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Effect of essential oils, medicinal plants, bio agents and chemicals on sheath rot incidence and yield of rice

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Abstract

Sheath rot of rice caused by *Sarocladium oryzae* is an important disease of rice causing heavy yield losses in all cultivated areas of Agro-Climatic conditions of Bihar. The present investigation was carried out in *Kharif* 2022 at rice field of RPCAU, Pusa Farm to evaluate the efficacy of some untraditional management practices (essential oils, medicinal plants, bio agents) along with traditional methods (chemical) for management of sheath rot disease of rice. The two best management practices were selected after one year of laboratory test during 2021 viz. White Tea oil @ 0.05%, Lemongrass oil @ 0.05%, Calotropis @ 15%, Datura @ 15%, *Trichoderma asperellum* @ 0.4%, *Pseudomonas fluorescens* @ 1%, Difenconazole 25% EC @ 0.05% and Thifluzamide 24% SC @ 0.8%. The minimum disease incidence of 33.9%, 42.4% disease decrease over control and maximum yield of 3610.00 kg/ha was found in the treatment sprayed twice with Difenconazole 25% EC @ 0.05%, which was followed by treatment Thifluzamide 24%SC where disease incidence was 38.6% with 3300.00 kg/ha yield and treatment *Pseudomonas fluorescens* @ 1%, with disease incidence of 39.1% and yield 3001.00 kg/ha. All the other treatments performed good result in comparison with plot without treatment.

Keywords: Effect, untraditional management practices, sheath rot, rice

Introduction

Rice is one of the most important staple food crops in the world along with India with China and India being the lead producing countries. In India, the major rice growing states are West Bengal, Uttar Pradesh, Punjab, Bihar, Tamil Nadu, Madhya Pradesh and Chhattisgarh. India ranks first in area (43.39 mha) and second in the world production of rice (104.32 mt) with 2404 kg/ha productivity. In Bihar rice is grown in an area about 3.21mha with 6.49 mt and 2019 kg/ha, production and productivity respectively (Ministry of Agriculture & Farmers Welfare, Department of Agriculture, 2015-16).

Rice is known to suffer from many biotic and abiotic stresses. The climatic condition of Bihar state in *kharif* is most favourable for rice cultivation as well as also most congenial for disease development. Several diseases were reported infecting rice crop and among them brown spot blast, sheath rot, bacterial blight, sheath blight and false smut are most important for Bihar state causing considerable yield losses.

In India the occurrence of sheath rot was reported for the first time from Satyamangalam, Coimbatore district of Tamil Nadu by Agnihothrudu in 1973 ^[1]. The occurrence was recorded from several rice growing states of India, viz. Andhra Pradesh, West Bengal and Bihar, Tamil Nadu, Orissa, Kerala, Punjab, Uttar Pradesh, Rajasthan and Madhya Pradesh. In Bihar this disease was first reported by Ghufuran *et al.*, in 1980 ^[4]. Sheath rot has gained the status as a major disease of rice (Reddy and Gosh, 1985) ^[8]. In India, losses due to sheath rot disease were found to be ranging from 50 to 65 per cent (Narayanaprasad *et al.*, 2008) ^[6]. Bigirimana *et al.*, (2015) ^[3] reported 85% yield loss of rice due to sheath rot. The disease causes yield loss that vary from 20% to 85% (Balgude *et al.*, 2019) ^[2]. The intensive uses of chemical pesticides has contributing to the numerous recent environmental problems. Seed treatment systems that will enhance efficacy of biological agents are needed and eco-friendly management practices is one such attempt may be made in this direction. Hence, the present investigation was undertaken to find out the other management practices like effects of

different essential oils, medicinal plants, bio agents along with some recent effective chemicals on *Sarocladium oryzae* (Swada) W. Gams & D Hawksw causing sheath rot disease of rice.

Materials and Methods

Field experiment was carried out during *Kharif* season 2022 at the Plant Pathological Rice Experimental Site, RPCAU, Pusa, Samastipur. Susceptible rice cultivar Sugandha was sown in the field. General agronomical practices were followed for cultivation in the experimental plots. There were 3 replications of all 9 treatments *i.e.* White Tea oil @ 0.05%, Lemongrass oil @ 0.05%, Calotropis @ 15%, Datura @ 15%, *Trichoderma asperellum* @ 0.4%, *Pseudomonas fluorescens* @ 1%, Difenconazole 25% EC @ 0.05% and Thifluzamide 24% SC @ 0.8%, including untreated (control) for each replication and the crop were sown in Randomized Block Design. The above treatment was selected after one year of laboratory test during 2021. The two best management practices from different essential oils, medicinal plants, bio agents and chemicals were evaluated and their effects on sheath rot incidence and yield of rice in kg/ha had been calculated for each treatment. Incidence of disease was calculated with the following formulae:

$$\text{Disease incidence} = \frac{\text{Number of infected tiller/hill}}{\text{Total Number of tiller/hill}} \times 100$$

