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## Efficacy of plant extracts and *Trichoderma* spp in the management of sheath blight of paddy (*Oryzae sativa* L.)

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### Abstract

An experiment was conducted to evaluate the effect of plant extracts, bioagents and fungicide *in vitro* and *in situ* against *Rhizotonia solani* causing sheath blight of paddy. Propiconazole @ 0.1% was effective in the inhibition of mycelial growth (85.21%) of *Rhizotonia solani*. Among the bio-agents, *Trichoderma harzianum* was found effective in the inhibition of mycelial growth (63.37%) followed by *Trichoderma asperellum* in inhibition (58.16%) of mycelial growth. Among the plant extracts, neem leaf extract @ 10% was found effective in the inhibition of mycelial growth (48.71%) followed by garlic bulb extract @ 10% (46.13%) and tulsi leaf extract @ 10% (34.38%). The plant extracts, potential bio-agent and fungicide found effective *in vitro* were tested as foliar spray against sheath blight of paddy under field conditions during *kharif* season 2016-2017. Among all the treatments foliar spray of propiconazole @ 0.1% as treated check was found effective in the disease reduction (57.59%), followed by neem leaf extract @ 10% (44.24%), garlic bulb extract @ 10% (37.61%), followed by tulsi leaf extract @ 10% was found effective in disease reduction (27.60%). Among the bio agents, *Trichoderma harzianum* @ 1% with (17.19%) and *Trichoderma asperellum* @ 1% (10.82%).

**Keywords:** bioagents, fungicide, paddy, plant extracts, *Rhizotonia solani*

### 1. Introduction

Rice (*Oryzae sativa* L.) is the staple food crop of over half of the world's population. Losses due to pests and diseases are one of the major constraints in rice production. Sheath blight disease of rice cause considerable loss, especially, in areas where high yielding varieties are grown. *Rhizoctonia solani* which causes rice sheath blight is both soil and water borne and management of the disease is difficult (Kagale *et al.*, 2004) [5]. Sheath blight is one of the common and destructive diseases of rice in India. The disease is characterized by the formation of lesions on leaf sheaths and culms at the water level, which become confluent giving characteristic banded appearance. The infection may spread up to the culms, killing all the leaves under favourable weather conditions. Losses up to 20 per cent in grain yield has been reported when disease invades at flag leaf stage. There are several important reports on the biological management of this disease. The losses due to sheath blight can be managed through the foliar application of chemical fungicides. Utilization of plant extracts and bio agents in disease management is considered as eco-friendly, without any environmental pollution. Bio-control agents have been used in disease management for long time as seed treatment but their use as foliar spray is rarely followed approach. The present study was carried out to explore, the efficiency of some plant extracts and *Trichoderma* spp. against sheath blight of paddy caused by *Rhizoctonia solani* *in vitro* and *in situ* at Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad, (U. P), India.

### 2. Materials and Methods

#### *In vitro* Experiment

Three plant extracts, neem leaf extract (10%), garlic bulb extract (10%), tulsi leaf extract (10%) and one chemical propiconazole (0.1%) were tested for their efficacy against the pathogen *Rhizoctonia solani* *in vitro* using poison food technique on Potato dextrose agar medium.

The selected fresh leaves of healthy plants were collected and washed thoroughly with clean water and dried. About 10 g of plant leaves were ground using pestle and mortar by adding same proportion 10 ml of sterilised distilled water in weight by volume method. The plant extract thus obtained by grounding filtered through muslin cloth and the extract was diluted by adding sterilised distilled water to get 10 per cent concentration and the calculated

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concentration of fungicides were thoroughly mixed in the medium. Twenty ml of amended medium was poured in 90 mm sterilized petridishes and allowed to solidify. Mycelial disc of 5 mm from seven day old actively growing culture was inoculated at the centre of the petriplate and then incubated at  $28 \pm 2$  °C for 7 days. Control was maintained without any treatment. Three replications were maintained for each treatment and data were recorded at 96 hours after inoculation.

The antagonistic microorganisms, *Trichoderma asperellum* and *Trichoderma harzianum* were tested *in vitro* for their antagonism against *Rhizoctonia solani* by dual culture technique. Twenty millilitre of PDA was poured into sterile petriplates. Fungal antagonists were evaluated by inoculating the pathogen at one side of the petriplate and the antagonist inoculated at exactly opposite side of the same plate by leaving 3 to 4 cm gap. One control was maintained where in only test fungus was grown. The plates were incubated at  $28 \pm 2$  °C for 96 hours. The experiment was conducted in completely randomized block design (RBD). Per cent inhibition of mycelial growth calculated using the following formula (Vincent 1927).

$$I = \frac{C - T}{T} \times 100$$

Where,

I= Per cent inhibition of mycelial growth

C= Colony diameter in control (mm)

T= Colony diameter treatment (mm)

### In situ Experiment

In order to check effect of foliar spray of fungicide, plant extracts and bio-agents on sheath blight of paddy under field condition, field experiments were laid-out in Randomized block design with three replications. Two sprays were given at an interval of 15 days. Treatments were imposed after appearance of the first disease symptoms. Observations on disease severity of *Rhizoctonia solani* were recorded by using 0-9 disease rating scale of Wheeler (1969) [11] at 15 days interval and yield data were obtained after the harvest on physiological maturity.

