STUDY ON EFFICACY OF PYRACLOSTROBIN 10% + THIFLUZAMIDE 10% SC AGAINST BLAST AND SHEATH BLIGHT DISEASES OF PADDY CROP

Abstract

Rice diseases are considered the main constraint in rice production and cause both qualitative and quantitative losses. Blast and sheath blight diseases are major constrain of rice production reported to cause extensive damage in crop production. The following experiment was conducted to know the efficacy of Pyraclostrobin 10% + Thifluzamide 10% SC in different doses against blast *(Pyricularia oryzae)* and sheath blight *(Rhizoctonia solani)* of paddy crop with 7 treatments and replicated three times in RBD design at ARS, Gangavati during *Kharif* 2021-22 and *Kharif* 2022-23 cropping season. In *kharif* 2021, at 10 days after second spray, the leaf blast of 17.10 and 18.45 PDI was recorded with Pyraclostrobin 10% + Thifluzamide 10% SC @ 90+90 g a.i./ha and Pyraclostrobin 10% + Thifluzamide 10% SC @ 80+80 g a.i./ha respectively. During *summer* 2022, at 10 days after second spray, Pyraclostrobin 10% + Thifluzamide 10% SC @ 90+90 g a.i./ha recorded the lowest PDI of 12.75 and untreated control recorded the highest PDI (43.50%). In *kharif* 2021, at 10 days after second spray, Pyraclostrobin 10% + Thifluzamide 10% SC @ 90+90 g a.i./ha and Pyraclostrobin 10% + Thifluzamide 10% SC @ 80+80 g a.i./ha were effective in reducing the panicle blast with minimum PDI of 3.00 and 3.50, respectively. Whereas, the maximum PDI of 23.50 was observed in untreated control. In *summer* 2022, lowest per cent panicle blast was recorded in Pyraclostrobin 10% + Thifluzamide 10% SC @ 90+90 g a.i./ha (1.50 PDI) and Pyraclostrobin 10% + Thifluzamide 10% SC @ 80+80 g a.i./ha (2.00 PDI). In *kharif* 2021, at 10 days after second spray, Pyraclostrobin 10% + Thifluzamide 10% SC @ 90+90 g a.i./ha and 80+80 g a.i./ha recorded lowest sheath blight PDI of 17.95 and 19.75, respectively. Similarly, during *summer* 2022, at 10 days after second spray lowest sheath blight of 11.75 PDI was recorded from Pyraclostrobin 10% + Thifluzamide 10% SC @ 90+90 g a.i./ha. During *kharif* 2022, Pyraclostrobin 10% + Thifluzamide 10% SC @ 90+90 g a.i./ha and Pyraclostrobin 10% + Thifluzamide 10% SC @ 80+80 g a.i./ha were recorded highest yield of 55.62 and 53.25 q/ha respectively as against 38.84 q/ha in untreated control. During *summer* 2022, Pyraclostrobin 10% + Thifluzamide 10% SC @ 90+90 g a.i./ha and Pyraclostrobin 10% + Thifluzamide 10% SC @ 80+80 g a.i./ha recorded highest yield of 58.20 q/ha and 57.50 q/ha respectively as against 40.40 q/ha in untreated control.

Key words: Blast, Paddy, Pyraclostrobin 10% + Thifluzamide 10% SC, and Sheath blight

