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Evaluation of Fungicides against Rhizoctonia solani Causal Agent Of Sheath Blight of Rice

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ABSTRACT

The present study was undertaken to assess the percent inhibition, percent disease index, disease severity and yield parameter against sheath blight of rice through various fungicidal treatment in in vitro as well as in field conditions. In this experiment results were found as Carbendazim 25% + Flusilazole 12.5% SE (NS) gave best results in the reduction of percent inhibition, disease severity, percent disease index and gave higher grain yield as compare to Carbendazim 25% + Flusilazole 12.5% SE (RS) (Luster), Kresoxime - methyl 44.3% SC (Ergon) and Validamycine 3% L (Sheathmaar-3) at different concentrations.

Keywords: ***Rice, Rhizoctonia solani, Sheath blight, Disease, Yield, Fungicides.***

I. INTRODUCTION

Sheath Blight is one of the most important and widely distributed diseases in all the rice growing regions of the world and causing considerable losses in grain yield (Ou, 1985). In India, the disease was first reported from Gurdaspur, Punjab by Paracer and Chahal (1963). Now, it is known to occur in almost all the rice growing states of the country causing up to 50% loss in yield (Chahal *et al*., 2003).

The importance of the disease has increased in recent years in most of the rice growing region of the world due to widespread cultivation of profusely tillering and fertilizer responsive high yielding verities and hybrids. In Japan, about 1,20,000 to19,00000 hectare area of rice was reported to be infected by this disease resulting in a loss of 24,000 to 38000 tons of rice every year (Anonymous, 1954). In Assam, India the losses varied between 10-36 percent depending upon the stage of crop at the time of occurrence of disease (Roy, 1979). Likewise, Cu *et al.* (1996) have observed that the losses in rice yield varied with cultivar, crop season and growth stage at the time of infection. They have also reported that the losses in yield were significant when infection started at panicle initiation, booting or flowering but it was non-significant when plants were infected at tillering or grain filling stage. Similarly, Tsai (1974) reported that inoculation at booting stage resulted in highest loss in grain yield (11.73%) followed by inoculation at 60 days after transplanting (10.78%) and 15-45 days after transplanting (6.05-7.95%) while the losses were minimum when the crop was inoculated at milking stage (1.85%). However, Boyette and Lee (1979) recorded the maximum losses when plant were infected at half inter node elongation stage in field.

The symptoms of sheath blight disease in both nursery and transplanted crop. The symptoms usually appear at tillering stage on leaf sheath at water level in the lowland and at ground level in upland eco system. The pathogen produces elliptical or oval to irregular, 1-3 cm long, greenish, grey spots on leave sheath and leaves. The centre of the spot become greyish white with brown margin. Under favourable conditions, the infection spreads rapidly to upper leaf sheaths and leaf blades of the same or adjacent tillers. Lesions on the upper parts of the plant extend rapidly, coalescing with each other to cover entire tiller from the water level to flag leaf. On the leaf blades, the lesions are larger

and somewhat irregular in shape, greenish gray to garish white with brown margin, ultimately causing death of leaf, tiller and the plant.

The pathogen has also been found to infect seedlings at nursery stage causing stunting (Naidu *et al.,* 1983), pre and post-emergence seedling blight and spotted/discoloured seed (Acharya *et al*., 1997,2004) bearing regular to irregular brownish black spots or black to ashy gray patches seedling raised from such infected seeds bear brownish black to blackish discoloured lesions on coleoptiles, first leaf, radical, second leaf and sheath (Sivalingam *et al*., 2006).

An increase in sheath blight severity by one percent resulted in grain yield loss of 0.38% (Saikia and Baruah, 1990) and 0.74 % (Arunyanart *et al.*,1984). Ahn and Mew (1986) reported no significant reduction in yield when relative lesion height (RLH) was less than 20% but the losses were up to 46% with a RLH of 90%. The complex genetic nature of resistance to sheath blight and genetic variability of the pathogen increases the difficulty in developing resistant host genotypes, as well as in effectively deploying available tolerant cultivars (Meena *et al*., 2013). Unfortunately, at present there is no known rice varieties which is either immune or possess high degree of resistance to sheath blight disease in Uttar Pradesh, India (Adhipathi *et al.*, 2013).

In the absence of suitable resistant donors, fungicides are the main answer to check these diseases. Earlier recommended fungicides such as Zineb etc. do not provide satisfactory disease control. The present study was undertaken to evaluate the different fungicides at different formulation for efficient control of sheath blight of rice.

