INTERNATIONAL JOURNAL OF PLANT PROTECTION
VOLUME 8 | ISSUE 2 | OCTOBER, 2015 | 303-306

● e ISSN-0976-6855 | Visit us : *www.researchjournal.co.in*

IJPP

RESEARCH PAPER

DOI : 10.15740/HAS/IJPP/8.2/303-306

Influence of zinc on *Trichoderma harzianum* and sheath blight of rice under glasshouse conditions

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ARITCLE INFO

Received : 01.07.2015
Revised : 16.08.2015
Accepted : 01.09.2015

KEY WORDS :
Rice, Sheath blight, *Trichoderma harzianum*, *Rhizoctoniasolani*, Zinc

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ABSTRACT

This study was carried out to know the effect of zinc on *Trichoderma harzianum* and sheath blight of rice under glasshouse conditions. The bio-agent significantly reduced the disease severity and incidence of sheath blight. Maximum reduction in disease severity (52.66%) and incidence (26.66%)was recorded when the zinc applied as foliar application in bio-agent treated pots it is followed by 36.80 per cent reduction in disease severity and 22.31 per cent in diseases incidence, respectively in pots where soil application of zinc was given in bio-agent treated pots. Minimum reduction in disease severity (42.10%) and incidence (22.31%) were recorded in pots without zinc application. The application of bio-agent significantly increased grain yield and 1000-grain weight. Maximum increase in grain yield (19.38%) was recorded when zinc was applied in the soil followed by foliar application of bio-agent. Maximum increase in 1000-grain weight (7.10%) was recorded in pots where foliar application of zinc and bio-agent was given. Minimum increase in 1000-grain weight (4.92%) was reported in pots where zinc was not applied.

How to view point the article : Khan, Ashraf Ali and Singh, Rajbir (2015). Influence of zinc on *Trichoderma harzianum* and sheath blight of rice under glasshouse conditions. *Internat. J. Plant Protec.*, **8**(2) : 303-306.

INTRODUCTION

Sheath blight of rice caused by *Rhizoctoniasolani* Kuhn [*Thanatephoruscucumeris* (Frank) Donk] is regarded as an internationally important disease which is known to cause considerable yield loss in all the rice growing areas. In India intensive and extensive cultivation system especially under rice-wheat cropping systems have resulted in occurrence of sheath blight in epiphytotic proportions hitherto considered as minor disease. The disease has caused loss of 25-50 per cent in yield from Philippines and 12-69 per cent from India (Naidu, 1992). The loss is closely correlated with the number of hills affected in a field. There is also strong relationship between disease severity and yield reduction which varies among cultivars (Singh *et al.,* 2008).The management of sheath blight by the use of resistant cultivars has not been successful because an adequate

level of host resistant has not been found (Mew and Rosales, 1986).Now a days chemicals are generally used to manage this disease, but indiscriminate use of chemicals is not only hazardous to living beings but also adversely affect the microbial population present in the ecosystems.

Biological control has emerged as an alternative and most promising means of the management of plant pathogens.Biological control of *R. solani*can be achieved by use of fungal antagonists has been viewed as an alternative disease management strategy. Among the several antagonists tested by various scientists, species of *Trichoderma,*have been found effective in inhibiting the sheath blight (*R. solani*). *T. harzianum* have been found effective in inhibiting the growth of *R. solani* under *in vitro* conditions. However, such organisms fail to control the pathogen in field in most of the cases due to various reasons. It is because of the fact that biological control recommendations may hold promise under certain set of conditions only (especially under controlled conditions). Time of application, plant growth stage, the inoculum level and potential of the pathogen as well as the bio-agents, mode and form of applications or delivery system of bio-agents, organic matter, soil pH and nutrition of soil play a vital role in bio-control strategies. Among the above factors nutritionis an important factor. It is therefore, essential to identify the role of nutritional factors that may contribute to biological control of sheath blight in transplanted rice by the use of fungal antagonists.

There are only few reports providing information on the role of nutritional factors on the effectiveness of bio-agents (Meena and Muthusami, 1998; Gnanamanickam *et al*., 1992). Present study was under taken to investigate the effect of zinc on the effectiveness of *T.harzianum* in managing sheath blight, and yield of rice under glasshouse conditions.

