

**Research Article**

## **Comparative Efficacy of Different Isolates of *Trichoderma* Spp. Against *Rhizoctonia Solani*, Incitant of Sheath Blight of Rice**

**<sup>1</sup>B. Nagendra Prasad and \*M. Reddi Kumar<sup>2</sup>**

<sup>1</sup>Department of Plant Pathology, S.V. Agricultural College, Tirupati 517502

\*Regional Agricultural Research Station<sup>2</sup>, Acharya N.G.Ranga Agricultural University, Tirupati

\*Author for Correspondence

### **ABSTRACT**

Three isolates of *Trichoderma* spp. were evaluated against sheath blight disease, isolated from rhizosphere soil in three different districts of Rayalaseema. The inoculation of pathogen and foliar spray of bioagent was done at 30 DAT and 60 DAT. The disease incidence was more at 60 DAT than 30 DAT. Among the three potential *Trichoderma* spp. TN3 was found highly effective against sheath blight pathogen, *R. solani* under *in vitro* conditions. It was found most effective in reducing disease incidence and increasing grain yield. Though the disease incidence was more on TN3 treated plants than hexaconazole treatment, the increase in grain yield was almost same in both the treatments. The bioagent could effectively controlled the disease and at the same time improved growth characters under the glasshouse conditions.

**Key words:** *Rhizoctonia solani*, rice, sheath blight, biological control, plant growth promotion

### **Abbreviations:**

DAT Days after transplantation

### **INTRODUCTION**

Several pathogenic diseases have been found to occur on the rice crop resulting in extensive damage to grain and straw yield. The crop is subjected to attack by many diseases caused by fungi, bacteria, viruses, nematodes and several physiological disorders which caused annual loss to the tune of 12-25 per cent of the total production. Rice is subjected to the attack of over 30 fungi in our country (Rangaswamy, 1992). Major fungal diseases are Blast, Brown spot, Sheath rot, Sheath blight, Stem rot, and Seedling blight. Among these diseases the sheath blight disease caused by *Rhizoctonia solani* Kuhn. earlier, considered to be minor disease is now regarded as an internationally important that is second only to and often rivals of the blast disease, because of the introduction of high yielding varieties since 1960. Several epidemics of the disease have been recorded in different parts of the world resulting in serious yield losses. The management of sheath blight by the use of resistant cultivars has not been successful because an adequate level of host resistance has not been found. Indiscriminate use of chemicals is not only hazardous to living beings but also adversely affect the microbial population present in the ecosystems. In recent years, the increasing use of pesticides in agriculture has been the subject of growing concern for both environmentalists and public health authorities. Besides their non-target

effects and hazardous to nature, they are becoming more expensive and some are losing their effectiveness due to development of resistant strains. Biological control has emerged as an alternative and most promising means of the management of plant pathogens. Bio-control of *Rhizoctonia solani* can be achieved by either promoting the native antagonists to reach a density sufficient to suppress pathogen(s) or by introducing alien antagonists. Among the several antagonists tested by various scientists, species of *Trichoderma*, *Gliocladium* and *Aspergillus* etc., have been found effective in inhibiting the sheath blight (*Rhizoctonia solani*). Though introduction of several antagonists against sheath blight pathogen seems to hold great promise to suppress the disease, no effective and economic management strategies have been derived. Keeping this fact in view, the present investigations were, therefore, undertaken to evaluate efficacy of *Trichoderma* spp. against *Rhizoctonia solani* under glasshouse conditions.

