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Evaluation of filia 52.5 SE (Tricyclazole 34.2% + Propiconazole 10.7%) against rice sheath blight

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Abstract
Sheath blight (*Rhizoctonia solani*) is one of the most devastating diseases of rice. In recent years, resistance development in pathogens a new constraint has emerged due to repeated fungicide usage with single mode of action. Therefore, A new combination molecule of Filia 52.5 SE (Tricyclazole 34.2% + Propiconazole 10.7%) was tried against sheath blight of rice under field condition. The results from first and second season trial revealed that all the doses of Filia 52.5 SE were very effective against rice sheath blight disease. In first season, the disease incidence ranges from 7.75 to 8.12 PDI in Filia 52.5 SE treatments at 15 days after 2nd spray. Among the various treatments, Filia 52.5 SE @ 1.5 ml/lit recorded the least PDI of 7.75 at par with Filia 52.5 SE @ 1.25 ml/lit (7.83 PDI) and Filia 52.5 SE @ 1.0 ml/lit (8.12 PDI). Whereas untreated control plots recorded 28.50 PDI at 15 days after 2nd spray. Similarly, the second season trial result revealed that, the disease incidence ranges from 3.50 to 4.45 PDI in Filia 52.5 SE treatments at 15 days after 2nd spray. Among the various treatments, Filia 52.5 SE @ 1.5 ml/lit recorded the least PDI of 3.50 at par with Filia 52.5 SE @ 1.25 ml/lit (3.63 PDI) and Filia 52.5 SE @ 1.0 ml/lit (4.45 PDI) followed by Propiconazole 25 EC @ 1.0 ml/lit (6.16 PDI), Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.4 g/lit (6.40 PDI), Tricyclozole 75 WP @ 0.8 g/lit (15.0 PDI) and Kitazine 48 EC @ 2.0 ml/lit (17.8 PDI) whereas untreated control plots recorded 21.20 PDI at 15 days after 2nd spray. Filia 52.5 SE at 1.5 and 1.25 ml/lit recorded significantly higher grain yields, which were on par with each other and followed by Filia 52.5 SE @ 1.0 ml/lit in both seasons.

Keywords: Rice, Sheath blight, Filia 52.5 SE

Introduction
Rice (Oryza sativa L.) is the world's single most important crop and a primary food source for half of the world's population. A total of 49% calories consumed by the human population come from rice, wheat, and maize, where 23% are provided by rice, 17% by wheat and 9% by maize. India stands second in rice production with an annual production of 152 million tonnes (FAO, 2014) [6]. However, at the current rate of population growth, rice production has to enhance and increasing yield target is a major challenge with shrinking available land and water resources, scarce and costly labor and other inputs combined with deteriorating environment and climate change.

There are so many constraints responsible for low yield of rice in India. Among them diseases are considered to be the most important one. Sheath blight (ShB) disease of rice caused by *Rhizoctonia solani* Kuhn is one of the major diseases of rice. The disease became a serious problem after the introduction of high yielding semi- dwarf cultivars. Further, intensive cultural practices and heavy application of nitrogenous fertilizers intensified the disease situation (Manibhushanrao and Baby, 2000) [23]. The disease appears at seedling, tillering and booting stage of the plant and the damage to crop is most severe when the disease appears at later stages (Cu *et al.*, 1996) [3]. The pathogen *R. solani* is a versatile soil borne saprophyte, survives in soil as sclerotia or thick walled mycelia (Endo, 1931) [5]. Sclerotia represent the primary source of inoculum (Lee and Rush, 1983; Leu and Yang, 1985) [19, 20] and they remain viable in soil for several months over a wide range of temperature and moisture (Manian and Manibhushanrao, 1990) [22]. Crop residues colonized by the pathogen also play an important role in ShB epidemics (Cu *et al.*, 1996) [3]. Losses due to sheath blight disease generally vary from 30 to 40 per cent and may be even 100 per cent in endemic areas (Li *et al.*, 2009) [21]. The reduction in yield due to the disease has been estimated to vary from 5.2 to 50.0 per cent (Ou, 1985, Hori 1969) [25, 10].

