EFFICACY OF AZOXYSTROBIN 7.5% + PROPICONAZOLE 12.5% SE AGAINST SHEATH BLIGHT IN RICE

Comment [D1]: Efficacy of fungicides against shealth blight (*Rhizoctonia solani* Kuhn) in rice (O*riza sativa* L). This should be better to avoid popularissing some trade names.

Abstract

Among the fungal diseases causing significant yield loss in rice, sheath blight caused by *Rhizoctonia solani* Kuhn is the most important ranked the second most important disease worldwide after blast and a serious threat in rice growing areas of the world and causes more economic yield losses. The field experiment was conducted with seven treatments and replicated three times in RBD design at ARS, Gangavati to know the effect of Azoxystrobin 7.5% + Propiconazole 12.5% SE against sheath blight in rice. The variety BPT-5204 was sown in plot size of 5 X 5 m^2 with all regular agronomic practices followed as per the standard package of practice of University of Agricultural Sciences, Raichur. It has been found that the fungicide Azoxystrobin 7.5% + Propiconazole 12.5% SE at different doses evaluated was effective in reducing the severity of rice sheath blight and thereby increased the rice grain yield. The treatment Azoxystrobin 7.5% + Propiconazole 12.5% SE @ 625 ml/ha recorded minimum sheath blight of 13.70 and 16.11 per cent PDI with yield of 64.60 q/ha and 63.20 q/ha compared to control treatment 48.70 and 57.96 per cent PDI with grain yield of 54.10 q/ha and 52.40 q/ha during the first and second season, respectively. In the current study, along with reducing sheath blight severity, fungicide treatments minimized grain yield losses in 2 years. Field trial conducted clearly indicated that Azoxystrobin 7.5% + Propiconazole 12.5% SE @ 500 and 625 ml/ha dose can effectively control sheath blight of rice. Azoxystrobin 7.5% + Propiconazole 12.5% w/v SE @ 500 ml/ha was at par with higher dose and resulted better yield than other treatments.

Keywords: Azoxystrobin 7.5% + Propiconazole 12.5% SE, Fungicide, Rice, Sheath blight.

Introduction

There are about 50 different biotic factors that can cause potential yield loss in rice including fungi, bacteria, viruses, nematodes and insects. Of the disease-causing organisms, fungal pathogens impose a greater challenge in sustaining rice production (Webster and Gunnell, 1992). Among the fungal diseases causing significant yield loss in rice, sheath blight is the most important ranked the second most important rice disease worldwide after blast (Pan *et al*., 1999; Groth, 2005; Zhou and Jo, 2014). Sheath blight of rice caused by *Rhizoctonia solani* Kuhn is an important disease of rice and a serious threat in rice growing areas of the world and causes more economic yield losses (Ou, 1985; Savary *et al*., 2000; Savary *et al*., 2006), ranging from 20 to 50 per cent depending on the severity of infection

(Groth and Bond, 2007; Margani and Widadi, 2018) and also 5-10 per cent yield loss in subtropical low land paddy cultivars of Asia (Savary *et al*., 2000). The yield losses ranging from 4 to 50 per cent have been reported depending on the crop stage at the time of infection, severity of the disease and environmental conditions (Singh *et al*., 2004; Zheng *et al*., 2013; Bhunkal *et al*., 2015). The potential losses due to sheath blight disease are reported to be 50 to 54.3 per cent alone in India (Roy, 1993; Rajan, 1987) and this disease is particularly most prevalent in intensive rice cultivation system due to excess use of nitrogenous fertilizers.

