

Evaluation of fungicides, botanicals and bio-agents against sheath blight of rice caused by *Rhizoctonia solani* Kühn under irrigated eco-system

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ARTICLE INFO

Received : 21.07.2017

Revised : 05.08.2017

Accepted : 19.08.2017

KEY WORDS :

Sheath blight, Rice, *Rhizoctonia solani*, Hexaconazole, Botanicals, Bio-agents

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ABSTRACT

The study was conducted to know the field efficacy of different fungicides, botanicals and bio-agents against sheath blight of rice under irrigated eco-system. Among the different treatments, the least per cent disease index (17.00 PDI) was recorded in Hexaconazole (Contaf 5 EC) with the highest grain yield (81.02 q/ha). This was followed by Validamycin 3L (21.60 PDI and grain yield 73.83 q/ha) and Carbendazim 50 WP (24.80 PDI and grain yield 69.21 q/ha). Among the botanicals and bio-agents, the least disease incidence was noticed in Tricure (Azadirachtin @ 0.03%) with 30.50 PDI and grain yield of 61.43 q per ha and *P. fluorescens* (Pfr-1) with 36.20 PDI with a grain yield of 54.02 q per ha. The C:B ratio was high in Hexaconazole (1:2.5) followed by Propiconazole (1:2.3).

How to view point the article : Nagaraju, P. and Naik, M.K. (2017). Evaluation of fungicides, botanicals and bio-agents against sheath blight of rice caused by *Rhizoctonia solani* Kühn under irrigated eco-system. *Internat. J. Plant Protec.*, **10**(2) : 247-251, DOI : 10.15740/HAS/IJPP/10.2/247-251.

INTRODUCTION

Sheath blight of rice caused by *Rhizoctonia solani* Kühn, once a minor disease, has become one of the major diseases inflicting heavy yield losses in most of the Asian countries. Rice sheath blight was first reported from Japan by Miyake in 1910, subsequently it was reported throughout the temperate and tropical rice growing areas. The occurrence of the disease in India was first reported by Paracer and Chahal (1963) from Gurdaspur in Punjab.

Now its occurrence is observed in almost all rice growing states of India with an estimated loss of grain yield to the extent of 5.20 to 50 per cent (Das and Mishra, 1990). Paracer and Chahal (1963) described the characteristic symptoms on the leaf sheath and the lesion in its early stages was circular or oblong with dark brown margin. The lesions were usually confined to the lower leaf sheaths at or near the water level. However, under constant humid weather, symptoms also occurred on the upper most leaf sheaths. Much work has been done in

different parts of the world to control the disease by using fungicides (Kannaiyan and Prasad, 1976). Although extensive work has been done on fungicidal control of sheath blight of rice, no blanket recommendation could be made since the results continue to be contradictory (Gangopadhyay and Chakrabarti, 1982). In the absence of resistant varieties, adapting integrated disease management (IDM) measures such as cultural practices, usage of plant extracts and antagonistic micro-organisms seems to be the other alternatives that needs knowledge on the role of plant products and bioagents in the management of sheath blight disease.

MATERIAL AND METHODS

A field experiment was carried out at Agricultural Research Station, Siruguppa, Karnataka, India, during *Kharif* 2006 and 2007 in order to evaluate the efficacy of four fungicides, two botanicals and two bio-agents against sheath blight of rice under natural epiphytotic conditions under irrigated eco-system by using the most popular cultivar samba mashuri (cv BPT-5204) in Randomized Block Design with nine treatments and three replications. Two sprays were given after 60 days of transplanting at an interval of 15 days and the disease was scored by using 0-9 scale (Anonymous, 1996) and is described below.

0= No infection

1= Vertical spread of lesion upto 0-20 per cent plant height.

3= Vertical spread of lesion upto 21-30 per cent plant height

5= Vertical spread of lesion upto 31-45 per cent plant height

7= Vertical spread of lesion upto 46-65 per cent plant height

9= Vertical spread of lesion upto 66-100 per cent plant height

The per cent disease index (PDI) was worked out by using the formula given by Wheeler (1969) and the grain yield was recorded from each plot after harvest of the crop and expressed in quintal per hectare.

$$PDI = \frac{\text{Sum of rating}}{\text{Number of plants observed}} \times \frac{100}{\text{Maximum scale}}$$

RESULTS AND DISCUSSION

During *Kharif* 2006, all the treatments differed significantly with respect to PDI (Table 1). Among the different treatments, the least PDI was recorded in Hexaconazole (18.50%) with an highest grain yield of 79.01 q per ha followed by Validamycin with disease severity of 20.30 PDI and grain yield of 74.41 q per ha. During *Kharif* 2007, the same trend was noticed (Table 2). Among different treatments, the least PDI was recorded in Hexaconazole (15.50%) with the highest grain yield of 83.03 q per ha which was followed by Validamycin (22.90 PDI and grain yield 72.25 q/ha).