### 3. Results and Discussion

The plant extracts like *Azadirachta indica* (10%), *Allium sativum* (10%) and *Ocimum sanctum* (10%) were tested against *Rhizoctonia solani*. All the botanicals tested were significantly effective in inhibiting the growth of pathogen over control (Table 1). Among different plant extracts tested *Azadirachta indica* at 10 per cent showed maximum inhibition (48.71%) followed by *Allium sativum* (46.13) and

least effectiveness was found in *Ocimum sanctum* (34.38%).

**Table 1:** Evaluation of plant extracts and fungicide against *Rhizoctonia solani in-vitro*

Treatments	Dosage (%)	Per cent inhibition (%)
Propiconazole (Treated check)	0.1%	85.21 (67.35)
Tulsi leaf extract ( <i>Ocimum sanctum</i> )	10%	34.38 (35.88)
Garlic bulb extract ( <i>Allium sativum</i> L)	10%	46.13 (46.13)
Neem leaf extract ( <i>Azadirachta indica</i> )	10%	48.71 (44.24)
Control	-	-
S.Ed. (±)		0.38
C.D (P=0.05)		1.21
Cv %		2.01

The fungus *Trichoderma harzianum* and *Trichoderma asperellum* bio-agents were evaluated *in vitro* against *Rhizotonia solani* by dual culture technique and using Potato dextrose agar as basal medium. From the *in vitro* evaluation of bio-agents, the observations revealed that the maximum reduction in colony growth of *Rhizotonia solani* was recorded in *Trichoderma harzianum* (63.37%) followed by *Trichoderma asperellum* (58.16%). The results (Table 2) revealed that *Trichoderma harzianum* exhibited fungistatic activity and significantly inhibited mycelial growth of *Rhizoctonia solani*.

**Table 2:** Evaluation of bio-agents against *Rhizoctonia solani in-vitro*

Treatments	Per cent inhibition (%)
<i>Trichoderma harzianum</i>	63.37 (52.73)
<i>Trichoderma asperellum</i>	58.16 (49.67)
Control	-
S.Ed. (±)	0.33
C.D (P=0.05)	1.15
Cv %	1.66

A field study was carried out to assess the efficacy of *Trichoderma sp.*, plant extracts and fungicide against sheath blight (*Rhizotonia solani*) of paddy with two sprays taken up at 60 DAT and 75 DAT during *khariif* season 2016-2017 (Table 3). Two sprays were given at 60 DAT and 75 DAT. Minimum disease intensity was recorded in *Azadirachta indica* at 60, 75 and 90 days after spray (20.33%, 27.45% and 30.44% respectively) followed by *Allium sativum* (21%, 31.27%, 35.24% respectively), *Ocimum sanctum* (23.67%, 36.69% and 41.20% respectively), *Trichoderma harzianum* (26.33%, 47.36% and 44.46% respectively) *Trichoderma asperellum* (27.67%, 45.05% and 52.39% respectively) and treated check propiconazole showing disease intensity (16.67%, 20.51% and 22.32% respectively) was also found effective and found statistically significant from control (29%, 50.47% and 60.82%, respectively).

**Table 3:** Effect of treatments on disease intensity at 60, 75 and 90 DAT

Treatment No.	Treatments	Disease Intensity (%)		
		60DAS	75DAS	90DAS
T <sub>1</sub>	Propiconazole 25% EC (Treated chek)	16.67 (24.08)	20.51 (26.91)	22.32 (28.18)
T <sub>2</sub>	<i>Trichoderma asperellum</i>	27.67 (31.72)	45.05 (42.14)	52.39 (46.35)
T <sub>3</sub>	Neem Leaf Extract ( <i>Azadirachta indica</i> )	20.33 (26.79)	27.45 (31.58)	30.44 (33.47)
T <sub>4</sub>	Garlic bulb extract ( <i>Allium sativum</i> L)	21 (27.26)	31.27 (33.98)	35.24 (36.40)
T <sub>5</sub>	<i>Trichoderma harzianum</i>	26.33 (30.86)	42.48 (40.65)	47.36 (43.46)
T <sub>6</sub>	Tulsi leaf extract ( <i>Ocimum sanctum</i> )	23.67 (29.10)	36.69 (37.26)	41.20 (39.91)
T <sub>0</sub>	Control	29 (32.57)	50.47 (45.25)	60.82 (51.22)
	S.E d(±)	1.22	0.78	0.52
	C.D.(P=0.05)	2.67	1.70	1.14

#### 4. Conclusion

Based on the results *Azadirachta indica* (10%) were found the most effective treatments showing minimum disease intensity and produced maximum grain yield (t/ha) and recorded highest cost benefit ratio as compare to other treatments except propiconazole, which was taken as treated control. *Azadirachta indica* @ 10% concentration were found as best treatment to management of sheath blight disease of paddy. Since chemicals have many harmful effects on the environment as well as the human health, they would be considered as better as they are eco-friendly and can also be recommended to the farmers for the efficient management of disease. The present research findings are limited to one crop season under Allahabad agroclimatic conditions as such more trails are required in future to validate the findings.

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