destructive disease caused by *P. capsici* and is prevalent in all pepper growing tracts of Kerala. The fungus survives on the infected plant debris remain on soil and the disease is generally noticed during June to September coinciding with the South-west monsoon. Initial symptoms start as appearance of black spot on the leaves which rapidly enlarge and cause defoliation. Infection of collar and root results in brown discoloration on the root tips, later leads to the rotting of roots, foliar yellowing and heavy defoliation.



Management

1. Remove and destroy the infected vines along with their root system and always select disease free rooted cuttings for planting

2. Excessive shade should be avoided and adequate drainage must be provided in the field
3. Use *Trichoderma* enriched potting mixture for raising rooted pepper cuttings
4. Application of *Trichoderma* enriched cowdung- neemcake mixture @ 5 kg and mycorrhizal culture @ 25 g/ vine in the basin before the onset of monsoon
5. Spray and drench with 2% *P. fluorescens* (20 g/litre) at monthly intervals is also found to be effective
6. As a curative measure, vines need to be drenched with 0.2 % copper oxy chloride (2 g/litre) @ 5 litre plants⁻¹ followed by foliar application of 1% Bordeaux mixture before the onset of monsoon
7. Drenching and spraying with 0.3% potassium phosphonate (3 ml/litre) @ 5 -10 litres / vine depending on the age of the plant is also found effective

2. Slow decline (Slow wilt)

This disease is a fungal nematode complex coupled with moisture stress and malnutrition. The infected vine may survive for 2-3 years and gradually lose its vigour and productivity. Foliar yellowing, die back of aerial stems, interveinal chlorosis and flaccidity of leaves are some of the foliar symptoms. The root system of diseased vines show varying degrees of root rot. Such damage to root tissues leads to rotting of feeder roots.



Management

- Raise rooted cuttings in solarized nursery mixture
- Apply green mulch of *Eupatorium odoratum* @ 45 tonnes/ha
- Select standards tolerant to nematodes such as *Garuga pinnata* and *Erythrina indica*

3. Pollu disease/ Anthracnose (*Colletotrichum gloeosporioides*)

Initially the symptom appeared as yellow spot on the leaves which later turns brown to black in colour. Infection in the peduncle of the spike