Introduction

Rice (*Oryza sativa* L) is the world's most important staple food crop of 2.7 billion people and is critically important for food security of the world. Of the world rice production 476 million tonnes, India is producing 22.1 per cent of it (105 million tonnes of rice), in an area of 44 million hectares (Anon., 2020). Plant diseases are the major biotic constraints affecting crop productivity resulted in global food crisis (Khoa *et al*., 2017). Rice diseases are considered the main constraint in rice production and cause both qualitative and quantitative losses (Law *et al*., 2017). Blast and sheath blight diseases are major constrain of rice production reported to cause extensive damage in crop production. The rice blast disease caused by *Pyricularia oryzae* (*Magnaporthe grisea*) has been reported as the most significant disease, resulting in yield losses of up to 50% (Nalley *et al*., 2016). Rice blast caused by *Pyricularia oryzae* is the most severe and widely distributed disease of rice worldwide having significant economic importance. Presently in India, blast is especially problematic in temperate areas, hilly tracts, tropical uplands and in delta regions. The pathogen infects leaf, node, collar and neck causing leaf blast, nodal blast, collar blast and neck blast. Among the fungal diseases causing significant yield loss in rice, sheath blight is ranked the second most important after rice blast (Pan et al., 1999). The disease causes a yield reduction ranging from 20 to 50 per cent depending on the severity of infection (Groth and Bond, 2007; Margani and Widadi, 2018). In the recent past, blast and sheath blight has become major threat, especially under intensive rice cultivation. Monoculture of high-yielding semi-dwarf rice varieties, heavy doses of nitrogenous fertilizers, imbalance use of fertilizer and the favourable micro-environment facilitated by the crop density are implicated as the major factors favouring the severe fungal infection cause sharp increase in the disease incidence and ultimately reduce rice production. (Savary *et al*., 1995; Cu *et al*., 1996). In rice, *R. solani* can infect the plant at any growth stage (Dath, 1990). The incidence of sheath blight is more severe in early maturing, semi-dwarf, highly tillering and compact cultivars (Bhunkal *et al*., 2015). The disease severity and incidence increase with plant age (Singh *et al*., 2004). Although several cultural, chemical and biological control strategies have been suggested to manage blast and sheath blight disease of rice (Yellareddygari *et al*., 2014; Datta and Vurukonda, 2017), chemical control has been the most widely used method so far. So, we have needed to know the appropriate effective chemicals which are able to stop the disease at lowest rate. In view of this, fungicides / pesticides / new molecules occupy a major share and contribute greatly towards disease management. It is mainly because of their convenience, easily available, effectiveness and broad spectrum. In such cases, the disease in susceptible rice varieties is managed by the application of chemical fungicides (Chou *et al*., 2020). Hence, chemical control is still widely practiced and is the most successful strategy for managing crop losses due to blast globally (Kumar *et al*., 2021). Therefore, an effective management of crop is required from early stage of diseases development which can be assured by proper fungicides. Keeping in view the increasing demand of rice in the local markets as well as its huge export potential and the challenge of disease management, the present study has been conducted to evaluate and screen the fungicide Pyraclostrobin 10% + Thifluzamide 10% SC in different doses against blast and sheath blight diseases of paddy crop

MATERIALS AND METHODS

The experiment was laid out with an objective to know the efficacy of Pyraclostrobin 10% + Thifluzamide 10% SC in different doses against blast *(Pyricularia oryzae)* and sheath blight *(Rhizoctonia solani)* of paddy crop with 7 treatments and replicated three times in RBD design at ARS, Gangavati during *Kharif* 2021-22 and *Kharif* 2022-23 cropping season. The variety BPT-5204 was sown with the spacing of 20 cm x 10 cm 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.

Table 1. Treatments details

Tr. No.	Product	a.i g/ha	Formulation ml/ha
T1	Pyraclostrobin 10% + Thifluzamide 10% SC	70+70	700
T2	Pyraclostrobin 10% + Thifluzamide 10% SC	80+80	800
T3	Pyraclostrobin 10% + Thifluzamide 10% SC	90+90	900
T4	Pyraclostrobin 100 g/l CS	100	1000
T5	Thifluzamide 24% SC	90	375
T6	Azoxystrobin 18.2% + Difenoconazole 11.4% SC	0.03% or 0.3 g/L	0.1% or 1 ml / Litre water
T7	Untreated control	-	-