MATERIAL AND METHODS

For glasshouse experiments,bio-agent *T.harzianum* obtained from culture collection of Rice Pathology Lab, Department of Plant Pathology, G.B. Pant University of Agriculture and Technology, Pantnagar. The fungal bio-agent was cultured on Jhangora(Barnyard millet, *Echinochloa frumentaceum*). The fungal biocontrol formulation was prepared by mixing the Jhangora powder into the talc+cmc powder (1:15 v/w) as to obtain the population 10^8cfu/ml. The powder was filled in polythene bags, sealed and kept in a refrigerator. The rice blight pathogen (*R. Solani*)was isolated from the infected leaf sheath of rice cv. Pant Dhan-4 and mass cultured on rice stem pieces. This experiment was conducted to determine the effect of soil application/foliar spray of zinc on *T. harzianum*. Treatments were soil application of zinc @ 25 kg/ha, foliar spray of urea + zinc (2 kg zinc + 200 g urea/ha) and a control without zinc.The pots without antagonist were maintained as check. Three replications were maintained for each treatment.Thirty cm diameter plastic pots were filled with clay loam soil and irrigated forpuddling. After puddling in each pot 22 days old rice seedlings were transplanted (2 seedlings/ hill) and two hills/pot were maintained. Pots irrigated daily to maintainappropriate moisture. Inoculation was done at maximum tillering stage (45 days aftertransplanting) by placing rice stem pieces covered with mycelium and sclerotiaof *R. solani* in between tillers at the water level. First foliar spray of bio-agent was @ 2g/l was given three days after pathogen inoculation and second at fifteen days after first spray. Unsprayed pots were maintainedwhich served as check. The final observations on the per cent disease severity and incidence were recorded a 15 days after second spray of the bio-agent, following standard evaluation system of rice (IRRI, 1996). The second observation was recorded at fifteen days interval on the same hills. All plants from each pot were harvested and threshed separately from which 1000-grains weight and total yield was recorded and calculated per ha. basis.

RESULTS AND DISCUSSION

Deficiency of zinc causeKhaira disease in rice which is a important disease of rice in several rice growing areas.Application of zinc sulphate in soil or foliar spray is the common method to control the disease. It is clear from the Table 1 that application of bio-agent significantly reduced the disease severity and incidence of sheath blight. Maximum reduction in disease severity (52.66%) was recorded when the zinc and bio-agent were applied as foliar applications, it is followed by with 36.80 per cent disease severity reduction in pots where soil application of zinc and foliar application of bio-agent were given to the pots. Minimum reduction in disease severity (42.10%) was recorded in plants without zinc. Similar trend has been observed in the case of disease incidence, maximum reduction in disease incidence (26.66%) was

recorded in treatments, where zinc as well bio-agent were applied as foliar spray,followed by zinc application in the soil and bio-agent application as foliar spray with 20.80 per cent reduction. Whereas minimum disease incidence (22.31%) was recorded in pots without zinc application. It is also evident from Table 2 that application of bio-agent increased grain yield and 1000-grain weight significantly. Maximum increase in grain yield (19.38%) was recorded when zinc was applied in the soil, it is followed by in treatments where foliar application of zinc and bio-agent were given with 18.36 per cent increase. It is clear from the Table 2 that theuse of bio-agent and zinc increased 1000-grain weight. Maximum increase in 1000-grain weight (7.10%) was also recorded in plant treated with bio-agent and foliar application of zinc was given. Minimum increase in 1000-grain weight (4.92%) was reported in plantswithout zinc application.

It has been observed that the soil/foliar application of zinc had adverse effect on *R. solani*. Effectiveness of *T.harzianum* was more in zinc applied plants. Disease severity was also high in zinc deficient soil when it was not treated with *T. harzianum*. Babich and Stotzky (1978) reported that a 10 mM concentration of Zn^{2+} completely inhibited growth of *R. solani* and significantly decreased the mycelial growth of *T. viride*. Differential sensitivities to Zn^{2+} were also noted with fungi, the sequence of sensitivity being *R. solani>F. solani>A. niger>T. viride* (Kiremidijian and Stotzky, 1976). Bhattacharyya and Roy (1998) observed strong inhibitory effect on lesion size (sheath blight) with sodium selenate (10^{-5}M) which was followed by zinc sulphate (10^{-4}M) and calcium nitrate (10^{-2}M). The addition of zinc to zinc deficient soils resulted in reduced yield loss in the presence of *R. solani*, a reduction in disease score were also reported (Streeter *et al.*, 2001). Prasad *et al*. (2010) reported that maximumdisease severity of sheath blight was where zinc was not applied.Dluzniewska(2008) observed that foliar application of micronutrients (N, Ca, K, B, Cu, Fe, Mn, Mo and Zn) reduced mycelial growth, spore germination and antagonism of

Table 1: Effect of zinc on the efficacy of *T. harzianum* against sheath blight, under glasshouse conditions

Treatments	Disease severity (%)			Disease incidence (%)		
	Treated* (with TH)	Untreated	Reduction in disease severity (%)	Treated* (with TH)	Untreated*	Reduction in disease incidence (%)
Soil application of zinc	23.12 (28.73)	36.80 (37.35)	37.17	72.60 (58.31)	91.70 (73.26)	20.82
Foliar application of zinc	19.10 (25.91)	40.35 (39.47)	52.66	63.80 (63.01)	87.00 (68.87)	26.66
Without zinc	26.40 (30.92)	45.60 (42.48)	42.10	76.75 (61.14)	98.80 (83.71)	22.31
C.D. (P=0.05)						
TH	2.47		-	7.82		-
Zinc	1.43		-	4.52		-
Interaction	3.50		-	11.06		-

