

Research Notes

Integrated management of foot rot of black pepper (*Piper nigrum*) caused by *Phytophthora capsici*

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India is known as the land of spices and among the spices grown in India, black pepper (*Piper nigrum* L.) is popularly known as the black gold. Diseases continue to be the main production constraint in black pepper. In India, although 17 diseases have been reported, foot rot caused by *Phytophthora capsici* Leonian and A. Alizadeh and PH Tsao (Tsao, 1991) is the major disease occurring in all black pepper growing tracts (Sarma *et al.* 1991). Joseph Thomas and George (1992) reported partial wilting of pepper vines upto 62 per cent and complete vine death upto 41.5 per cent in the hilly terrains of western ghats. Since all the ruling high yielding cultivars are highly susceptible, an investigation was carried out for an integrated management of this disease. Two field trials were conducted during 1999-2001 at Horticultural Research Station, Pechiparai by selecting uniform sized Panniyur-1 pepper vines with the following 10 treatments tried in a randomized block design replicated thrice.

- T₁ *Pseudomonas fluorescens* - commercial formulation pre and post monsoon. soil application and foliar spray
- T₂ Neem cake @ 1 kg/vine : applied pre monsoon soil application
- T₃ Bordeaux mixture (1%): pre and post monsoon soil and foliar application
- T₄ Metalaxyl MZ. 0.1%: pre and post monsoon soil and foliar application
- T₅ Neem cake @ 1 kg/vine : applied pre monsoon soil application + Metalaxyl MZ. 0.1%: pre and post monsoon soil and foliar application
- T₆ Bordeaux mixture (pre monsoon soil and foliar application + *P. fluorescens* commercial formulation pre and post monsoon soil application and foliar spray

- T₇ Metalaxyl MZ (0.1 %) (Pre monsoon soil and foliar application) + *P. fluorescens* commercial formulation pre and post monsoon soil application and foliar spray
- T₈ Neem cake @ 1 kg/vine : applied pre monsoon soil application + Bordeaux mixture (pre monsoon soil and foliar application) + *P. fluorescens* - commercial formulation pre and post monsoon soil application and foliar spray
- T₉ Neem cake @ 1 kg/vine: applied pre monsoon soil application + Metalaxyl MZ (0.1%) (Pre monsoon soil and foliar application) + *P. fluorescens* - commercial formulation pre and post monsoon soil application and foliar spray
- T₁₀ Control.

Soil and foliar applications of native isolate of *P. fluorescens* was done at a concentration of 1.0 and 0.5 per cent respectively. The pepper vines were uniformly fertilized with other recommended crop management operations. No other fungicides were given. The trial was replicated four times and in each replication ten plants were maintained. The observations on disease incidence on leaf, branch and spike, wilt incidence and yield attributes viz. number of berries/spike, green berry yield/vine and dry berry yield/vine were recorded. The cost benefit ratio for the integrated management of foot rot incidence in the pepper garden was worked out for the different treatments based on the price fixed by Tamil Nadu Agricultural University, Coimbatore.

The treatment consisting of soil application of neem cake 1 kg/vine plus pre monsoon soil and foliar application of metalaxyl MZ (0.1%) plus pre and post monsoon foliar spray (0.5%) and soil application (1%) of *P. fluorescens*

Table 1. Integrated management of foot rot disease incidence in black pepper

Treatment	Disease incidence (%)*			
	Leaf	Branch	Spike	Vine
<i>P. fluorescens</i> (CF) pre and post monsoon SA and FA	9.60 (18.10)	12.74 (20.90)	14.80 (22.63)	7.5 (13.82)
Neem cake @ 1 kg/vine pre monsoon SA	14.90 (22.80)	17.40 (24.70)	19.80 (26.40)	7.5 (13.82)
Bordeaux mixture (1%) pre and post monsoon SA and FA	9.34 (17.76)	11.46 (19.85)	13.20 (21.30)	7.5 (11.25)
Metalaxyl-MZ (0.1%) pre and post monsoon SA and FA	4.82 (12.76)	6.36 (14.62)	6.60 (14.90)	2.5 (4.61)
<i>P. fluorescens</i> (CF) pre and post monsoon SA and FA + Neem cake @ 1kg/vine pre monsoon SA	9.10 (17.40)	12.00 (20.27)	14.40 (22.30)	7.5 (13.82)
<i>P. fluorescens</i> (CF) pre and post monsoon SA and FA + Bordeaux mixture (1%) pre monsoon SA and FA	6.24 (14.50)	8.72 (17.20)	8.30 (16.76)	2.5 (4.61)
<i>P. fluorescens</i> (CF) pre and post monsoon SA and FA + Metalaxyl-MZ (0.1%) pre monsoon SA and FA	3.94 (11.45)	5.04 (12.99)	6.60 (14.89)	2.5 (4.61)
Neem cake @ 1kg/vine pre monsoon SA + <i>P.fluorescens</i> (CF) pre and post monsoon SA and FA + Bordeaux mixture (1%) pre monsoon SA and FA	4.96 (12.90)	6.41 (14.65)	9.10 (17.50)	2.5 (4.61)
Neem cake @ 1kg/vine pre monsoon SA + <i>P.fluorescens</i> (CF) pre and post monsoon SA and FA + Metalaxyl-MZ (0.1%) pre monsoon SA and FA	2.12 (8.20)	2.76 (9.67)	6.00 (14.20)	0.00 (0.0)
Control	17.24 (24.60)	18.80 (25.70)	21.30 (27.49)	10.0 (18.43)
CD (P=0.05)	3.40	2.65	1.4	2.7