The fungicides were applied as foliar spray treatment in randomized block design in the replicated plots just after the appearance of blast and sheath blight diseases in the main field and standard agronomic practices were adopted on susceptible variety BPT-5204. The plots were inspected regularly to see the disease development. The test fungicide Cuprous oxide 86.2% WG was applied as foliar spray using Knapsack sprayer fitted with hollow cone nozzle. The first spray was given when the initial symptoms of blast and sheath blight appeared on the crop. A total of two sprays were taken for sheath blight and blast at an interval of 10 days. The rice crop observation for disease incidence on the bacterial blight, false smut and rice blast were recorded from the randomly selected ten hills per plot and efficacy of molecule in controlling of these diseases.

Method of observation:

Disease scoring against blast and sheath blight disease of rice was made following 0-9 disease rating scale of Standard Evaluation System of IRRI (2014). Scoring was done before each treatment spray. Twenty plants were selected at random in the middle 1 sq.m area, from each plot and scored for each plant (hill) and per cent disease index (PDI) was calculated. Observations on sheath blight and blast of diseases were recorded in each replicated plot for each treatment before each treatment spray, 5th and 10th day after each spray and per cent disease incidence was calculated after each spray based on standard procedure.

Table 2. Diseases rating scale for paddy leaf blast disease evaluation

Sr. No.	Description	Score
1	No lesions observed	0
2	Small brown specks of pin-point size or larger brown specks without sporulation center	1
3	Small roundish to slightly elongated, necrotic gray spots, about 1-2 mm in diameter, with a distinct brown margin	2
4	Lesion type is the same as in scale 2, but a significant number of lesions are on the upper leaves	3
5	Typical susceptible blast lesions 3 mm or longer, infecting less than 4 % of the leaf area	4
6	Typical blast lesions infecting 4-10 % of the leaf area	5
7	Typical blast lesions infection 11-25 % of the leaf area	6
8	Typical blast lesions infection 26-50 % of the leaf area	7
9	Typical blast lesions infection 51-75 % of the leaf area and many leaves are dead	8
10	More than 75 % leaf area affected	9

Diseases rating scale for paddy Panicle Blast

The observation for panicle blast was made for 25 panicles per replication and grade was given by using the scale and finally disease severity was given.

Table 3. Diseases rating scale for paddy Panicle Blast

Sr. No.	Description	Score
1	No visible lesions or observed lesions on only few pedicels	0
2	Lesions on several pedicels or secondary branches	1
3	Lesions on a few primary branches or middle part of panicle axis	3
4	Lesions partially around the base (node) or the uppermost internode or the lower part of the panicle axis near the base	5
5	Lesions completely around panicle base or uppermost internode or panicle axis near base with more than 30% filled grains	7
6	Lesions completely around panicle base or uppermost internodes or the panicle axis near the base with less than 30% filled grains	9

Table 4. Diseases rating scale for paddy Sheath blight (based on relative lesion height)

Sr. No.	Description	Score
1	No infection observed	0
2	Lesions limited to lower 20 % of the plant height	1
3	20-30 % of the plant height	3
4	31-45 % of the plant height	5
5	46-65 % of the plant height	7
6	More than 65 % of the plant height	9

Per cent Disease Index (PDI)

Observation on intensity of diseases were observed in each replicated plot for each treatment. The severity of the disease was recorded as PDI. The scores of the twenty selected plants were converted to PDI using the formula mentioned below.

$$\text{Percent Disease Index (PDI)} = \frac{\text{Sum of numerical rating}}{\text{Total no. of plants observed} \times \text{Maximum rating scale}} \times 100$$

Grain yield

In order to record the yield, after final crop harvesting, the plants were sun dried, thrashed and grains were separated by winnowing. The grain yield of the net plot was recorded separately from individual replicated plots of experimental treatment and average paddy yield was recorded and converted to quintal per hectare and was statistically analyzed.