Results and Discussion

The eight best management practices from different

essential oils, medicinal plants, bio agents and chemicals were evaluated to know their effects on sheath rot disease incidence during the *Kharif* 2022 crop season. Two sprayings of each treatment *i.e.* 1st spray at boot leaf stage and 2nd, after 10 days of 1st spray were given. The result obtained under the field conditions in the study clearly revealed that all the management strategies tested were significantly reduced the disease intensity over control plot and increased the grain yield of rice. It is evident from the table that during the field evaluation of best essential oils, medicinal plants, bio agents and chemicals after laboratory work on of sheath rot incidence, two sprays with Difenconazole 25% EC @ 0.15% recorded lowest disease incidence of 33.9 per cent, maximum (42.4%) per cent disease inhibition over control and highest yield of rice with 3610 kg/ha was calculated. This treatment was followed by treatment Thifluzamide 24%SC where disease incidence was 38.6% with 3300.00 kg/ha yield and the treatment *Pseudomonas fluorescens* @ 1%, with disease incidence of 39.1% and yield 3001.00 kg/ha. This treatment was statistically at par with sprayings of *Trichoderma asperellum* @ 0.4%, Calotropis @ 15% and Datura @ 15% in which incidence of the disease was 43.5%, 44.0% and 46.35% and yield was 2719.00 kg/ha, 2630.00 kg/ha and 2460.00 kg/ha respectively. The treatment with Lemongrass oil @ 0.05% (44.0% & 2630.00 kg/ha) and White Tea oil @ 0.05% (47.5% & 2350 kg/ha) also performed good over control plot. Hence it may be said that along with chemical treatment all other non chemical treatments also performed good result in comparison with plot without treatment and this may be the future prospects for use of this components in natural farming system.

Table 1: Field evaluation of essential oils, medicinal plants, bio agents and chemicals on sheath rot incidence and yield of rice during *Kharif* 2022

Treatment No.	Treatments	Disease incidence (%)*	% disease decrease over control	Yield (kg/ha)
T ₁	White Tea oil @ 0.05%	47.5	19.2	2350.00
T ₂	Lemongrass oil @ 0.05%	44.0	25.2	2630.00
T ₃	Calotropis @ 15%	44.0	25.2	2630.00
T ₄	Datura @ 15%	46.3	21.3	2460.00
T ₅	<i>Trichoderma asperellum</i> @ 0.4%	43.5	26.0	2719.00
T ₆	<i>Pseudomonas fluorescens</i> @ 1%	39.1	33.5	3001.00
T ₇	Difenconazole 25% EC @ 0.05%	33.9	42.4	3610.00
T ₈	Thifluzamide 24% SC @ 0.8%	38.6	34.4	3300.00
T ₉	Control	58.8	-	1950.00
	SEm (±)	1.84		61.53
	CD (P=0.05)	5.52		190.24

*Average of three replications

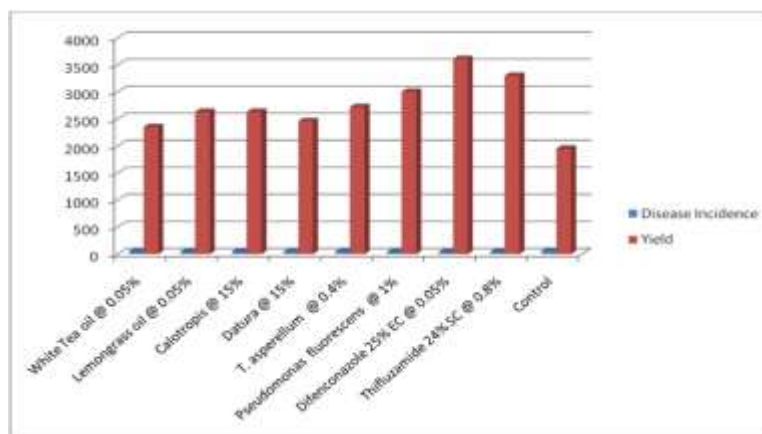


Fig: Field evaluation of essential oils, medicinal plants, bio agents and chemicals on sheath rot incidence and yield of crop during *Kharif* season 2022

The result obtained under the field conditions in the study clearly revealed that all fungicides significantly reduced the disease intensity over control and increased the grain yield of rice over control plot. Finding of several reports are in agreement with the present findings as they had also reported the effectiveness of Plant extracts, bioagents and new generation fungicides in the management of rice sheath (Persaud *et al.*, 2019; Seema and Devaki, 2010; Sehajpal *et al.*, 2009)^[7, 10, 11]. The use of biological control agents may have potential (Sakthivel and Gnanamanickam, 1987; Mew *et al.*, 2004)^[9, 5]. Many Pseudomonads can act efficiently for controlling *S. oryzae*, by favoring antagonism, for example through the inhibition of fungal development as do some *P. fluorescens* strains, or by inducing systemic resistance (Saravanakumar *et al.*, 2009)^[7].

Conclusion

Sheath rot of rice caused by *Sarocladium oryzae* is an important disease of rice causing heavy yield losses in all cultivated areas of Agro-Climatic conditions of Bihar. The present investigation was carried out in *Kharif 2022* at rice field of RPCAU, Pusa Farm to evaluate the efficacy of some untraditional management practices (essential oils, medicinal plants, bio agents) along with traditional methods (chemical) for management of sheath rot disease of rice. The result so obtained was concluded that all the treatments significantly reduced the disease intensity and increased the grain yield of rice over control plot. Obviously, two sprays with Difencnazole 25% EC @ 0.15% recorded lowest disease incidence of 33.9 per cent, maximum (42.4%) per cent disease inhibition over control and highest yield of 3610 kg/ha was obtained. But the other untraditional methods like treatment with *Pseudomonas fluorescens* @ 1%, with disease incidence of 39.1% and yield 3001.00 kg/ha, sprayings of *Trichoderma asperellum* @ 0.4% , Calotropis @ 15% and Datura @ 15% in which incidence of the disease was 43.5%, 44.0% and 46.35% and yield was 2719.00 kg/ha, 2630.00 kg/ha and 2460.00 kg/ha respectively were also obtained which was higher than control (1950.00 kg/ha)

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