II. MATERIALS AND METHODS

A. In vitro evaluation of fungicides against the *Rhizoctonia solani*

Rhizoctonia solani was isolated from the infected sheath of rice plant and isolate was incubated on Potato dextrose agar medium (PDA) at 28°C ± 2°C and 70% relative humidity. Efficacy of four fungicides Carbendazim 25% + Flusilazole 12.5% SE (NS), Kresoxime - methyl 44.3% SC (Ergon), Carbendazim 25% + Flusilazole 12.5% SE (RS) (Luster) and Validamycine 3% L (Sheathmaar-3) at different concentrations was evaluated against *R. solani* by using poisoned food technique. A series of concentration as 10, 20 and 50 μg^{-1}ml of all fungicides were made on the basis of active ingredient. Required amount of each fungicide was incorporated aseptically in autoclaved PDA as 10, 20 and 50µg/ml. Twenty ml. of molten medium amended with different concentrations of the test fungicides were poured in 90 mm sterilized petriplates and allowed to solidify. Three petriplates were used for each concentration to test the sensitivity of *Rhizoctonia solani*. Suitable controls without fungicides were also maintained simultaneously.

Mycelium agar discs (5 mm diameter) cut with the help of sterilized cork borer from margin of an actively growing culture of *R. solani* was incubated in Petri dishes containing PDA poisoned with different concentrations of test fungicides. These inoculated petriplates were incubated at 28 ± 2°C, 70% RH and observed after 48 hr. The fungal colony diameter was measured in each plate and per cent of inhibition in mycelial growth was calculated in different treatment over check. The per cent inhibition of mycelial growth was worked out by using the following formula by Vincent (1947) and the data were analyzed statistically using completely randomized design.

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

Where,
I = Percent inhibition in mycelia growth
C = Average colony / fungal growth diameter in control
T= Average colony / fungal growth diameter in treatment

B. In vivo evaluation of fungicides against the *Rhizoctonia solani*

The field trials were conducted in a randomized block design (RBD) with three replications and plot size of 5.0m X 4.0 m (spacing 15cm X 20cm) on rice variety BPT at Agricultural Research Farm of BHU to study the efficacy of different fungicides against sheath blight of rice. These fungicides viz; Validamycine 3% L (Sheathmar 3), Kresoxim-methyl 44.3% SC (Ergon), Carbendazim 25% + Flusilazole 12.5% SE (Luster), Flusilazole 12.5% + Carbendazim 25% SE (NS) were sprayed twice at 15 days interval at 0.02% and 0.05 % concentration. Grain yield was observed and recorded on plot basis and expressed as q/ha.

Percent disease index:

Disease severity of sheath blight was recorded 10 days after the second spray. Five sampling units of 1 m^2 area were marked in each plot at random. The disease score was recorded on fifteen plants per sampling unit by counting the number of infected tillers/ leaves and degree of severity on each tiller/leaf using 0-5 scale (0=0%, 1 = < 5%, 2 = 6-10%, 3 = 11- 25%, 4 = 26-50%, 5 = > 50%)

The percentage of disease index was calculated by following formula.

$$PDI = \frac{\text{Sum of all disease rating}}{\text{Total no.of rating}} \times \frac{100}{\text{Maximum disease grade}}$$

III. RESULTS AND DISCUSSION

A. Invitro evaluation fungicides against *Rhizozctonia solani*

All four fungicides viz. Carbendazim 25% + Flusilazole 12.5% SE (Luster), Kresoxim-methyl 44.3% SC (Ergon), Validamycine 3% L (Sheathmar 3), Flusilazole 12.5% + Carbendazim 25% SE (NS) exhibited varying level of efficacy against *Rhizoctonia solani* for mycelia growth inhibition. These fungicides were prepared at different concentration (µg/ml) viz. 10, 20, and 50 then tested by poisoned food technique.