In the absence of effective host plant resistance against sheath blight pathogen in rice, the management of sheath blight disease is mainly carried out through the use of chemicals (Naik *et al*., 2017). Fungicide based management of sheath blight disease is successful at filed level in majority of the cases (Kandhari *et al*., 2003; Kandhari and Gupta, 2003; Groth and Bond 2006; Bhuvaneshwari and Raju, 2012; Kumar *et al*., 2013). Foliar spray and seed treatment are the most popular method of fungicidal application against R. solani. Even though both systemic and non-systemic fungicides are used for chemical management, systemic fungicides offer better management of this disease (Naik *et al*., 2017). Timely application of selective fungicides between panicle differentiation and heading stage offers effective protection against this disease. Periodical monitoring of the rice field and application of fungicides at the initial stages of infection especially at booting stage is recommended for managing sheath blight in susceptible varieties (Singh *et al*., 2016; Uppala and Zhou, 2018). Most of the fungicides like benomyl, carbendazim, chloroneb, captafol, mancozeb, zineb, edifenphos, Iprobenphos, thiophanate, carboxin etc. have been found effective for the control of the disease under field conditions (Dash and Panda, 1984; Kannaiyan and Prasad, 1984; Singh and Sinha, 2004). Out of these benomyl, carbendazim, edifenphos and Iprobenphos were the most effective chemicals (Roy, 1993). For many years, strobilurin fungicides have been the backbone for management of rice sheath blight. It has been opined that *R. solani*, would not develop fungicide resistance or would be slow to develop resistance (Robinson, 2013). Presently, the Strobilurin group of systemic fungicides are the most preferred chemical group to manage sheath blight disease in rice (Yellareddygari *et al*., 2014). Azoxystrobin from this group is very effective for not only controlling the disease but also found to enhance yield as well (Groth and Bond, 2007). The combinatory chemical formulation such as Azoxystrobin 18.2% + Difenoconazole 11.4% (Bhuvaneswari and Raju, 2012; Kumar *et al*., 2018), Trifloxystrobin 25% + Tebuconazole 50% (Shahid *et al*., 2014; Rashid *et al*., 2020), etc., are recommended to manage the disease. Recently, many combination fungicides such as kresoxim methyl 40% + hexaconazole 8%, azoxystrobin

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18.2% + difenoconazole 11.4% SC, trifloxystrobin 25% + tebuconazole 50% 75 WG, have been shown to control the sheath blight disease under field condition (Kumar and Veerabhadraswamy, 2014; Bag, 2009) Continuous use of same group fungicides having same mode of action will lead to the development of resistant strain of same fungi and hence, it is necessary to search for a new molecule with different mode of action. Hence, the present study was under taken to know the field efficacy of a combination fungicide Azoxystrobin 7.5% + Propiconazole 12.5% SE against sheath blight in rice.

MATERIALS AND METHODS

The field experiment was conducted with seven treatments and replicated three times in RBD design at ARS, Gangavati to know the effect of Azoxystrobin 7.5% + Propiconazole 12.5% SE against sheath blight in Rice. The variety BPT-5204 was sown in plot size of 5 X 5 m^2 with all regular agronomic practices followed as per the standard package of practice of University of Agricultural Sciences, Raichur. The evaluation of the fungicide was done along with standard checks and untreated control against the incidences of sheath blight disease in rice. Treatments details were as follows - T1 - Azoxystrobin 7.5% + Propiconazole 12.5% SE @ 375 ml / ha; T2 - Azoxystrobin 7.5% + Propiconazole 12.5% SE @ 500ml / ha; T3 - Azoxystrobin 7.5% + Propiconazole 12.5% SE @ 625 ml / ha; T4 - Azoxystrobin 23 % SC @ 500 ml / ha; T5 - Propiconazole 25% EC @ 500 ml / ha; T6 – Validamycin 3% L @ 2000 ml / ha; T7 - Untreated control.

The fungicides were applied as foliar spray treatment in the replicated plots just after the appearance of sheath blight disease in the main field at 45DAT. The plots were inspected regularly to see the disease development and further two more spray were applied at an interval of 15 days on 60 and 75 Days after Transplanting (DAT). Observations were recorded on disease severity in each treatment after three sprays as per the standard method The incidence of disease were recorded on leaves as Per cent Disease Index (PDI) on the basis of scoring of the diseases as per the disease rating scale of Standard Evaluation System (SES) for rice (IRRI, 2002). In the present study, observations for disease incidence were recorded from the randomly selected twenty clumps / hills per plot for recording the disease severity in each replicated plots of the treatments. The observations were recorded on intensity of diseases were observed in each replicated plot for each treatment on 10th day after each spray. After 10 days of last spray, the final scoring of the disease incidence was recorded. Further, the scored data were converted into Per cent Disease Index (PDI) of plants using formula given by Wheeler (1969)

Sum of numerical values 100

PDI= ----------------------------------- X ------------------------------------
Number of leaves observed   Maximum disease rating value

In order to record the yield, crop was harvested plot-wise from the individual replicated plots and average paddy yield was recorded and converted into q/ha.