*Figures in parentheses are angular transformed value.
TH = *Trichoderma harzianum*
RS = *Rhizoctoniasolani*

Table 2 : Effect of plant zinc application on efficacy of *T. harzianum* and grain yield per hectareand 1000-grain weight of rice,under glasshouse conditions

Treatments	Grain yield (q/ha)			Thousand grain weight (g)		
	Sprayed (with TH)	Unsprayed	Increase (%)	Sprayed (with TH)	Unsprayed	Increase (%)
Soil application of zinc + RS	72.20	58.20	19.38	28.90	27.12	6.56
Foliar application of zinc + RS	73.10	59.67	18.36	29.40	27.45	7.10
Without zinc + RS	70.98	59.78	15.78	28.75	27.40	4.92
C.D. (P=0.05)						
TH	38.1.9		-	0.44		-
Zinc	66.18		-	0.76		-
Interaction	93.51		-	1.07		-

TH = *Trichoderma harzianum*
RS = *Rhizoctoniasolani*

*Trichoderma*isolates. Esfahani *et al.* (2014), reported that foliar spray of Zn+Siresulted maximum 1000-grain weight and grain yield in rice crop.

REFERENCES

Babich, H. and Stotzky, G. (1978). Toxicity of Zink to fungi, bacteria and coli phages, influence of chloride ions. *Appl. Environ. Microbiol*.,**36** (6) : 906-914.

Bhattacharyya, A. and Roy, A.K. (1998). Induction of resistance in rice plant against sheath blight with non-conventional chemicals.*Indian Phytopath*., **51** (1) : 81-86.

Dluzniewska, J. (2008). The effect of foliar fertilizers on the developmentand activity of *Trichoderma* spp. *Polish J. Environ. Stud.,* **17** (6) : 869-874.

Esfahani, A. A., Pirdashti, H. and Niknejhad, Y. (2014). Effect of iron, zinc and silicon application on quantitative parameters of rice (*Oryza Sativa* L. cv. Tarom Mahalli). *Internat. J. Farm. & Allied Sci.*, **3** (5) : 529-533.

Gnanamanickam, S.S, Ahmed, S. and Mew, T.W. (1992). Biological control of rice diseases. *Indian Rev. Life Sci.*, **12**: 3-22.

IRRI (1996). Standared Evaluation System for Rice. 4th Edition, INGER Genetic Resources Centre, International Rice Research Institute, Philippines pp.52.

Kiremidijian, S.L. and Stotzky, G. (1976). Influence of mono and multivalent cations on the electrokinetic properties of normal human lymphoid and Burkitt lymphoma cells. *Expoerientia*, **32** (3) : 312-314.

Meena, B. and Muthusami, M. (1998). Efficacy of different mode of application of *Pseudomonas fluorescens* against rice sheath blight disease.*Oryza*,**35** : 293-294.

Mew, T.W. and Rosales, A.M. (1986). Bacterization of rice plants for control of sheath blight caused by *Rhizoctoniasolani. Phytopathology*, **76** : 1260-1264.

Naidu, V.D. (1992). Influence of sheath blight of rice on grain and straw yield in some popular local varieties. *J. Res., Assam Agric. Univ.*, **10**: 78-80.

Prasad, D, Singh, A. and Singh, A. (2010). Management of sheath blight of rice with integrated nutrients.*Indian Phytopath.*, **63** (1) : 11-15.

Singh, R., Sinha, A.P., Khan, A.A. and Prasad, D. (2008). Ecologically sustainable management of sheath blight disease of rice. In: D. Parasad (ed.) *Insect Pests and Disease Management*, Daya Publishing House, New Delhi, pp 291-315.

Streeter, T.C., Rengel, Z., Meate, S.M. and Graham, R.D. (2001). Zinc fertilization increases tolerance to *Rhizoctoniasolani* (AG8) in *Medicagotrucalula. Plant & Soil*, **228** : 233-242.

Weller, J.M. (1988). Biological control of soil borne plant pathogens in the rhizosphere with bacteria. *Annu. Rev. Phytopath.*,**26** : 379-407.

Whitehead, M.D. (1957). Sorghum grain: a medium for the increase inoculum for studies of soil borne and other fungi. *Phytopathology*, **47** : 450.

Yedidia, I., Srivastva, A.K., Kapulnik, Y. and Chet, I. (2001). Effect of *T. harzianum*on microelement concentrations and increased growth of cucumber plants. *Plant & Soil*, **235** (2) : 235-242.

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