### **MATERIALS AND METHODS**

Three potential *Trichoderma* species were used to test the efficacy in controlling sheath blight of rice under glasshouse conditions. The soil was filled in plastic pots of 30 cm diameter. The soil in pots were fertilized with

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**A**



**B**

**Figure 1: A - Symptoms development on rice plants. B - Sclerotia developed on rice plants (10 DAI)**



**Figure 2: Symptoms developed on plants at 10 days after second inoculation**

requisite quantities of NPK. 21 days old seedlings of susceptible rice variety NLR-34449 obtained from Agricultural Research Station, Nellore, was transplanted in each pot and two hills/pot were maintained. Inoculation of pathogen was done in two treatments viz., 30 days after transplanting and 60 days after transplanting. *Typhae* (water sedge – aquatic weed) bits of 5 cm were inoculated aseptically and allowed to overgrew with the pathogen. Inoculation of susceptible rice plant was done by placing 2 *Typhae* pieces covered with mycelium and sclerotia of the pathogen at the centre of each hill above water level (Sudhakar, 1996). Spores of bioagent were harvested from 10 day old culture grown on PDA with the help of a camel hair brush and the spores were then suspended in distilled water and the concentration was measured with a Haemocytometer to get a final count of about  $2 \times 10^9$  spores/ml. The first spray of bioagent @  $2 \times 10^9$  spores/ml was given at the time of pathogen inoculation (30 DAT) until run-off occurred. Second spray was given at 30 days (60 DAT) interval. At the time of second spray, second treatment (60 DAT) was done. All the inoculated plants were covered with polythene bags to maintain humidity (RH > 90) for one week. The disease parameters were recorded 14 days after inoculation.

**Disease Scoring**

The treatments imposed were T1 : Foliar application of potential *Trichoderma* from Chittoor after inoculation of pathogen i.e., 30 DAT, T2 : Foliar application of potential *Trichoderma* from Chittoor after inoculation of pathogen i.e., 60 DAT, T3 : Foliar application of potential *Trichoderma* from Kadapa after inoculation of pathogen i.e., 30 DAT, T4 : Foliar application of potential *Trichoderma* from Kadapa after inoculation of pathogen i.e., 60 DAT, T5 : Foliar application of potential *Trichoderma* from Nellore after inoculation of pathogen i.e., 30 DAT, T6 : Foliar application of potential *Trichoderma* from Nellore after inoculation of pathogen i.e., 60 DAT, T7 : Foliar application of Hexaconazole @ 0.2% after inoculation of pathogen i.e., 30 DAT, T8 : Foliar application of Hexaconazole @ 0.2% after inoculation of pathogen i.e., 60 DAT, T9: Inoculated control at 30 DAT, T10 : Inoculated control at 60 DAT. The number of days required for the development of first lesions was recorded after imposing the treatments. The number of infected tillers and the number of tillers in the hill were counted and the percentage of disease incidence was calculated. After harvesting, the grain yield was also recorded.

$$\% \text{ Disease incidence} = \frac{\text{No. of infected tillers}}{\text{Total no. of tillers /hill}} \times 100$$

$$\text{Percent reduction in disease incidence} = \frac{\text{Number of infected tillers in control} - \text{Number of infected tillers in treatment}}{\text{Number of infected tillers in control}} \times 100$$

**Table 1: Comparative efficacy of different isolates of *Trichoderma* spp. and fungicide on disease incidence and yield at 30DAT**

Treatments ( 30 DAT)	Disease incidence (%)*	Reduction in disease incidence(%)	Grain yield (g/plant)*	Grain yield (g/plant)*
T1. Foliar application of potential <i>Trichoderma</i> from Chittoor	28.8	21.52 (27.64)	11.183	27.56 (31.67)
T3 . T3 : Foliar application of potential <i>Trichoderma</i> from Kadapa	29.6	19.34 (26.09)	8.29	2.35 (8.82)
T5. Foliar application of potential <i>Trichoderma</i> from Nellore	25.8	<b>29.70 (33.02)</b>	12.32	<b>34.31 (35.86)</b>
T7. Foliar application of Hexaconazole @ 0.2%	10.9	<b>70.29 (56.97)</b>	12.37	<b>34.55 (36.00)</b>
T9. Inoculated control	36.7	-	8.1	-