The original PDI values were suitably transformed into arcsine transformed values and subjected to statistical analysis for drawing conclusions

EXPERIMENTAL RESULTS AND DISCUSSION:

It has been found that Azoxystrobin 7.5% + Propiconazole 12.5% SE @ 500- 625 ml/ha reduced the sheath blight infection more than rest of the treatments and improved the rice yield. The Azoxystrobin 7.5% + Propiconazole 12.5% SE was found to be effective in reducing the severity of the sheath blight disease. In the 1st season, the treatment Azoxystrobin 7.5% + Propiconazole 12.5% SE @ 625 ml/ha recorded least PDI of sheath blight disease incidence (13.70%) and was significantly superior over control treatment (48.70%). The same treatment was significantly on par with Azoxystrobin 7.5% + Propiconazole 12.5% SE @ 500 ml/ha treatment with PDI of 14.07 per cent. All other treatments were inferior to these two treatments though significantly superior to the untreated check. Among the various treatments, Azoxystrobin 23% SC @ 500ml/ha was found least effective with higher PDI of sheath blight (26.11%) (Table-1). During the 2nd season, the Azoxystrobin 7.5% + Propiconazole 12.5% SE was found to be effective in reducing the severity of the sheath blight disease. The treatment Azoxystrobin 7.5% + Propiconazole 12.5% SE @ 625 ml/ha recorded least PDI of sheath blight disease incidence (16.11%) and was significantly superior over control treatment (57.96%). The same treatment was significantly on par with Azoxystrobin 7.5% + Propiconazole 12.5% SE @ 500 ml/ha treatment with PDI of 16.48 per cent. All other treatments were inferior to these two treatments though significantly superior to the untreated check (57.96%). Among the various treatments, Azoxystrobin 23% SC @ 500ml/ha was found least effective with higher sheath blight (30.56%) (Table 2). These data were in accordance with Phelp and Soto (1993) and Jones *et al*. (1987). These finding are in full agreement with the previous reports of fungicide combinations such as azoxystrobin + difenconazole (Bhuvaneswari and Krishnam Raju, 2012), kresoxim methyl + hexaconazole, fluxapyroxad + epixiconazole (Kumar and Veerabhadraswamy, 2014), trifloxystrobin + tebuconazole (Bag and Saha, 2009; Bag, 2009; Visalakshmi *et al*., 2016), flutolanil + azoxystrobin, thiophonate methyl + azoxystrobin, tebuconazole + azoxystrobin, propiconazole + azoxystrobin (Jin *et al*., 2013) reported the better efficacy against sheath blight. Various reviews confirmed that strobilurin compounds found to be effective in controlling many diseases like sheath blight (Bag 2009; Bag *et al*., 2016).

Yield:

Due to varying degree of reduction in sheath blight disease incidences the difference in the yield level between treated and untreated plots was very much significant. During the 1st season, the maximum grain yield of 64.60 q/ha was recorded with Azoxystrobin 7.5% + Propiconazole 12.5% SE @ 625 ml/ha followed by the same fungicide @ 500ml/ha which recorded 63.50 q/ha was statistically superior and comparatively effective than rest of the treatments. The treatments Propiconazole 25% EC, Validamycin 3% L, and Azoxystrobin 23% SC recorded the yield of 61.00, 60.70 and 59.40 q/ha, respectively. The lowest grain yield (54.10 q/ha) was recorded in untreated control (Table 1). During the 2nd season, the maximum grain yield of 63.20 q/ha was recorded with Azoxystrobin 7.5% + Propiconazole 12.5% w/v SE @ 625 ml/ha followed by the same fungicide @ 500ml/ha which recorded 62.20 q/ha was statistically superior and comparatively effective than rest of the treatments tested. The treatments Propiconazole 25% EC, Validamycin 3% L and Azoxystrobin 23% SC recorded the yield of 59.00, 58.70 and 57.60 q/ha, respectively. The lowest grain yield was recorded with 52.40 q/ha in untreated control (Table 2). In the current study, along with reducing sheath blight severity, fungicide treatments minimized grain yield losses in 2 years. The results are in agreement with previous studies that reported the efficacy of azoxystrobin (Groth, 2005), azoxystrobin and flutolanil (Groth and Bond, 2007) against sheath blight and in minimizing yield losses. Application of fungicides has been reported to enhance the crop yield due to reduction in disease load (Biswas and Bag, 2010; Bag, 2011). The present results are in conformity with those of previous reports (Bhuvaneshwari and Raju, 2012; Bag *et al*., 2016) reported that fungicides application increases the yield of rice, mainly due to reduced disease severity of sheath blight.

