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Ecofriendly Management Of Sheath Blight of Paddy Caused By *Rhizoctonia Solani* Khun

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ABSTRACT
The effect of treatments with bioagents and plant extract of paddy, Pseudomonas fluroescens was found significantly superior over rest of the treatments. The maximum yield, for the number of tillers, and highest shoot length (cm) of rice was recorded with Trichoderma viride followed by Trichoderma harzianum (FS), Pseudomonas fluorescens (FS). The highest cost benefit ratio was obtained in T_5Pseudomonas fluorescens (FS)(2.377), T_1neem extract (2.355), T_3Trichoderma viride(FS)(2.335), T_2 tulsi extract (2.321), T_4Trichoderma harzianum (FS)(2.309), as compared to T_0 control (untreated) (2.292). Use of botanicals and bioagents in management of sheath blight of paddy was found to be effective.
***Key words**: sheath blight, Trichoderma viride, Trichoderma harzianum, Pseudomonas fluorescens, rice.*

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INTRODUCTION

Sheath blight caused by a fungal pathogen *Rhizoctonia solani* is one of the most severe diseases of rice causing Significant losses in all rice growing tracts of India. Losses caused by this disease range from 1.2 - 69.0 per cent (Naidu, 1992). Among various fungal antagonists, *Trichoderma* sp. have gained wide attention due to their ability to control many fungal pathogens on a variety of crop plants under greenhouse and field conditions.

However, development of formulation, mass production and an efficient delivery system are the major constraints in implementation of biological control. Therefore, experiments were undertaken to assess the influence of mode of application (delivery system) of *T. harzianum* and its biocontrol potential against sheath bight of rice under glasshouse and field conditions. Fungicides added to seeds can also cause stunting and chlorosis of young seedling and result may very as fungicides are absorbed or inactivated by component of the soil or planting medium fungicides treatment can also be toxic to nitrogen-fixing *Rhizobium* sp. indiscriminate use of chemical is not only hazardous to living being but also adversely affect the microbial population present in the ecosystem. Biological control methods have the advantage of being non-toxic to the environment. Biological control is an innovative, cost effective and eco-friendly approach. For the case of soil borne pathogens, seed treatment may cost less than soil treatments because less biomass is required. Keeping in view the significance of the disease and losses caused by the pathogen, a study was carried out entitled,**"Ecofriendly management of sheath blight of paddy caused by*Rhizoctonia solani* kuhn"** with the objectives to:

a) To calculate the percentage of disease severity.
b) To evaluate the comparative efficacy of different bio-agents and fungicide against sheath blight of rice *in situ.*
c) To work out the economics of treatments.

MATERIALS AND METHODS

Cleaning and sterilization of glasswares:-

Metallic objects like blade, scissor, forceps, inoculation needle, cork borer etc. were sterilized by dipping in the spirit and heating on flame to red hot before inoculation. Laminar flow was sterilized with formalin and ultra violet lamp before spirit was used as general disinfectant of hand. Glasswares, such as petridishes, culture tubes, funnel, glass rods, beakers and flasks etc were cleaned in chromic acid (potassium di-chromate 60 g, concentrated sulphuric acid 60 ml and water 100 ml) followed by washing in running water. Dried glass wares were sterilized at 180 ^{0}C for 2 hours in an electric hot air oven before further use.

Media:-

For isolating and culturing of pathogen *(Rhizoctonia solani)* Potato dextrose agar (PDA) medium was used.

Isolation and identification of pathogen:

The infected plant showing characteristic symptoms of sheath blight disease of paddy was cut with healthy portion into small pieces (2-5mm), surface sterilized with 0.1 percent mercuric chloride ($HgCl_2$) solution thrice rinsed with sterilized distilled water and then transferred aseptically on PDA medium in petri-plates. These petri-plates were then incubated at 25$\pm$2°C. After 3 days, a whitish colony growth was observed from this colony growth, a portion from the periphery having single hyphal tip was separated and transferred to other petriplates having medium to get pure culture and identification of the pathogen was confirmed by observing the morphological features of colony, spore characteristic and referring the relevent literature and monographs. The pure culture was maintained in PDA slants and kept in refrigerator for further use.