\* Mean of three replications

S.Ed	0.0260	0.0089
CD (0.05)	0.0601	0.0204
CV (%)	0.09	0.04

#### Abbreviations

**S.Ed** : Standard Error Deviation

**C.D** : Critical Difference

**C V** : Coefficient of Variation

The observations on disease severity and infected tillers/hill (disease incidence) was recorded. All plants from each pot were harvested and threshed separately from which number of grains per panicle and total yield per plant were recorded to know any inhibitory or stimulatory effect of the treatments imposed (Khan and Sinha, 2007). Wherever necessary the data were statistically analyzed (Gomez and Gomez, 1984). Three replications were maintained and following the Completely Randomized Design (CRD) for dual culture technique, population assessment and pot culture studies.

#### RESULTS AND DISCUSSION

Pot culture experiment was conducted to study the relative efficacy of different isolates of *Trichoderma* spp. against *Rhizoctonia solani*. The inoculation of the pathogen onto the rice plants was done at two intervals viz., i.e. 30 days after transplanting (Table 1 and Fig 1) and 60 days after transplanting (Table 2, and Fig 2).

#### Effect of bioagents on disease incidence at 30 DAT and 60 DAT

A perusal of data presented ( Table 1) revealed that all the isolates of *Trichoderma* spp. significantly reduced incidence of the disease after inoculation of pathogen at 30 DAT. The chemical, hexaconazole treatment was shown to be most effective with 70.29 % reduction in disease incidence after 15 days of first spray. Among the *Trichoderma* isolates, foliar spray with TN3 isolate was most effective showing 29.70 % reduction in disease incidence. However *Trichoderma* isolate of TC3 was least effective (19.34 %) against sheath blight. The data presented (Table 2) revealed that all the isolates of *Trichoderma* spp. significantly reduced incidence of the disease after inoculation of pathogen at 60 DAT. The chemical hexaconazole treatment was most effective in reducing the disease incidence to 62.0% after 15 days of first spray. Among the *Trichoderma* treatments, foliar spray with TN3 isolate was most effective and shown 15.28 % reduction in disease incidence. Similar to

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**Table 2: Comparative efficacy of different isolates of *Trichoderma* spp. and fungicide on disease incidence and yield at 60 DAT**

Treatments ( 60 DAT)	Disease incidence( %)*	Reduction in disease incidence(%)	Grain yield(g/plant)*	Increase in grain yield(g/plant)
T2.Foliar application of potential <i>Trichoderma</i> from Chittoor	72.0	11.98(20.25)	11.215	26.24(30.81)
T4. Foliar application of potential <i>Trichoderma</i> from Kadapa	76.9	5.13(13.09)	10.437	22.39(28.24)
T6. Foliar application of potential <i>Trichoderma</i> from Nellore	69.3	<b>15.28(23.01)</b>	14.27	<b>42.03(40.41)</b>
T8. Foliar application of Hexaconazole @ 0.2%	31.08	<b>62.0(51.94)</b>	14.67	<b>43.60(41.32)</b>
T10. Inoculated control	81.8	-	8.272	-

\* Mean of three replications

S.Ed	0.6387	0.0303
CD (0.05)	1.4730	0.0699
CV (%)	2.91	0.11

**Abbreviations**

**S.Ed : Standard Error Deviation**

**C.D : Critical Difference**

**C V : Coefficient of Variation**

earlier treatments, *Trichoderma* isolate TC3 was least effective (5.13 %) against sheath blight.