CONCLUSION:

The fungicide Azoxystrobin 7.5% + Propiconazole 12.5% SE at different doses were evaluated at Agriculture Research Station, Gangavati and was found effective in reducing the severity of rice sheath blight and thereby increased the rice grain yield. Field trial conducted clearly indicated that Azoxystrobin 7.5% + Propiconazole 12.5% SE @ 500 and 625 ml/ha dose can effectively control sheath blight of rice. Azoxystrobin 7.5% + Propiconazole 12.5% w/v SE @ 500 ml/ha was at par with higher dose and resulted better yield than other treatments.

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Table 1. Effect of Azoxystrobin 7.5% +Propiconazole 12.5% SE on sheath blight of rice during *Kharif* - 2011 (1st season)

Sl. No.	Treatment	Dose a.i. (g/ha)	Dose Formulation (ml/ha)	Sheath blight intensity on rice				Grain Yield (q/ha)
				Initial score	10 days after I spray	10 days after II spray	Terminal score (10 days after III spray)	
1	Azoxystrobin 7.5% + Propiconazole 12.5% SE	28.1+46.9	375	4.63 (12.43)*	12.78 (20.94)	17.22 (24.52)	25.19 (30.12)	59.40
2	Azoxystrobin 7.5% + Propiconazole 12.5% SE	37.5+62.5	500	4.07 (11.64)	6.67 (14.96)	12.41 (20.62)	14.07 (22.03)	63.50
3	Azoxystrobin 7.5% + Propiconazole 12.5% SE	46.9+78.1	625	4.44 (12.17)	6.11 (14.31)	11.85 (20.14)	13.70 (21.73)	64.60
4	Azoxystrobin 23% SC	125	500	4.26 (11.91)	13.15 (21.26)	20.37 (26.83)	26.11 (30.73)	59.10
5	Propiconazole 25% EC	125	500	4.07 (11.64)	8.96 (17.42)	14.15 (22.10)	18.37 (25.38)	61.00
6	Validamycin 3% L	60	2000	4.26 (11.91)	10.56 (18.96)	16.30 (23.81)	20.74 (27.09)	60.70
7	Control	-	-	4.81 (12.68)	26.30 (30.85)	33.52 (35.38)	48.70 (44.26)	54.10
	CD at 5% level			NS	2.40	1.38	3.30	2.48

*** Figures in the parentheses represent arcsine transformed values**

Table 2. Effect of Azoxystrobin 7.5% +Propiconazole 12.5% SE on sheath blight of rice during *Kharif* - 2012 (2nd season)

Sl. No.	Treatment	Dose a.i. (g/ha)	Dose Formulation (ml/ha)	Sheath blight intensity on rice				Grain Yield (q/ha)
				Initial score	10 days after I spray	10 days after II spray	Terminal score (10 days after III spray)	
1	Azoxystrobin 7.5% + Propiconazole 12.5% SE	28.1+46.9	375	5.19 (13.16)*	15.37 (23.08)	19.81 (26.43)	29.07 (32.63)	57.50
2	Azoxystrobin 7.5% + Propiconazole 12.5% SE	37.5+62.5	500	5.37 (13.40)	9.63 (18.08)	15.93 (23.52)	16.48 (23.66)	62.20
3	Azoxystrobin 7.5% + Propiconazole 12.5% SE	46.9+78.1	625	5.00 (12.92)	8.70 (17.16)	15.19 (22.93)	16.11 (23.66)	63.20
4	Azoxystrobin 23% SC	125	500	5.56 (13.63)	18.52 (25.49)	25.37 (30.24)	30.56 (33.56)	57.60
5	Propiconazole 25% EC	125	500	5.37 (13.40)	11.93 (20.21)	18.85 (25.73)	22.37 (28.23)	59.00
6	Validamycin 3% L	60	2000	5.74 (13.86)	14.81 (22.64)	20.00 (26.57)	24.81 (29.88)	58.70
7	Control	-	-	5.74 (13.86)	29.81 (33.10)	34.44 (35.94)	57.96 (49.58)	52.40
	CD at 5% level			NS	2.12	2.18	3.24	3.00

***Figures in the parentheses represent arcsine transformed values**