The stock culture of *Rhizoctonia solani* associated with paddy plant was mounted and PDA slants were preserved in refrigerator at 5˚C. The pathogen was sub cultured at a regular intervals of 1 month to maintain the live culture.

Method of artificial inoculation

The leaves of plant *Typha angustata* Borry and Chaub were cut into pieces of about 2-3 inches in length dipped in to 5 per cent glucose solution and placed in Erlenmeyer flasks and autoclaved. The flasks containing the bits were then inoculated with single sclerotium and incubated at 25$\pm$2°C. for 8 days and used for inoculation **(Kuldeep *et al*., 2003).**

Ingredient of glucose solution

Peptone	- 20gm
Sucrose	- 40gm
Dipotassium Hydrogen phosphate($K_2 HPO_4$)	- 0.2gm
Magnesium sulphate ($MgSO_4$)	- 0.2gm
Distilled water	- 2 lit.

The pathogen *R. solani* multiplied on Typha stem bits **(Bhaktavatsalam *et al*., 1978)** was inoculated to the plants at maximum tillering stage between the leaf sheath and the culm. High relative humidity was provided to the plants both 24 hours periods to and after inoculation by spraying the plants with water in pot culture. For control, the plants were similarly inoculated with single, healthy, surface sterilized stem bit of typha.

Microscopic characteristics of Pathogen:

- The basic character of genus are the formation of sclerotia of irregular size and shape but of uniform texture, brown or black, more or less loosely packed.
- Mycelium stout, septate, more or less at right angles constricted at the point of origin multinucleate.
- The cell of hyphae are barrel shaped anatomizing frequently, branching more or less at right angles **(Ainsworth *et al.*,1973)**

Pathogenicity test:

The pathogenicity of the isolated fungus were tested as per the Koch's postulates in a pot experiment.

Field Preparation:

The selected field area was well prepared and plot marked as per the lay out plan. The selected field was dugged up, cleaned and the soil was pulverized after which the total area was divided into sub-plots.

Observations recorded:-

- Number of tillers at 30,45 & 60 DAT
- Shoot length (cm) at 30,60 & 90 DAT
- Disease severity at 60, 75 & 90 DAT
- Yield (q/ha.)

Disease severity was calculated by given formula:-

$$\text{Disease severity (\%)} = \frac{\text{Sum of all disease rating}}{\text{Total no. of sheath} \times \text{Maximum rating}} \times 100$$

RESULTS AND DISCUSSION

Effect of treatments with bioagents and plant extract on shoot length (cm)

Analysis of data presented in table 4.1 and graphically shown in fig. 4.1 revealed that there were significant difference among the treatment in the average shoot length.

Shoot length at 30 DAT

The maximum shoot length recorded with T_6mancozeb (treated)(20.13), followed by T_4*Trichoderma harzianum* (FS)(19.49), T_5*Pseudomonas fluorescens* (FS)(19.36), T_3*Trichoderma viride* (FS)(19.33), T_1neem extract (19.05), T_2tulsi extract (18.95), while the minimum shoot length found in T_0 control (untreated)(18.29).

Shoot length at 60 DAT

The highest shoot length recorded with T_6mancozeb (treated)(34.15), followed by T_3*Trichoderma viride*(FS)(32.15), T_5*Pseudomonas fluorescens* (FS)(32.01), T_2tulsi extract (32.15), T_4*Trichoderma harzianum* (FS) (31.55), T_1neem extract (30.82), while the minimum shoot length T_0control (untreated) (30.28).

Shoot length at 90 DAT

The maximum shoot length recorded with T_6 mancozeb (treated) (70.72), T_3*Trichoderma viride* (FS)(69.32), T_5*Pseudomonas fluorescens* (FS)(64.85), T_1 neem extract (64.72), T_2 tulsi extract (64.65), T_4*Trichoderma harzianum* (FS)(64.45), while the minimum shoot length T_0control (untreated)(62.32). Similar results of **Anitha and Savitha (2013)** found that concentration of 3, 6 mg has stimulatory effect on seed germination, root length, shoot length, vigour index , chlorophyll and phenolic contents and concentration of 9 and 12mg showed inhibitory effect on germination and other parameters.