Fungicide based management of the sheath blight disease is successfull at field level in majority of the cases (Kandhari *et al.* 2003) [13]. Fungicides with multiple effects on the pathogen like sclerotial germination, mycelial growth inhibition and reduction of the disease

spread will be most ideal (Bhuvaneswari and Krishnam Raju, 2012) [1]. 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 (Kandhari and Gupta, 2003; Groth and Bond 2006; Bhuvaneshwari and Raju, 2012; Kumar *et al.*, 2013) [14, 9, 1, 17]. Timely application of effective fungicides is essential for the management of the disease. Systematic evaluation of commercially available fungicides from time to time is needed for evolving recommendations on chemical fungicides, so that the farmers can choose the fungicides based on the efficacy as well as cost (Ganesha Naik *et al.*, 2017) [7]. In this view, the present study was undertaken to test the efficacy of new combination fungicide Filia 52.5 SE at different doses against sheath blight diseases under field conditions.

Materials and Methods

A field experiment was carried out in a randomized block design to assess the bio-efficacy of Filia 52.5 SE (Tricyclazole 34.2% + Propiconazole 10.7%) on sheath blight of Rice. The plot size was 40sq.m and each treatment was replicated three times. The treatments included were

T. No.	Treatments	Dose rate g.ai/lit (w/w basis)	Dose rate Product (ml/lit)
T1	Untreated Check	-	-
T2	Filia 52.5 SE (Tricyclazole 34.2% + Propiconazole 10.7%)	0.45	1.0
T3	Filia 52.5 SE (Tricyclazole 34.2% + Propiconazole 10.7%)	0. 56	1.25
T4	Filia 52.5 SE (Tricyclazole 34.2% + Propiconazole 10.7%)	0.67	1.50
T5	Filia 52.5 SE (Tricyclazole 34.2% + Propiconazole 10.7%)	1.35	3.00
T6	Tricyclazole 75 WP	0.6	0.8
T7	Propiconazole 25 EC	0.25	1.0
T8	Tebuconazole 50% + Trifloxystrobin 25% WG	0.3	0.4
T9	Kitazine 48 EC	1.0	2.0

The test fungicide Filia 52.5 SE contains Tricyclazole 40% + Propiconazole 12.5%) on w/v basis which is equal to Tricyclazole 34.2% + Propiconazole 10.7%) on w/w basis. Tebuconazole 50% + Trifloxystrobin 25% WG (Nativo 75 WG) and Kitazine 48 EC were used as standard check chemicals and compared with untreated check. The various fungicides were applied as foliar spray using a water volume of 500 lit/ha.

Methods of assessment of incidence of Sheath blight diseases

Diseases grade was recorded using score chart – scale 0-9

Grade		Symptoms
0	-	No infection
1	-	vertical spread of the lesions up to 20 % of plant height
3	-	vertical spread of the lesions up to 21-30 % of plant height
5	-	vertical spread of the lesions up to 31- 45% of plant height
7	-	vertical spread of the lesions up to 46 -60% of plant height
9	-	vertical spread of the lesions up to >60 % of plant height

The per cent disease index (PDI) was calculated as under,

$$PDI = \frac{\text{Sum of all ratings}}{\text{Total leaves observed}} \times \frac{100}{\text{Max. Grade in scale}}$$

Results and Discussion

Efficacy of Filia 52.5 SE against Sheath blight of Rice

The results from first season trial revealed that all the doses of Filia 52.5 SE were very effective against rice sheath blight disease. The disease incidence ranges from 7.75 to 8.12 PDI in Filia 52.5 SE treatments at 15 days after 2nd spray. Among the various treatments, Filia 52.5 SE @ 1.5 ml/lit recorded the least PDI of 7.75 at par with Filia 52.5 SE @ 1.25 ml/lit (7.83 PDI) and Filia 52.5 SE @ 1.0 ml/lit (8.12 PDI) followed by Propiconazole 25 EC @ 1.0 ml/lit (9.63 PDI), Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.4 g/lit (10.33 PDI), Tricyclozole 75 WP @ 0.8 g/lit (17.53 PDI) and Kitazine 48 EC @ 2.0 ml/lit (22.45 PDI) whereas untreated control plots recorded 28.50 PDI at 15 days after 2nd spray (Table 1).

