

HOW TO PREVENT THE MOST SERIOUS DISEASES OF BLACK PEPPER (*Piper nigrum* L.) – A CASE STUDY OF VIETNAM

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At present, soil-borne diseases and pests are the main problems confronting the development of pepper production in Vietnam. Results of studies on diseases and pests in black pepper showed that there are five major species of fungi, in which *Phytophthora capsici* is the most destructive fungus; two species of nematodes and mealy bug are two main pests of black pepper.

Foot rot or quick wilt caused mainly by *Phytophthora capsici* and slow decline caused by nematodes, mealy bug and other soil-borne fungi are main factors causing the degradation of pepper gardens. In many pepper orchards, these two diseases brought about slow growth and death of pepper vines, in some cases 100% pepper vines died off.

Good drainage in the rainy season, water-saving irrigation including drip irrigation and under-shade sprinkler minimise the spread and contamination of diseases, and significantly reduce the incidence and yield loss of pepper gardens. However, there are no evidence about the effectiveness of the drainage on the population of nematodes in soils and pepper roots.

Liming and treatment of soils before planting with some chemicals, such as Bordeaux mixture, Hexaconazol, Mancozeb, Fosetyl Aluminium, Methidathion, Ethroprophos and Copper Hydroxide, are effective practices for the management of foot rot and slow decline.

Mulching and planting of cover crops, such as *Arachid pintoii* and *Stylosanthes* sp., do not reduce the population of destructive micro-organisms but these measures help to improve soil nutrients and regulate soil humidity, hence improve plant health.

Timely application of manure and micro-nutrients with micro-organism products, namely *Trichoderma harzianum*, *Pseudomonas fluorescens* and *Bacillus* sp. help to limit the development of foot rot and slow decline in black pepper.

The integrated crop management of black pepper is considered the best practice in limiting the outbreak of soil-born diseases of black pepper, this procedure help to keep a stable yield of black pepper gardens and contribute to a sustainable development of black pepper.

Table 1. Major diseases and pests on black pepper in Vietnam

Order	Diseases and pests	Causal agents	Infected parts	Level
1	Foot rot	<i>Phytophthora capsici</i>	Collar region, roots	+++
2	Slow decline	<i>M. incognita</i> , <i>R. similis</i>	Roots	+++
3	Stunted	PYMV, CMV, TMV, Badna virus	Leaves, shoots	+
4	Root rot	<i>Rhizoctonia</i> sp., <i>Fusarium</i> sp.	Collar	++
5	Leaf spot	<i>Diplodia</i> sp.	Leaves	+
6	Leaf blight	<i>C. gloeosporioides</i>	Leaves	++
7	Algae leaf spot	<i>Cephaleuros virescens</i>	Leaves, branches, fruits	++
8	Mealy bug	<i>Pseudococcus</i> sp.	Leaves, branches, fruit spikes, stem, collar	++

Note: (+++) very popular; (++) popular; (+) rare

Table 2. Main causes of foot rot of black pepper in major pepper growing areas of Vietnam

Causes	Evaluation [†] (%)
Runoff water from infected gardens	96.1
Soils of high humidity	68.6
<i>Phytophthora capsisi</i>	
Nematodes	31.3
Unbalance fertilization	27.4
Clean weeding	13.7
Susceptible cultivars	11.7
Mealy bug	5.8
Excessive irrigation	9.8
Inherent fungi	5.8
Bumping crop	3.9
Heavy rain	1.9
Deep planting, no ridging	1.9

Note: [†] compared with normal case

Table 3. Prevention and control measures for foot rot and slow decline

Prevention and control measures	Effectiveness [†] (%)
Good drainage systems	94.1
Plant health maintenance	58.8
Organic fertilizer application	49.8
Balanced inorganic fertilizer application	48.3
Agro-chemicals and bio-fungicide application	47.6
Cover crops, mulching	39.8
Liming	33.3
Foliar fertilizer application	1.9
Limited upturning soil	1.9
Ridging, shallow planting	1.9

Note: [†] compared with farmers' practice