Effect of treatments with bioagents and plant extract on number of tiller per hill

Analysis of data presented in table 4.2 and graphically shown in fig. 4.2 revealed that there were significant difference among the treatment in the average number of tillers per hill.

Number of tillers per hill at 30 DAT

The maximum number of tillers per hill recorded with T_6 mancozeb (treated) (20.38), followed by T_3*Trichoderma viride* (FS)(17.45), T_4*Trichoderma harzianum* (FS)(16.25), T_1 neem extract (15.72), T_5*Pseudomonas fluorescens* (FS)(15.58), T_2 tulsi extract (15.18), while the minimum number of tillers per hill found in T_0control (untreated)(15.05).

Number of tillers per hill at 45 DAT

The highest number of tillers per hill recorded with T_6 mancozeb (treated)(25.40), T_3*Trichoderma viride* (FS)(21.00), T_1 neem extract (19.94), T_2 tulsi extract (19.54), T_5*Pseudomonas fluorescens* (FS)(19.20), T_4*Trichoderma harzianum* (FS)(19.00), while the minimum number of tillers per hill T_0control (untreated)(18.60).

Number of tillers per hill at 60 DAT

The maximum number of tillers per hill recorded with T_6 mancozeb (treated)(31.78), T_3*Trichoderma viride* (FS)(25.18), T_4*Trichoderma harzianum* (FS)(23.71), T_5*Pseudomonas fluorescens* (FS)(23.51), T_1 neem extract (23.24), T_2 tulsi extract (23.04), while the minimum number of tillers per hill. T_0control (untreated)(22.91).

Effect of seed treatments with bioagents and plant extract on disease severity (%)

Analysis of data presented in table 4.3 and graphically shown in fig. 4.3 revealed that there were significant difference among the treatment in the average disease severity.

Disease severity (%)at 60 DAT

The lowest disease severity (%) recorded with T_6mancozeb (treated)(10.05), followed by T_5*Pseudomonas fluorescens* (FS)(10.34), T_4*Trichoderma harzianum* (FS)(11.16), T_2tulsi extract (11.45), T_3*Trichoderma viride*(FS)(11.68), T_1neem extract (12.12), while the maximum disease severity recorded in T_0 control (untreated)(13.01).

Disease severity (%)at 75 DAT

The minimum disease severity (%) recorded with T_6mancozeb (treated)(13.63), followed by T_5*Pseudomonas fluorescens* (FS)(14.07), T_4*Trichoderma harzianum* (FS) (15.19),T_2tulsi extract (16.22), T_3*Trichoderma viride* (FS)(16.75), T_1neem extract (17.56), while the maximum disease severity T_0control (untreated)(22.37).

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Disease severity (%)at 90 DAT

The lowest disease severity (%) recorded with T_6 mancozeb (treated)(16.84), followed by T_5*Pseudomonas fluorescens* (FS)(18.25), T_4*Trichoderma harzianum* (FS)(19.06), T_2tulsi extract(20.47), T_3*Trichoderma viride*(FS)(21.29), T_1neem extract (21.58), while the maximum disease severity T_0 control (untreated)(28.39).

However, seed treatment with mancozeb were found superior among all the treatments in managing sheath blight of rice. Similar results were reported of **Saxena and Tripathi (2006)** also found that mancozeb, Bavistin, Topsin-M, Kavach and Propiconazole were significantly reduced the disease severity. The same results were also reported **by Singh *et al.* (2007), Rathore (2006) and Dubey and Singh (2006).**

Effect of treatments with bioagents and plant extract on yield (q/ha) of paddy

Analysis of data presented in table 4.4 and graphically shown in fig. 4.4 revealed that there were significant difference among the treatment in the average yield.The highest yield (q/ha) recorded with T_6mancozeb (treated)(40.25), T_5*Pseudomonas fluorescens* (FS)(39.42), T_1neem extract (39.05), T_2tulsi extract (38.48), T_4*Trichoderma harzianum* (FS) (38.28), T_3*Trichoderma viride*(FS)(38.18), while the lowest yield recorded in T_0 control (untreated)(36.18). Similar result of under field condition topsin-M and carbendazim were found effective in reducing disease incidence and increase grain yield **(Elazagus and Mew, 1987 and Kaur *et al.*, 2004).**

Table 4.1 Effect of treatments with bioagents and plant extract on shoot length (cm) of paddy.