The pooled analysis (Table 3) of two years indicated that all treatments differed significantly with respect to per cent disease severity and grain yield over untreated check. Among different treatments, significantly least disease severity was observed in Hexaconazole (Contaf 5 EC) with 17.00 per cent disease index (PDI) and

Table 1: Efficacy of spray of different fungicides, botanicals and bio-agents against sheath blight of rice under field condition during *Kharif* 2006

Sr. No.	Treatments	Concentration (%)	Per cent disease index	Grain yield (q/ha)
1.	Carbendazim 50 WP	0.1	25.40 (30.26)	70.11
2.	Hexaconazole 5 EC	0.1	18.50 (25.47)	79.01
3.	Validamycin 3 L	0.15	20.30 (26.78)	74.41
4.	Propiconazole 25 EC	0.1	25.45 (30.26)	71.00
5.	Achook (Azadirachtin 0.15%)	0.5	30.10 (33.27)	62.20
6.	Tricure (Azadirachtin 0.03%)	0.5	29.50 (32.90)	59.20
7.	<i>Trichoderma harzianum</i> (Dharwad) (10 ⁶ cfu/ml)	0.41	37.90 (38.00)	49.30
8.	<i>P. fluorescens</i> (Pfr-1) (10 ⁸ cfu/ml)	0.5	37.10 (37.52)	55.00
9.	Untreated check	--	44.45 (41.78)	41.00
	S.E.±		0.98	1.85
	C.D. (P=0.05)		2.45	4.63

Figures in parentheses are arcsine values

differed significantly with all other treatments resulting in highest grain yield (81.02 q/ha). This was followed by Validamycin (Rhizocin) 3 L with 21.60 PDI and Carbendazim (Bavistin 50 WP) with 24.80 PDI with an yield of 73.83 q per ha and 69.21 q per ha, respectively and were at par with each other. Among botanicals and bio agents, the least disease severity of sheath blight was noticed in Tricure (Azadirachtin 0.03 %) with 30.50 PDI and *P. fluorescens* (Pfr-1) recording 36.20 PDI with an yield of 61.43 q per ha and 54.02 q per ha, respectively. In general, the sheath blight severity decreased in all the treatments resulting in increased yield, as against untreated check (45.90 PDI) with a least yield (42.02 q/ha).

A glance towards previous investigations supports our present findings. Tiwari (1997) reported maximum disease control using Hexaconazole followed by Edifenphos and the least control was found in Mancozeb.

The results are in agreement with the work of Meena *et al.* (2003), where they noticed the volatile activity of *T. harzianum* as effective in causing significant suppression of both, growth and sclerotia formation of *R. solani* f sp. *sasakii*. *P. fluorescens* isolated from rice rhizosphere, showed antagonism towards *R. solani* inhibiting the mycelial growth and affecting sclerotial viability, under *in vitro* condition (Devi *et al.*, 1989) has been observed in our present investigation. Similar result was obtained by earlier

Table 2: Efficacy of spray of different fungicides, botanicals and bioagents against sheath blight of rice under field condition during Kharif 2007

Sr. No.	Treatments	Concen-tration (%)	Per cent disease index	Grain yield (q/ha)
1.	Carbendazim 50 WP	0.1	24.20 (29.47)	68.31
2.	Hexaconazole 5 EC	0.1	15.50 (23.59)	83.03
3.	Validamycin 3 L	0.15	22.90 (28.59)	72.25
4.	Propiconazole 25 EC	0.1	24.35 (29.53)	67.00
5.	Achook (Azadirachtin 0.15%)	0.5	32.30 (34.63)	58.76
6.	Tricure (Azadirachtin 0.03%)	0.51	31.50 (34.14)	61.63
7.	<i>Trichoderma harzianum</i> (Dharwad) (10 ⁶ cfu/ml)	0.4	39.90 (39.17)	51.98
8.	<i>P. fluorescens</i> (Pfr-1) (10 ⁸ cfu/ml)	0.5	35.30 (36.45)	53.04
9.	Untreated check	--	47.35 (43.45)	43.04
	S.E.±		1.01	1.79
	C.D. (P=0.05)		2.53	4.48

Figures in parentheses are arcsine values

Table 3: Efficacy of spray of different fungicides, botanicals and bioagents against sheath blight of rice under field condition (pooled data of two years)

Sr. No.	Treatments	Concen-tration (%)	Per cent disease index	Grain yield (q/ha)
1.	Carbendazim 50 WP	0.1	24.80 (29.85)	69.21
2.	Hexaconazole 5 EC	0.1	17.00 (24.32)	81.02
3.	Validamycin 3 L	0.15	21.60 (27.69)	73.83
4.	Propiconazole 25 EC	0.1	24.90 (29.95)	69.00
5.	Achook (Azadirachtin 0.15%)	0.5	31.20 (33.95)	60.48
6.	Tricure (Azadirachtin 0.03%)	0.5	30.50 (33.49)	61.43
7.	<i>Trichoderma harzianum</i> (Dharwad) (10 ⁶ cfu/ml)	0.4	38.90 (38.56)	50.64
8.	<i>P. fluorescens</i> (Pfr-1) (10 ⁸ cfu/ml)	0.5	36.20 (36.95)	54.02
9.	Untreated check	--	45.90 (42.61)	42.02
	S.E.±		1.14	1.92
	C.D. (P=0.05)		3.35	5.66