EXPERIMENTAL RESULTS AND DISCUSSION

Evaluation of the Pyraclostrobin 10% + Thifluzamide 10% SC in comparison with their individual products Pyraclostrobin 100 g/l CS and Thifluzamide 24% SC and standard fungicide Azoxystrobin 18.2% + Difenoconazole 11.4% SC against leaf blast, sheath blight disease of paddy was carried out during *kharif* 2021 and *summer* 2022.

A) Leaf Blast:

In *kharif* 2021, the PDI before treatment imposition varied with range of 11.00 to 12.75 which were non-significant. At 5 days after first spray Pyraclostrobin 10% + Thifluzamide 10% SC @ 90+90 g a.i./ha and Pyraclostrobin 10% + Thifluzamide 10% SC @ 80+80 g a.i./ha were significantly effective and on par in reducing the blast disease severity recording minimum PDI of 13.50 and 14.00, respectively when compared to other treatments, whereas, the maximum PDI of 25.50 was observed in control. Similar trend was followed in 10 days after first spray and 5 and 10 days after second spray (Table 1). At 10 days after second spray the highest per cent reduction over control of 87.23 and 85.11 per cent was recorded in Pyraclostrobin 10% + Thifluzamide 10% SC @ 90+90 g a.i./ha and Pyraclostrobin 10% + Thifluzamide 10% SC @ 80+80 g a.i./ha, respectively.

Similarly, during *summer* 2022, at one day before spray the PDI ranged from 8.50 to 10.50 which were non-significant. At 5 days after first spray Pyraclostrobin 10% + Thifluzamide 10% SC @ 90+90 g a.i./ha and Pyraclostrobin 10% + Thifluzamide 10% SC @ 80+80 g a.i./ha recorded the lowest PDI of 10.30 and 10.75, respectively and significantly superior over all other treatments. Untreated control recorded the highest PDI of 20.50 per cent. Similar trend was observed even at 10 days after first spray and 5 days after second spray. At 10 days after second spray Pyraclostrobin 10% + Thifluzamide 10% SC @ 90+90 g a.i./ha recorded the lowest PDI of 12.75 followed by Pyraclostrobin 10% + Thifluzamide 10% SC @ 80+80 g a.i./ha (14.60) which were on par with each other and significantly superior over all other treatments. Untreated control recorded the highest per cent disease Index of 43.50 per cent (Table 2). At 10 days after second spray, Pyraclostrobin 10% + Thifluzamide 10% SC @ 90+90 g a.i./ha and 80+80 g a.i./ha recorded the highest per cent reduction over control of 70.68 and 66.44 per cent, respectively.

b) Panicle blast:

In *kharif* 2021, Pyraclostrobin 10% + Thifluzamide 10% SC @ 90+90 g a.i./ha and Pyraclostrobin 10% + Thifluzamide 10% SC @ 80+80 g a.i./ha were significantly effective and on par in reducing the panicle blast disease severity recording minimum PDI of 3.00 and 3.50, respectively with per cent reduction control of 87.23 and 85.11 per cent, respectively. Whereas, the maximum PDI of 23.50 was observed in untreated control.

In *summer* 2022, lowest per cent panicle blast was recorded from treatment Pyraclostrobin 10% + Thifluzamide 10% SC @ 90+90 g a.i./ha (1.50 PDI) and Pyraclostrobin 10% + Thifluzamide 10% SC @ 80+80 g a.i./ha (2.00 PDI) with per cent reduction over control of 91.89 and 89.19 per cent, respectively.

c) Sheath blight:

