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Control of Foot Rot of Brinjal Through Chemicals and Organic Soil Amendments

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Abstract: Two fungicides namely Tilt 250 EC (Propiconazole 500 ppm) and Ridomil 72 wp (Metalaxyl 1140 ppm) and two organic soil amendments namely ash and sesame oil cake (@ 2% kg^{-1} soil) were tested as means of control measure against foot rot of brinjal at two growth stages of plants in a field experiment during Kharif-I and Kharif-II (wet) season. Ridomil 72 wp was less effective than Tilt 250 EC in percent inhibition of linear growth (mm) of *S. rolfsii in vitro*. All the disease control treatments were significantly effective in controlling foot rot, with highest percent plant recovered by Tilt 250 EC applied as curative as well as preventive measure. Tilt 250 EC also significantly reduced percent infection when used as preventive measure. Among the organic soil amendments, ash was better even than Ridomil at early flowering stage and equally effective with sesame oil cake at peak fruiting stage as curative control measure. Sesame oil cake was better as preventive control measure of foot rot at peak fruiting stage.

Key words: Foot rot (*Sclerotium rolfsii*), brinjal (*Solanum melongena* L.), fungicides, organic soil amendments

Introduction

Brinjal (*Solanum melongena* L.) is a common and widely cultivated vegetable crop of Bangladesh and grown in all seasons. The crop suffers from many diseases (Ahmed and Hossain, 1985). The foot rot pathogen *Sclerotium rolfsii* Sacc. inflicts severe damage at any growth stages of the crop in all seasons (Begum *et al.*, 1985). The disease has become a major constraint in successful cultivation of brinjal mainly due to aggressive nature of the pathogen, its soil borne habit and continuous cropping of brinjal in many areas. Infestation from seedling to flowering stage may result 100% crop loss. At maturity diseased plants yield malformed smaller fruits with poor food and market quality. Treatment of soil with fungicides has direct effect on the control of *S. rolfsii* and other soil borne pathogen (Khare *et al.*, 1974; Chowdhury and Maiti. 1975; Backman and Kabana, 1975; Mathur and Sarbhoy, 1980; Fellman *et al.*, 1983; Lal and Nagarajan, 1983 and Sharma and Verma, 1985). Organic soil amendments have also been reported to be effective in controlling the pathogen (Nargund *et al.*, 1984; Linderman, 1989; Hadar and Gorodeeki, 1991 and Kulkarni and Kulkarni, 1995). But there exists a few (perhaps none) evidence of research work on controlling brinjal foot rot in Bangladesh. Hence this experiment has been designed to select an effective fungicide and method (s) of organic soil amendments to control foot rot of brinjal. So that, the effective and economically viable advise to farmer to achieve the objective of increasing per unit economic return through safe harvest of the crop.

Materials and Methods

Ten brinjal varieties were grown in experiment plots laid out in Randomized Complete Block Design (RCBD) with 20.0 x 2.5 m^2 each during Kharif-I and Kharif-II (wet) at the Bangladesh Agricultural University Campus, Mymensingh. The fungicides Tilt 250 EC (Propiconnazole) and Ridomil 72 wp (Metalaxyl) were evaluated at 3 concentrations for each respectively at 400, 500 and 750 ppm for Tilt 250 EC and 1000, 1440 and 2000 ppm for Ridomil 72 wp against *S. rolfsii* through inhibition of linear growth (mm) *in vitro* by poisoned food technique (Nene and Thapliyal, 1979). In the field, chemical control of foot rot on brinjal was done through application of Tilt 250 EC (500 ppm) and Ridomil 72 wp (1440 ppm) after foot rot incidence through drenching of soil of infected plant base as curative control measure. As a means of preventive control, fungicides were applied before 10 days of inoculation of the plants.