Filia 52.5 SE at 1.5 and 1.25 ml/lit recorded significantly higher grain yields of 6.60 and 6.45 t/ha which were on par with each other and followed by Filia 52.5 SE @ 1.0 ml/lit (5.90 t/ha), Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.4 g/lit (5.60 t/ha), Tricyclozole 75 WP @ 0.8 g/lit (5.50 t/ha), Kitazine 48 EC @ 2.0 ml/lit (5.20 t/ha) and Propiconazole 25 EC @ 1.0 ml/lit (4.23 t/ha) while it was lower (3.56 t/ha) in untreated check.

Similarly, the second season trial result revealed that all the doses of Filia 52.5 SE were very effective against rice sheath blight disease. The disease incidence ranges from 3.50 to 4.45 PDI in Filia 52.5 SE treatments at 15 days after 2nd spray. Among the various treatments, Filia 52.5 SE @ 1.5 ml/lit recorded the least PDI of 3.50 at par with Filia 52.5 SE @ 1.25 ml/lit (3.63 PDI) and Filia 52.5 SE @ 1.0 ml/lit (4.45 PDI) followed by Propiconazole 25 EC @ 1.0 ml/lit (6.16 PDI), Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.4 g/lit (6.40 PDI), Tricyclozole 75 WP @ 0.8 g/lit (15.0 PDI) and Kitazine 48 EC @ 2.0 ml/lit (17.8 PDI) whereas untreated control plots recorded 21.20 PDI at 15 days after 2nd spray (Table 2).

Filia 52.5 SE at 1.5 and 1.25 ml/lit recorded significantly higher grain yields of 7.15 and 7.12 t/ha which were on par with each other and followed by Filia 52.5 SE @ 1.0 ml/lit (6.56 t/ha), Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.4 g/lit (6.10 t/ha), Tricyclozole 75 WP @ 0.8 g/lit (6.0 t/ha), Kitazine 48 EC @ 2.0 ml/lit (5.70 t/ha) and Propiconazole 25 EC @ 1.0 ml/lit (4.90 t/ha) while it was lower (3.80 t/ha) in untreated check.

Application of carbendazim and iprodione (Izadyar and Baradaran, 1989) [12]; epoxiconazole (Kumar *et al.*, 1997) [18]; difenoconazole and validamycin (Saha, 2003; Kandhari, 2007) [29, 15]; metominostrobin (Ichiba *et al.*, 2000) [11]; thifluzamide and hexaconazole (Sunder *et al.*, 2003) [31]; propiconazole and tebuconazole (Mian *et al.*, 2004) [24] and pencycuron and azoxystrobin (Goswami *et al.*, 2012) [8] were

highly effective in disease control and yield protection. Besides, the combination treatments of fungicidal formulations such as carbendazim + mancozeb (Prasad *et al.*, 2006) [26]; propiconazole + difenconazole (Kandhari, 2007) [15]; carbendazim + epoxiconazole (Saha, 2003) [29] andcarbendazim 25% + flusilazole 12.5% SE (Goswami *et al.*, 2012) [8] have been found promising against sheath blight in different parts of the country. Benlate and zineb sprays were also effective in checking air-borne infection and secondary spread of the disease (Premlatha Dath, 1990) [27]. Tebuconazole and propiconazole + difenconazole were found promising in reducing disease incidence and severity by 59.0-72.3% and 58.5-82.8%, respectively (Rodriguez *et al.*, 2001) [28] while hexaconazole and diniconazole reduced the disease severity by about 70% along with an enhanced grain yield (Singh *et al.*, 2010) [30]. In multi-location testing under AICRIP, tricyclazole + propiconazole (Filia 52.5 SE), trifloxystrobin 25% +tebuconazole 50% (Nativo 75 WG), metominostrobin 20SC and hexaconazole 75 WG were highly effective in checking disease severity and in improving grain yield (DRR, 2006-2010) [4].