In *kharif* 2021, before treatment imposition the PDI varied from 12.50 to 13.35 and were non-significant. Observation recorded 5 days after first spray showed that the test product Pyraclostrobin 10% + Thifluzamide 10% SC @ 90+90 g a.i./ha and Pyraclostrobin 10% + Thifluzamide 10% SC @ 80+80 g a.i./ha were significantly effective and on par in reducing the sheath blight disease severity recording minimum PDI of 14.75 and 15.95, respectively and significantly superior over other treatments. The untreated control recorded the highest PDI of 29.50. Similar trend was followed in 10 days after first spray and 5 days after second spray. At 10 days after second spray Pyraclostrobin 10% + Thifluzamide 10% SC @ 90+90 g a.i./ha and 80+80 g a.i./ha recorded the significantly lowest PDI of 17.95 and 19.75, respectively. This was followed by Pyraclostrobin 10% + Thifluzamide 10% SC @ 70+70 g a.i./ha with PDI of 23.00 (Table 3). At 10 days after second spray Pyraclostrobin 10% + Thifluzamide 10% SC @ 90+90 g a.i./ha and 80+80 g a.i./ha recorded the highest reduction over control of 70.81 and 67.89 per cent, respectively.

Similarly, during *summer* 2022, at one day before spray the PDI across the treatment ranged from 7.75 to 9.00 which were non-significant. At 10 days after second spray significantly lowest PDI of 11.75 was recorded from Pyraclostrobin 10% + Thifluzamide 10% SC @ 90+90 g a.i./ha and on par with Pyraclostrobin 10% + Thifluzamide 10% SC @ 80+80 g a.i./ha (12.50 PDI). This was followed by Pyraclostrobin 10% + Thifluzamide 10% SC @ 70+70 g a.i./ha, Azoxystrobin 18.2% + Difenoconazole 11.4% SC @ 0.03%, Pyraclostrobin 100 g/l CS @100 g a.i./ha and Thifluzamide 24% SC @ 90 g a.i./ha with PDI of 19.50, 16.50, 22.75 and 25.00, respectively (Table 4). At ten days after second spray the highest per cent reduction over control of 70.99 and 69.14 was recorded from Pyraclostrobin 10% + Thifluzamide 10% SC @ 90+90 g a.i./ha and Pyraclostrobin 10% + Thifluzamide 10% SC @ 80+80 g a.i./ha respectively.

Yield:

During *kharif* 2018, yield analysis revealed that Pyraclostrobin 10% + Thifluzamide 10% SC @ 90+90 g a.i./ha and Pyraclostrobin 10% + Thifluzamide 10% SC @ 80+80 g a.i./ha were significantly effective and on par to each other and recorded highest yield of

55.62 and 53.25 q/ha respectively as against 38.84 q/ha in untreated control and was significantly effective over other treatments in increasing the yield (Table 5).

During *summer* 2022, yield analysis revealed that Pyraclostrobin 10% + Thifluzamide 10% SC @ 90+90 g a.i./ha and Pyraclostrobin 10% + Thifluzamide 10% SC @ 80+80 g a.i./ha were significantly effective and on par to each other and recorded highest yield of 58.20 q/ha and 57.50 q/ha respectively as against 40.40 q/ha in untreated control and was significantly effective over other treatments in increasing the yield (Table 5).

The fungicides Azoxystrobin + Difenoconazole and Azoxystrobin + Tebuconazole were found to be as effective as tricyclazole in reducing the rice blast severity and increasing the rice yields (Mohiddin *et al*., 2021). Various strobilurin group of molecules in combination with Triazole molecules (Azoxystrobin 18.2% + Difenconazole 11.4% SC; Metiram 55% + Pyraclostrobin (5%) WG; Tebuconazole 50% + Trifloxystrobin 25% w/w (75 WG) were tested for their efficacy at a constant dosage of 1.0 ml/1 and effectively reduced the blast disease PDI to 26.66%, 20.63% and 14.6%, respectively compared to control PDI of 54.46% (Li et al., 2021; Rajeswari *et al*., 2023).

Even though both systemic and non-systemic fungicides are used for chemical management, systemic fungicides offer better management of the disease (Naik *et al*., 2017). Timely application of selective fungicides between panicle differentiation and heading stage offers effective protection against the 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; Dethoup *et al*., 2023).