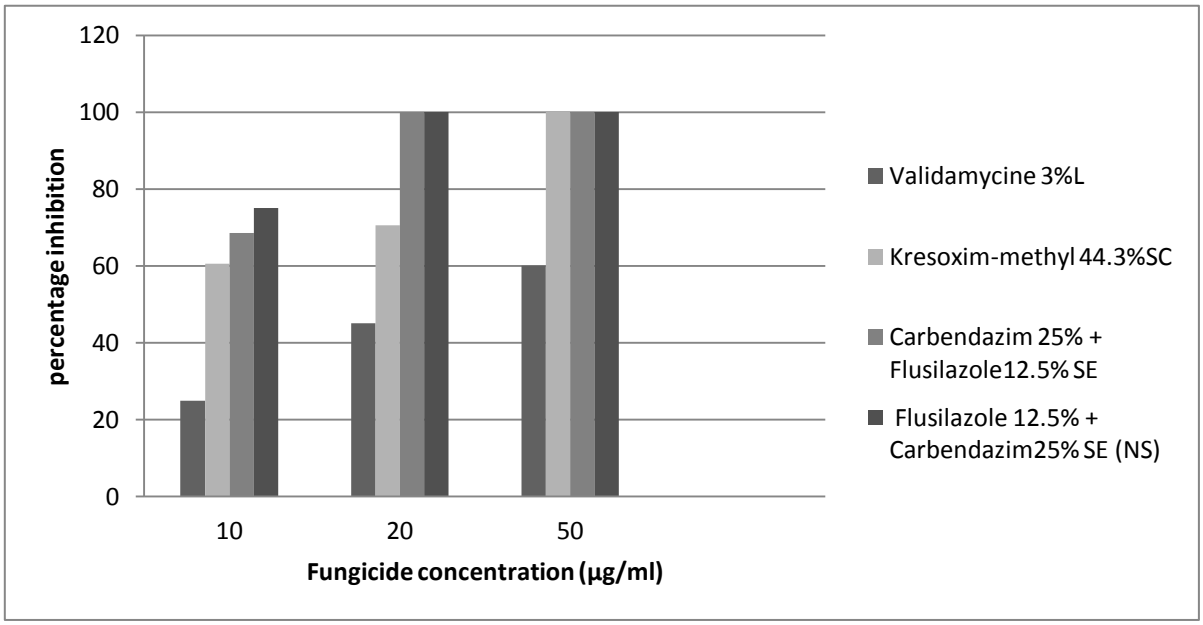
The result tabulated in Table 1.0 indicate that Flusilazole 12.5% + Carbendazim 25% SE (NS) was found to be highly inhibitory (100%) to *Rhizoctonia solani* (Rice) at the concentration of 20 and 50 µg/ml while 75% percent inhibition was found at the concentration of 10 µg/ml. Carbendazim 25% + Flusilazole 12.5% SE (Luster) was found as 68.55% inhibition to mycelial growth at 10 µg/ml but 100% inhibition was recorded at 20 and 50 µg/ml. Kresoxim-methyl 44.3% SC (Ergon) was exhibited 60.55 and 70.55 per cent inhibition of radial growth at 10 and 20 µg/ml concentration but at higher concentration 50 µg/ml it exhibit 100% inhibition in mycelia growth. Validamycine 3% L (Sheathmar 3) was showed only 25% and 45% inhibition of radial growth at 10 and 20 µg/ml concentration but shows 60% inhibition of radial growth at 50 µg/ml concentration.

Table1.0 *In vitro* Evaluation of various fungicides against growth of *R. solani*

Fungicide	Concentration (µg/ml)	Radial growth(cm)	Percent inhibition (%)
Validamycin 3% L	10	6.75	25
	20	4.95	45
	50	3.60	60
Kresoxim-methyl44.3% SC	10	3.55	60.55
	20	2.65	70.55
	50	0.00	100
Carbendazim 25% + Flusilazole 12.5% SE (Luster)	10	2.83	68.55
	20	0.00	100
	50	0.00	100
Flusilazole12.5% + Carbendazim25% SE (NS)	10	2.250	75.00
	20	0.00	100
	50	0.00	100
Controlled		9.00	0.00

CD (P0.05) = 22.95

***Invitro* Effect of fungicides at different concentration on the growth of *R. solani* Kuhn**



These results are confirmative with the findings of Dash and Panda (1984) and Shukla *et al.* (1990). They have been proved that Carbendazim was the most effective for inhibition of mycelia growth of *R. solani*. Gupta (2002) those observed that Carbendazim inhibited 95-100% of fungal growth of *R. solani.* Reddy and Murlidharan (2007) have also reported that Luster 37.5 EC an effective combination product of Flusilazole and Carbendazim against sheath blight of rice and found that spray of Luster was significantly superior to the spray of single straight fungicide application of Flusilazole or Carbendazim.