Figures in parentheses are arcsine values

workers (Li *et al.*, 1993). The maximum disease control was obtained using Hexaconazole and the per cent reduction in disease index ranged from 80.37 to 88.5 per cent over the control (Akter *et al.*, 2001). Biswas and Roychoudhary (2003) reported that Spictaf followed by *Neem* Azole and Achook performed best in reducing the disease severity and also improved the yield. However, no botanicals were significantly superior to fungicide. Weller (1988) reported that ability of *Pseudomonads* to suppress root disease is attributed to their greater colonizing ability in the root. Similar result was obtained by earlier workers (Kannaiyan and Prasad, 1984; Telan and Lapis, 1986 and Ahmed *et al.*, 1988).

Dubey and Toppo (1997) reported that, of the eleven fungitoxicants evaluated *in vitro*, Contaf and Bavistin inhibited the mycelial growth completely even at lower concentrations (500 and 250 ppm). Bavistin application increased germination by 38.5 per cent and eliminated seed borne infection by 97.8 per cent followed by Topsin-M. Three sprays of Contaf (0.1%) at 15 days interval were most effective and economical, resulting in minimum disease intensity (8.1%) and highest yield (4.06 t/ha) with maximum return per rupee spent (Rs. 7.6) followed by Bavistin and Bavistin + Indofil-M-45.

The economic analysis (Table 4) of management of sheath blight of rice revealed that, the highest total net income (Rs. 31,825) was obtained in Hexaconazole (Contaf 5 EC) which was followed by Validamycin 3 L (Rs. 26,890), Propiconazole (Tilt 25 EC) (Rs. 23,262)

and Carbendazim (Rs. 22,137). The least net income of Rs. 11,616 was recorded in *T. harzianum* (Dharwad) treatment (Rs. 11616).

The cost benefit ratio was worked out for all fungicides, botanicals and bioagents. The results indicated that Hexaconazole (Contaf 5 EC) @ 0.1 per cent concentration recorded a cost benefit ratio of 1:2.5 followed by Validamycin 3L @ 0.15 per cent with a cost benefit ratio of 1:2.3 and Propiconazole 25 EC recording 1:2.1 cost benefit ratio. The least cost benefit ratio of 1:1.6 was recorded in *T. harzianum* (Dharwad) treated plot.

From the farmers' point of view, the chemical which gives maximum returns apart from disease suppression is more important rather than a mere control of the disease. Hence, the cost benefit ratio was worked out to get an idea whether to recommend these chemicals to the farmers. Hexaconazole (Contaf 5 EC) not only reduced the disease incidence but also gave the higher cost benefit ratio (1:2.5). This was due to the higher yield (81.02 q/ha) obtained at 0.1 per cent concentration of Hexaconazole (Contaf 5 EC) treated plot followed by Validamycin 3 L having an yield of 73.83 q per ha with a cost benefit ratio of 1:2.3.

From the investigation, it was concluded that the fungicide Hexaconazole 5EC, the botanical Tricure (Azadirachtin 0.03%) and bio-agent *P. fluorescens* (Pfr-1) were found good for the management of sheath blight of rice.

Table 4: Economic analysis of management of sheath blight of rice

Sr. No.	Treatments	Concentration (%)	Per cent disease index	Mean yield (q/ha)	Gross returns (Rs.)	Cost of chemical + spray	Cost of cultivation (Rs.)	Gross cost (Rs.)	Net income (Rs.)	C:B ratio
1.	Carbendazim 50 WP	0.1	24.8 (29.85)	69.21	44987	2850	20000	22850	22137	1:2.0
2.	Hexaconazole 5 EC	0.1	17.0 (24.32)	81.02	52663	838	20000	20838	31825	1:2.5
3.	Validamycin 3 L	0.15	21.6 (27.69)	73.83	47990	1100	20000	21100	26890	1:2.3
4.	Propiconazole 25 EC	0.1	24.9 (29.95)	69.00	44850	1588	20000	21588	23262	1:2.1
5.	Achook (Azadirachtin 0.15%)	0.5	31.2 (33.95)	60.48	39312	2025	20000	22025	17287	1:1.8
6.	Tricure (Azadirachtin 0.03%)	0.5	30.5 (33.49)	61.43	39930	1875	20000	21875	18055	1:1.5
7.	<i>Trichoderma harzianum</i> (Dharwad) (10^6 cfu/ml)	0.4	38.9 (38.56)	50.64	32916	1300	20000	21300	11616	1:1.6
8.	<i>P. fluorescens</i> (Pfr-1) (10^8 cfu/ml)	0.5	36.2 (36.95)	54.02	35112	800	20000	20800	14313	1:1.7
9.	Untreated check	--	45.9 (42.61)	42.02	27313	-	-	-	-	-
	S.E.±		1.14	1.92						
	C.D. (P=0.05)		3.36	5.66						

Figures in parentheses are arcsine values

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