Soil organic amendments ash and sesame oil cake were applied respectively as dust and liquid paste by mixing properly with soil at plant base @ 2% kg^{-1} soil after foot rot incidence as curative and before 10 days of inoculation as preventive control measure. Brinjal plants at early flowering and peak fruiting stage were inoculated by the pathogen (*S. rolfsii*) grown on oats. For each treatment control (untreated) as check were maintained. In both cases, data were collected on number of plants infected, number of plants killed and number of plants recovered. Data collected during experimental period were analyzed following proper statistical procedures such as analysis of variance was done by F test (Panse and Sukhatme, 1987) and mean values were seperated by DMR test (Steel and Torrie, 1980). Analysis was also performed on transformed values calculated by arc sine transformation method (Zaman *et al.*, 1982)

Results and Discussion

Results of growth inhibition of *S. rolfsii* through chemical fungicides *in vitro* indicated that Tilt 250 EC was best and effective at lowest concentration of 400 ppm, at which 95.78% growth was inhibited (Table 1). However, 100% growth inhibition was achieved at 500 ppm concentration. Percent growth inhibition with Ridomil 72 wp at 1000 ppm, 1440 and 2000 ppm were respectively 71.97%, 83.68% and 85.14% indicating that Ridomil was less effective than Tilt 250 EC. Captan and Ridomil (Metalaxyl) were most effective against mycelial growth of *S. rolfsii*. Benlate (Benomil) and Metalaxyl checked germination of sclerotia most effectively. Metalaxyl and Benomil at 500 ppm applied as seed treatment and soil drench respectively, gave 100% control of collar rot on lentil seedlings (Shahid *et al.*, 1990) which does not confirm the findings of this studies.

Management of foot rot of brinjal through chemical fungicides and organic soil amendments were found effective at both stages of plant growth. Control measures taken as curative and preventive could check the foot rot incidence on brinjal varieties at early flowering and peak fruiting stages and were significantly effective over control. However, there were variations in efficacy of treatments applied (Table 2 and 3).

At early flowering stage, percentage of plants recovered as recorded against all the curative treatments were statistically

Table 1: Inhibition of linear growth of *Sclerotium rolfsii* by two fungicides *in vitro*

Fungicide	Concentrations (ppm)	% inhibition of growth (mm)
Tilt 250 EC	400	95.78ab
	500	100a
	750	100a
Ridomil 72 wp	1000	71.97b
	1440	83.68ab
	2000	85.15ab
Control	0	0.0c
LSD at 1%		29.76

Table 2: Efficacy of curative treatments on foot rot of brinjal at early flowering and peak fruiting stage during Kharif-I to Kharif-II season

Treatments	Concentrations	Percent plant recovered at	
		Early flowering stage	Peak fruiting stage
Tilt 250 EC	500ppm	90(70.28a)	80(70.28)a
Ridomil 72 wp	1440ppm	83.33(73.9)a	70(61.85)a
Ash	2%	86.67(78.70)a	66.67(59.04) a
Sesame oil cake	2%	66.67(61.85)a	66.67(59.04) a
Control	0	23.34(25.34)a	30(28.15)b
LSD at 1%		21.38	25.16

Figures in parenthesis are transformed values (arc sinc).

Table 3: Efficacy of preventive treatment on foot rot of brinjal at early flowering and peak fruiting stage during Kharif-I to Kharif-II season

Treatment	Concentration	Percent infection occurred after treatment	Percentage plants recovered
Tilt 250 EC	500ppm	43.33(39.38)b	93.33(81.51) a
Ridomil 72 ml	1440ppm	100.00(87.13)a	73.33(64.66) a
Ash	2%	100.00(87.135)a	66.67(59.04) a
Sesame oil cake	2%	100.00(87.13)a	70.00(61.85) a
Control	0	23.34(25.34)b	23.33(22.53) b
LSD at 1%		13.11	21.07

Figures in parenthesis are transformed values (arc sinc).