**Effect on yield per plant when inoculated at 30 DAT and 60 DAT**

It was evident from the Table 1 that all the isolates of *Trichoderma* and chemical treatment significantly increased the yield per plant as compared to control. The highest yield per plant (12.37 g) was obtained with foliar spray of hexaconazole. Among the *Trichoderma* isolates, the highest yield per plant (12.32 g) was obtained with foliar spray of TN3 followed by foliar spray of TK3 and TC3 isolates, which resulted in the yield of 11.18 g/plant and 8.29 g/plant respectively. The highest increase in grain yield per plant obtained with hexaconazole (34.55 %) followed by TN3 (34.31%) isolate. The treatment TC3 gave minimum increase in grain yield (2.35%). It was evident from the Table 2 that all the isolates of *Trichoderma* and chemical treatment significantly increased the yield per plant as compared to check. The highest yield per plant (14.67 g) was obtained with foliar spray of hexaconazole. Among the *Trichoderma* isolates the highest yield per plant (14.27

g) was obtained with foliar spray of TN3 followed by foliar spray of TK3 and TC3 isolates, which resulted in the yield of 11.21 g / plant and 10.43 g / plant respectively. The highest increase in grain yield per plant obtained with hexaconazole (43.60 %) followed by TN3 (42.03 %) isolate. The treatment TC3 gave minimum increase in grain yield (22.39%).

In the present investigation, three isolates of *Trichoderma* spp. were evaluated against sheath blight disease under glasshouse conditions. The potential *Trichoderma* spp. isolated from three districts of Rayalaseema viz; Chittoor, YSR Kadapa and PSR Nellore and hexaconazole were used for foliar sprays. The inoculation of pathogen and foliar spray of bioagents done at two intervals viz., i.e. 30 DAT and 60 DAT. The disease incidence was less when inoculated at 30 DAT than the plants inoculated at 60 DAT. Though the incidence was less when inoculated at 30 DAT the grain yield was also low when compared to the plants inoculated at 60 DAT. These results showed that, when the plants attacked by the pathogen at early stages may lead to produce less number of panicles per hill and

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more empty grains. Among both the treatments, the hexaconazole treatment was found most effective in reducing disease incidence and increasing grain yield. Among the three potential *Trichoderma* sprayed TN3 isolate was found most effective in reducing disease incidence and increasing grain yield. TN3 was also found highly effective against sheath blight pathogen *R. solani* under *in vitro* screening. TK3 has found effective next to TN3 isolate in controlling the disease and increasing the yield.

Khan and Sinha (2007) reported that all the isolates of *Trichoderma* spp. significantly reduced severity and incidence of rice sheath blight. *T. harzianum* was most effective showing 38.8 per cent and 24.6 per cent reduction in disease severity and incidence. The highest increase in grain yield/plant (21.0%) and 1000 – grain weight (6.3%) was obtained with *T. harzianum*. Of the five isolates of *Trichoderma* spp. screened under *in vitro* and glasshouse conditions, *T. harzianum* was found most effective against *R. solani*. Das *et al.*, (1996) reported that foliar spray with *T. harzianum*, *T. viride* and *Aspergillus terreus* significantly reduced sheath blight severity. *T. viride* and *B. subtilis* significantly decreased sheath blight infection and increased grain yield (Dennis and Webster, 1971).

Previous reports and present investigation indicated that both the chemical treatment and biocontrol treatments were significantly reduced disease incidence. Though the disease incidence was more on plants treated with TN3 than plants treated with hexaconazole, the increase in grain yield was almost same in both the treatments. The bioagents can effectively control the disease and at the same time improve growth characters under the field conditions and thus is a better alternative to chemical application. Though, hexaconazole controls the disease incidence, it did not enhance plant growth to that extent. But when bio-control agents were introduced, the growth of the plants was promoted and at the same time they could effectively increased grain yield. The results were in agreement with Windham *et al*, 1986 who reported that the activity of biocontrol agents could also

reduce the concentration of substances in soil that are inhibitory to plant growth. Baby and Manibhushan Rao (1993) observed 25 per cent increase in growth of rice plants, when antagonists were applied to soil. Mishra *et al.* (1989) observed that seed treatment or soil application of fungal biocontrol agents (*Trichoderma harzianum*, *Gliocladium virens* and *Aspergillus niger*) significantly increased root and shoot growth of rice plants

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