Treatments		30 DAT	60 DAT	90 DAT
T_0	**C**ontrol (Untreated)	18.29	30.28	62.32
T_1	Neem extract	19.05	30.82	64.72
T_2	Tulsi extract	18.95	30.28	64.65
T_3	*Trichoderma viride* (FS)	19.33	32.15	69.32
T_4	*Trichoderma harzianum* (FS)	19.49	31.55	64.45
T_5	*Pseudomonas fluorescens* (FS)	19.36	32.01	64.85
T_6	mancozeb (Treated)	20.13	34.15	70.72
Overal Mean		**19.23**	**31.61**	**65.86**
F- test		NS	S	S
S. Ed. (±)		0.558	0.554	0.567
C. D. (P = 0.05)		1.184	1.174	1.202

Table 4.2 Effect of treatments with bioagents and plant extract on number of tillers per hill of paddy.

Treatments		30 DAT	45 DAT	60 DAT
T_0	**C**ontrol (Untreated)	15.05	18.60	22.91
T_1	Neem extract	15.72	19.94	23.24
T_2	Tulsi extract	15.18	19.54	23.04
T_3	*Trichoderma viride* (FS)	17.45	21.00	25.18
T_4	*Trichoderma harzianum* (FS)	16.25	19.00	23.71
T_5	*Pseudomonas fluorescens* (FS)	15.58	19.20	23.51
T_6	mancozeb (Treated)	20.38	25.40	31.78
Overal Mean		**16.52**	**20.38**	**24.77**
F- test		S	S	S
S. Ed. (±)		0.458	0.777	0.417
C. D. (P = 0.05)		0.971	1.647	0.883

Table 4.3 Effect of treatments with bioagents and plant extract on disease severity (%) of paddy.

	Treatments	60 DAT	75 DAT	90 DAT
T_0	Control (Untreated)	13.01	22.37	28.39
T_1	Neem extract	12.12	17.56	21.58
T_2	Tulsi extract	11.45	16.22	20.47
T_3	*Trichoderma viride* (FS)	11.68	16.75	21.29
T_4	*Trichoderma harzianum* (FS)	11.16	15.19	19.06
T_5	*Pseudomonas fluorescens* (FS)	10.34	14.07	18.25
T_6	mancozeb (Treated)	10.05	13.63	16.84
	Overal Mean	**11.40**	**16.54**	**20.84**
	F- test	S	S	S
	S. Ed. (±)	0.737	0.339	0.875
	C. D. (P = 0.05)	1.563	0.718	1.855

Table 4.4 Effect of treatments with bioagents and plant extract on yield (q/ha) of paddy.

	Treatments	Yield (q/ha)
T_0	Control (Untreated)	36.18
T_1	Neem extract	39.05
T_2	Tulsi extract	38.48
T_3	*Trichoderma viride* (FS)	38.18
T_4	*Trichoderma harzianum* (FS)	38.28
T_5	*Pseudomonas fluorescens* (FS)	39.42
T_6	mancozeb (Treated)	40.25
	Overal Mean	**38.55**
	F- test	S
	S. Ed. (±)	0.100
	C. D. (P = 0.05)	0.211

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CONCLUSION
The result obtained from the present experiment showed that *Pseudomonas fluorescens* was found to be the best treatment and ecofriendly management of sheath blight of paddy next to the chemical mancozeb. Since chemical will be long losting and harmful for human beings, use of botanicals and bioagents in management of sheath blight of paddy was found to be effective. for the number of tillers, and highest shoot length (cm) of rice was recorded with *Trichoderma viride* followed by *Trichoderma harzianum* (FS),*Pseudomonas fluorescens* (FS). The present study was limited to one seasons only, therefore to substantiate the present findings more trials over a period of seasons is needed to come out with sound recommendations.

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