Table 4: Varietal performance after inoculation and curative treatments application on foot rot at early flowering and peak fruiting stage of brinjal

Varieties/ lines	Early flowering stage		Peak fruiting stage	
	% plant infected	% plant infected	% plants infected	% plants infected
Uttara	93.33	80.00 (70.28)	100.00	66.67 (59.04)abc
BL-034	100.00	73.33 (64.66)	10.00	26.67 (25.34)c
Sufala	100.00	60 (53.43)	100.00	46.67 (42.19)abc
Khotkhotia	100.00	53.33 (47.81)	72.22	53.33 (47.81)abc
Dohazari	100.00	73.33 (64.66)	60.00	66.67 (59.04)abc
Singnath	100.00	66.67 (59.04)	88.89	86.67 (75.89)a
Islampuri	100.00	46.67 (42.19)	10.00	33.33 (30.96)bc
Eye-red	93.33	73.33 (64.66)	83.33	86.87 (75.90)bc
Mirsarai-1	86.67	6.67 (75.89)	75.00	80.00 (70.28)ab
Mirsarai-2	86.67	86.67 (75.89)	93 33	80.00 (70.28)ab
LSD at 1%	NS	NS	NS	35.59

Figures in parenthesis are transformed values (arc sine), NS = Not significant

similar but differed significantly from control (Table 2). Among the chemical fungicides, highest percentage of infected plants recovered and became healthy after application of Tilt 250 EC at concentration of 500 ppm (90%) as compared to control (23.34%). But with Ridomil 72 wp at concentration of 1440 ppm it was 83.33%. In case of organic amendments percentage of infected plants recovered by ash (86.67%) was higher than by sesame oil cake (66.67%).

At peak fruiting stage percentage of plants recovered in treatments significantly differed from control. Effect of chemical fungicides and organic soil amendments were statistically similar. Percent plants recovered were highest in Tilt EC treatment (80%) and Ridomil 72 wp saved 70%. Percent plant recovered in ash and sesame oil cake were equal (66.67%). All the treatments were significantly effective as compared with percent plants recovered in control (30%) (Table 2). Treatment with ash was found to limit rots, healing up of rotten bark and triggered formation of secondary adventitious roots from the healthy tissues above the infected zone. The roots directly penetrated into the soil and the plants recovered quickly. Literatures pertinent to the above observations are not available.

Infection of foot rot on brinjal varieties occurred in all treatments applied as preventive measure. But percentage of plant recovery in treatments was significantly higher over control (Table 3). The lowest infection was observed in Tilt 250 EC (43.33%) treatment and differed from others including control significantly. All plants (100%) were found infected in Ridomil 72 wp, ash and sesame oil cake treatment and were found equally effective with control. Of all treatments percentage of plants recovery was highest (93.33%) in Tilt 250 EC followed by Ridomil (73.33%), sesame oil cake (70%) and ash (66.67%) and lowest in control (23.33%). Effect of all treatments, as preventive measure was statistically similar and significantly higher over control (Table 3). Varieties exhibited proneness to infection when inoculated irrespective of time. However, varieties differed significantly in recovery with response to treatments, at peak fruiting stage. Varieties Singnath and Eye-red showed 86.67% and 86.87% recovery followed by varieties Mirsarai-1 and Mirsarai-2 (Table 4).

The increase in efficacy of sesame oil cake at peak fruiting stage might be due to rainfall, temperature and humidity which was higher than early flowering stage and favoured the growth and development of antagonistic soil microbial population. No such reports regarding brinjal foot rot control with sesame oil cake are available. But it is established that organic amendments favour the build up antagonistic microbes (Linderman, 1989). Best results of organic amendments on *S. rolfsii* causing foot rot of wheat were, however, obtained with groundnut and safflower oil cake (Nargund *et al.*, 1984).

Since brinjal varieties were found mostly susceptible to foot rot both at early flowering and peak fruiting stages, its better cultivation and safe harvest would be possible, when an integrated disease management approach through organic soil amendments by using sesame oil cake (@ 2% kg^{-1} soil) before planting as preventive measure and application of ash (@ 2% kg^{-1} soil) after disease incidence has been first observed to control foot rot, is adapted. Chemical control measure through application of Tilt 250 EC @ 500 ppm concentration could however be applied at the later stage for achievement of full success in controlling the disease incidence when economic threshold level (ETL) is crossed.

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