CF : Commercial formulation, SA : Soil application, FS : Foliar application

*Mean of two field experiments

(Figures in parentheses are arcsine transformed values)

was most effective in reducing the leaf, branch and spike infections by recording 2.12, 2.76 and 6.0 per cent respectively as against 17.24, 18.80 and 21.30 per cent respectively in the control (Table 1). This treatment also recorded nil wilt incidence as against 10.0 per cent in the control. This was followed by the treatment consisting of pre monsoon soil and foliar application of metalaxyl MZ (0.1%) plus pre and post monsoon soil and foliar application of *P. fluorescens* which recorded respectively 3.94, 5.04 and 6.60

per cent leaf, branch and spike infections. Addition of substrates of food bases into the soil increased the proliferation of bio-control agent in the rhizosphere (Papavizas and Lewis, 1983). Ramachandran *et al.* (1991) reported that metalaxyl was highly effective in suppressing soil population of *P. capsici* and application of neem cake one kg/vine reduced the *Phytophthora* foot rot incidence to a limited extent. Mammooty *et al.* (1991) reported high foot rot incidence in the month of July (39.08 %) when rainfall

number of rainy days and relative humidity were high. Since the disease incidence was high during North East monsoon at this region the pre monsoon application of *P. fluorescens* would be much beneficial to promote the multiplication of antagonist in the phylloplane environment (Blakeman and Fokkema, 1982).

Among the different treatments tried, the treatment consisting of soil application of neem cake plus pre monsoon soil and foliar application of *P. fluorescens* recorded the maximum number

of berries/spike (104.8), green berry yield/vine (4.85 kg) and dry berry yield/vine (1.601 kg) as against the minimum of 70.2 no., 3.05 kg and 1.005 kg respectively in the control. This accounted for 59.3 per cent increased dry berry yield over control (Table 2). Among the treatments soil application of neem cake alone recorded the least number of berries (73.2), green berry yield/vine (3.18 kg) and dry berry yield/vine (1.050 kg). This type of mechanism might have acted upon with *P. capsici* and

Table 2. Effect of integrated management of foot rot incidence on yield

Treatment	No. of* berries/ spike	Greenberry* yield/ vine (kg)	Dryberry* yield/vine (kg)	Increase over control (%)	Cost benefit ratio
<i>P. fluorescens</i> (CF) pre and post monsoon SA and FA	80.2	3.72	1.228	22.19	1:2.14
Neem cake @ 1 kg/vine pre monsoon SA	73.2	3.18	1.050	4.48	1:0.55
Bordeaux mixture (1%) pre and post monsoon SA and FA	80.0	3.70	1.221	21.49	1:1.17
Metalaxyl-MZ (0.1%) pre and post monsoon SA and FA	95.00	4.39	1.449	44.18	1:1.22
<i>P. fluorescens</i> (CF) pre and post monsoon SA and FA + Neem cake @ 1kg/vine pre monsoon SA	82.6	3.82	1.261	25.47	1:1.26
<i>P. fluorescens</i> (CF) pre and post monsoon SA and FA + Bordeaux mixture (1%) pre monsoon SA and FA	84.5	3.98	1.313	30.65	1:1.74
<i>P. fluorescens</i> (CF) pre and post monsoon SA and FA + Metalaxyl-MZ (0.1%) pre monsoon SA and FA	96.5	4.46	1.472	46.47	1:1.67
Neem cake @ 1kg/vine pre monsoon SA + <i>P. fluorescens</i> (CF) pre and post monsoon SA and FA + Bordeaux mixture (1%) pre monsoon SA and FA	90.0	4.16	1.373	36.62	1:1.40
Neem cake @ 1kg/vine pre monsoon SA + <i>P. fluorescens</i> (CF) pre and post monsoon SA and FA + Metalaxyl-MZ (0.1%) pre monsoon SA and FA	104.8	4.85	1.601	59.30	1:1.61
Control	70.2	3.05	1.005		
CD (P=0.05)	5.4	0.7	0.3		

CF : Commercial formulation, SA : Soil application, FS : Foliar application

*Mean of two field experiments

(Figures in parentheses are arcsine transformed values)

which tends to reduce the pathogen population with subsequent reduction in disease incidence. So it was concluded that one pre monsoon application of metalaxyl MZ combined with neem cake 1 kg/vine and pre and post monsoon soil and foliar application of *P. fluorescens* was effective for the management of foot rot incidence in the export oriented and exchange earning crop, "The black gold".

The cost benefit ratio was the highest (1:2.14) in pre and post monsoon soil and foliar application of *P. fluorescens* and followed by combination of this treatment with bordeaux mixture (1%) pre monsoon soil and foliar application (1: 1.74)

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Research Notes

Influence of pruning levels on crop regulation in tamarind (*Tamarindus indica* L.) cv. PKM 1

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Tamarind is a productive tree spice crop and one of the most popular trees found throughout India as stray plantation or avenue. The fruits are used for various culinary purposes all over the country. The wood is used in cartwheels, rice pounders, oil mills, etc. The bark is used in tanning; the tender leaves and flowers are eaten as a vegetable. The decoction of bark is useful in diarrhoea. The seeds are

rich in pectin. Though it is a deciduous crop and has the tendency of alternate bearing, crop load regulation has not yet been taken up. Pruning is necessary to have regular crop load every year. Hence, the trial was conducted to study the effect of different levels of pruning on fruit yield and quality in tamarind. An experiment was conducted in 15 years old tamarind cv. PKM 1 trees at Horticultural College and