***B. In vivo* evaluation of different fungicides**

Field trial conducted during *kharif* 2013 at Agricultural Research Farm of BHU to study the efficacy of different fungicides against sheath blight of rice, all the test fungicides reduced disease

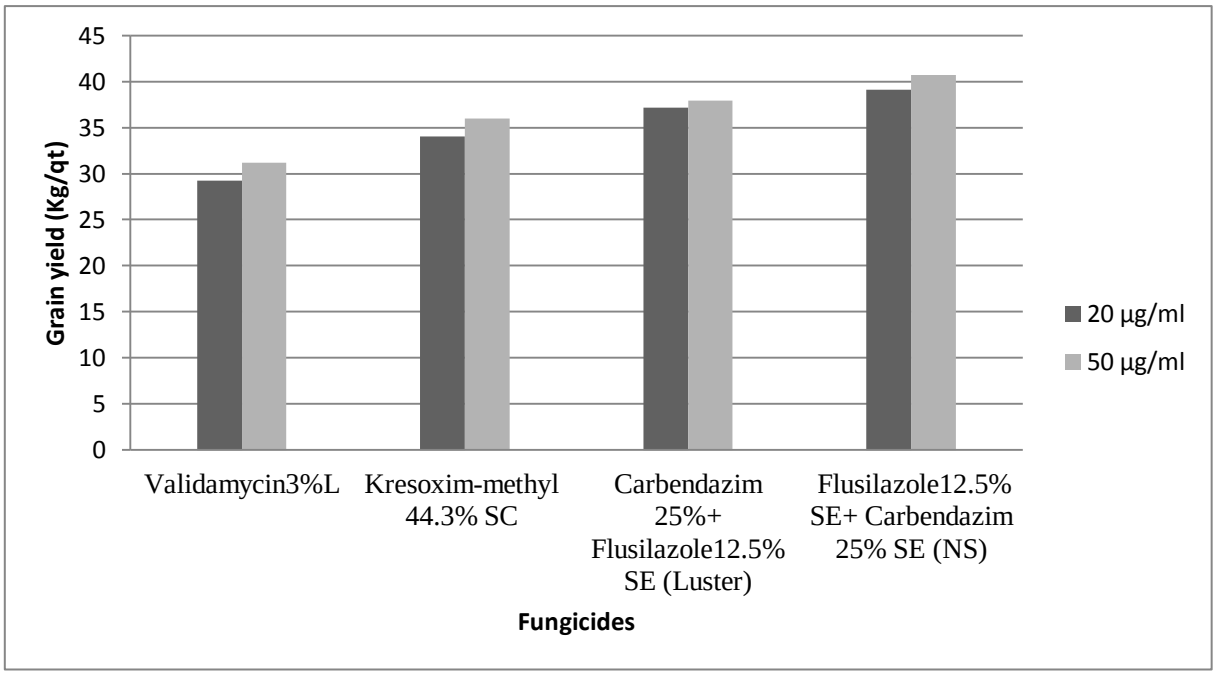
severity and increased grain yield of cultivar BPT significantly (Table 2.0). Flusilazole 12.5% + Carbendazim 25% SE (NS) was proved to be best closely followed by Carbendazim 25% + Flusilazole 12.5% SE (Luster), Kresoxim-methyl 44.3% SC (Ergon) and Validamycine 3%L (Sheathmar 3) in reducing disease and increasing yield.

Table 2.0 *In vivo* Evaluation of various fungicides against *R. solani*

Fungicides	Concentration (%)	Percent disease index	Yield	
			Kg/plot	Qt/ha
Validamycin 3%L	0.02%	15	10.53	29.25
	0.05%	13	11.23	31.20
Kresoxime-methyl 44.3% SC	0.02%	12	12.24	34.01
	0.05%	10	12.96	36.00
Carbendazim 25% + Flusilazole 12.5% SE (Luster)	0.02%	9	13.37	37.16
	0.05%	8	13.66	37.96
Flusilazole 12.5% + Carbendazim 25% SE (NS)	0.02%	8	14.07	39.09
	0.05%	8	14.65	40.70
Controlled		20	9.52	27.00

CD(P0.05) = 0.50

***In vivo* fungicidal efficacy against *R. solani* Kuhn with respect to grain yield**



Flusilazole 12.5% + Carbendazim 25%SE (NS) at 0.05% concentration was found highly effective against sheath blight of rice and gave good result with 40.70 qt/ha. It was also effective at 0.02% concentration. Other fungicides such as Carbendazim 25% + Flusilazole 12.5% SE (Luster) and Kresoxime-methyl 44.3% SC (Ergon) at 0.05% were reduced the disease incidence and increased the yield as 37.96 qt/ha and 36.00 qt/ha respectively. These fungicides were also effective at 0.02% concentration while Validamycine 3%L (Sheathmar 3)was least effective among all testing fungicides which gave yield 31.2 qt/ha only at 0.05% concentration. These results are confirmative

with the findings of Borthakur and Addy (1989), Das and Mishra (1990), Sharma *et al*. (1995) Reddy and Murlidharan (2007) and Dutta and Kalha (2011).