Krishnam Raju *et al.* (2008) [16] reported the efficacy of hexaconazole 5 EC @ 2.0 ml/l, propiconazole 25 EC @ 1.0 ml/l and tebuconazole 25 EC @ 1.5 g/l against sheath blight of rice. Jones *et al.* (1987) reported that Tilt (Propiconazole) applied twice significantly reduced sheath blight disease severity and increased yield. Groth *et al.* (1993) also reported that Tilt (Propiconazole) gave good control of sheath blight disease. Swamy *et al.* (2009) reported that new fungicide formulations tricyclozole 400g + propiconazole 125g @ 0.25% and trifloxystrobin 25g + tebuconazole 50g @ 0.04% was on par with the standard checks hexaconazole 5% EC @ 0.2% and validamycin 3L @ 0.25%. Field trials in 2008 and 2009 conducted by Parsons *et al.* (2009) showed that a newly formulated mixture of azoxystrobin and propiconazole called Quilt Xcel was highly effective in controlling sheath blight and protecting rice yield and milling quality. Use of tricyclazole, a melanin biosynthesis inhibitor has been advocated by Yamaguchi (2004) [32], as this is an environmentally safe fungicide and is less likely to lead to resistance development in the pathogen. The combination of tricyclazole with chemicals of different modes of action like mancozeb and hexaconazole may further reduce the risk of resistance development in the pathogen besides being more effective than tricyclazole and hexaconozole alone (Chethana, 2018) [2].

Table 1: Efficacy of Filia 52.5 SE against Sheath blight and grain yield in Rice: I season

S. No	Treatments (ml/lit)	Sheath blight (PDI)*				Grain Yield (t/ha)
		PTO	15 days after I spray	15 days After II spray	% control over untreated check	
1	Untreated Check	3.57	17.20 (24.50)^{e}	28.50 (32.27)^{e}	-	3.56
2	Filia 52.5 SE @ 1.0	3.72	6.90 (15.23)^{b}	8.12 (16.56)^{a}	71.50	5.90
3	Filia 52.5 SE @ 1.25	3.57	6.24 (14.47)^{a}	7.83 (16.25)^{a}	72.52	6.45
4	Filia 52.5 SE @ 1.5	3.67	6.06 (14.25)^{a}	7.75 (16.16)^{a}	72.80	6.60
5	Tricyclozole 75 WP @ 0.8	3.62	13.50 (21.56)^{d}	17.53 (24.75)^{c}	38.49	5.50
6	Propiconazole 25 EC @ 1.0	3.62	7.93 (16.36)^{c}	9.63 (18.08)^{b}	66.21	4.23
7	Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.4	3.53	8.35 (16.80)^{c}	10.33 (18.75)^{b}	63.75	5.60
8	Kitazine 48 EC @ 2.0	3.70	14.36 (22.27)^{d}	22.45 (28.28)^{d}	21.22	5.20
	CD(0.05)	NS	0.97	1.20	-	0.30

* Mean of three replications, PTO- Pre Treatment Observation, PDI- Per cent Disease Index. Data followed by the same letter in a column are not significantly different from each other according to Duncan's multiple range test at $P = 0.05$.Values in parentheses are arcsine transformed

Table 2: Efficacy of Filia 52.5 SE against Sheath blight in Rice: II season

S. No	Treatments (ml/lit)	Sheath blight (PDI)*				Grain Yield (t/ha)
		PTO	15 days after I spray	15 days after II spray	% control over untreated check	
1	Untreated Check	1.23	12.60 (20.79)^{e}	21.20 (27.42)^{f}	-	3.80
2	Filia 52.5 SE @ 1.0	1.37	3.86 (11.33)^{b}	4.45 (12.18)^{b}	79.00	6.56
3	Filia 52.5 SE @ 1.25	1.30	3.10 (10.14)^{a}	3.63 (10.98)^{a}	82.87	7.12
4	Filia 52.5 SE @ 1.5	1.27	3.00 (9.97)^{a}	3.50 (10.78)^{a}	83.49	7.15
5	Tricyclozole 75 WP @ 0.8	1.23	10.00 (18.43)^{d}	15.00 (22.79)^{d}	29.24	6.00
6	Propiconazole 25 EC @ 1.0	1.37	4.30 (11.97)^{c}	6.16 (14.37)^{c}	70.94	4.90
7	Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.4	1.27	4.90 (12.79)^{c}	6.40 (14.65)^{c}	69.81	6.10
8	Kitazine 48 EC @ 2.0	1.23	10.33 (18.75)^{d}	17.80 (24.95)^{e}	16.03	5.70
	CD(0.05)	NS	0.82	1.03	-	0.41

* Mean of three replications, PTO- Pre Treatment Observation, PDI- Per cent Disease Index. Data followed by the same letter in a column are not significantly different from each other according to Duncan's multiple range test at $P = 0.05$.Values in parentheses are arcsine transformed.

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