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BIBLIOGRAPHY

[1] Adhipathi, P., Singh, V., and Meena, S.C. (2013). Virulence diversity of *rhizoctonia solani* causing sheath blight disease in rice and its host pathogen interaction. *The Bioscan* **8**(3):949-952
[2] Anonymous, (1954). Insect and Disease of rice plant in Japan. Paper presented in the 4th session, International Rice Commission Tokyo, 33 pp.
[3] Arunyanart, P., Surin, A. Rojanahasadin, W., Dhitikattipong, R. and Disthaporn, S. (1986). Chemical control of sheath blight (ShB). *Intern rice res. Newsl*. **11**(2):20.
[4] Ahn, S.W. and Mew, T.W. (1986). Relation between rice sheath blight and yield. *Intern. Riceres. Newsl*.**11**(5):21-22.
[5] Borthakur, B.K. and Addy, S. K. (1989). Control of sheath blight disease of rice withsystemic fungicides. *Pesticides*. **23**: 33-34.
[6] Boyette, C.D. aand Lee F.N. (1979). Reduction in rice yield caused by sheath blight. Arkanash Farm Res**28**(3):5.
[7] Chahal, K.S., Sokhi, S.S. and Rattan, G.S. (2003). Investigations on sheath blight of rice in Punjab. *Indian phytopathol*. **56**: 22-26.
[8] Chang, Y.C. (1986). Studies on the effect of disease severity of sheath blight on rice yield. *J agric. Res. China* **35**:202-209.
[9] Cu, R.M., Mew, T.W., Cassman, K.G., and Teng, P.S. (1996). Effect of sheath blight onyield in tropical intensive rice production system. *Pl. Dis.* **80**: 1103-1108.
[10] Dash, S.C. and Panda, S.(1984). Chemical control of rice sheath blight disease. *Indian Phytopathol*.**37**:79-82.
[11] Das, S.R. and Mishra, B. (1990). Field evaluation of fungicides for control of sheath blight of rice. *Indian phytopathology* **43** (1): pp. 94-96.
[12] Ding, K.J., Tan, G.J. and Ji, B.H. (1998). Factors affecting the affecting the prevalence and damage of rice sheath blight. *Chinesej. Applied Ecol.* **9**: 47-50.
[13] Dutta U., Kalha C.S.(2011). *In vitro* evaluation of fungicides, botanicals and bioagents against *Rhizoctonia solani* causing sheath blight of rice and their integration for effective management of the disease under field conditions *Plant Disease Research* **26** (1): 14-19.
[14] Gupta, R.P. (2002). Fungicides management of web blight of moong bean *J. Mycol. Pl.Pathol*., 32(1):141.
[15] Meena, S.C., Singh, V., Adhipathi, P. and Chand R. (2013). Screening for sheath blight resistant genotypes among mutated population of rice cv. Pusa basmati-1. *The bioscan* **8**(3): 919-924
[16] Ou, S.H. (1985). *Rice Disease. 2nd edn.*, CMI, Kew, Surrey, U.K., p. 272-286.
[17] Paracer C.S. and Chahal D.S. (1963). Sheath blight of rice caused by *Rhizoctonia solani* Kuhn, new record in India. *Curr. Sci.* **32**:328-329.
[18] Reddy C. S. and Muralidharan K.(2007). Lustre 37.5 SE - An effective combination product of Flusilazole and Carbendazim against sheath blight of rice *Indian Journal of Plant Protection.* **35**(2): 287-290.
[19] Roy, A.K. (1979). Susceptibility of rice plants to sheath blight at different stages of growth. *Indian Journal of Plant Protection.* pp. 25-26.
[20] Sharma, M.K. (1993). Assesment of yield losses and chemical control of sheath blight of rice caused by *Rhizoctonia solani*. M.Sc. Thesis, G.B. Pant Univ. of Agri. and Technology, Pantnagar, pp 70-72.
[21] Shukla, R.P., Singh R.K. and Dwivedi, R.S. (1990). Efficacy of fungicides against enzyme produced by rice sheath blight pathogen, *Int. Rice Res. Newsl*, 15: 20.
[22] Sudhakar, R., Rao, K. C. and Reddy, C.S. (2005).Chemical control of rice sheath blight incited by *R. solani* Kuhn. *Research on crops*, **6** (2): 343-348.
[23] Tsai, W.H. (1973). Variation in cultural characteristics and pathogenicity of single basidiospore of *Thanatephorus cucumeris* (frank) Donk, causing sheath blight of rice. M.Sc. Thesis, University of Phillipines, LosBanos, Laguna,Phillipines.
[24] Vincent, J.M. (1947). Distortion of fungal hyphae in presence of certain inhibitors 159: 850.