Several chemical formulations are in use for the control of sheath blight in rice. The major focus in the development has been on the identification of fungicides with novel target sites and diverse modes of action. Presently, the Strobilurin group of systemic fungicides are the most preferred chemical group to manage sheath blight disease in rice (Yellareddygari et al., 2014). Strobilurin group of fungicides are derivatives of β-methoxy acrylates and are obtained from forest-grown wild mushrooms (Strobilurus tenacellus). 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). Application of other chemicals such as Flutolanil, Carbendazim, Iprobenfos, Mancozeb, Thifluzamide and Validamycin also offers effective control of disease. The use of a single chemical with the same mode of application for a prolonged time leads to the evolution of resistance in the fungus (Uppala and Zhou, 2018). Hence, a combinatory chemical formulation such as Azoxystrobin 18.2% + Difenoconazole 11.4% (Bhuvaneswari and Raju, 2012; Kumar *et al*., 2018); Propiconazole + Difenoconazole (Kandhari, 2007); Prothioconazole + Tebuconazole 240 g/kg SC (Chen *et al*., 2021); Trifloxystrobin 25% + Tebuconazole 50% (Shahid *et al*., 2014; Rashid *et al*., 2020); Carbendazim + Mancozeb (Prasad *et al*., 2006; Kumar *et al*., 2013; Dethoup *et al*., 2023); Carbendazim 25% + Flusilazole 12.5% SE (Sanjay *et al*., 2012) etc., are recommended to manage the disease. The chemical method of control is applicable for all areas, irrespective of varieties and has an advantage in a reduction in disease occurrence, spread and enhance yield.

CONCLUSION:

In *kharif* 2021 and *summer* 2022, at 10 days after second spray, the leaf blast of 17.10 and 12.75 PDI was recorded with Pyraclostrobin 10% + Thifluzamide 10% SC @ 90+90 g a.i./ha, respectively. Similarly, minimum panicle blast of 3.00 and 1.50 PDI recorded with Pyraclostrobin 10% + Thifluzamide 10% SC @ 90+90 g a.i./ha in *kharif* 2021 and *summer* 2022, respectively. In *kharif* 2021 and *summer* 2022, at 10 days after second spray, Pyraclostrobin 10% + Thifluzamide 10% SC @ 90+90 g a.i./ha recorded lowest sheath blight of 17.95 and 11.75 PDI, respectively. During *kharif* 2022, Pyraclostrobin 10% + Thifluzamide 10% SC @ 90+90 g a.i./ha recorded highest yield of 55.62 q/ha as against 38.84 q/ha in untreated control. During *summer* 2022, Pyraclostrobin 10% + Thifluzamide 10% SC @ 90+90 g a.i./ha recorded highest yield of 58.20 q/ha as against 40.40 q/ha in untreated control. The Pyraclostrobin 10% + Thifluzamide 10% SC @ 90+90 and Pyraclostrobin 10% + Thifluzamide 10% SC 80+80 g a.i./ha were found to be the effective and optimum concentration for the management of blast and sheath blight disease in rice.

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Table 5. Bio-efficacy of Pyraclostrobin 10% + Thifluzamide 10% SC on rice against blast during *kharif* 2021.

Tr. No.	Treatments	Dosage (g a.i./ha)	Leaf Blast (PDI)						Panicle blast (PDI)	% ROC of Panicle blast
			First Spray			Second spray				
			BS	5 DAS	10 DAS	5 DAS	10 DAS	% ROC @ 10 DASS		
T1	Pyraclostrobin 10% + Thifluzamide 10 % SC	70+70	11.5 (19.82)	18.5 (25.47)	20.5 (26.92)	22.5 (28.32)	24.3 (29.53)	56.49	7.00	70.21
T2	Pyraclostrobin 10% + Thifluzamide 10% SC	80+80	12.50 (20.70)	14.00 (21.97)	16.15 (23.70)	17.50 (24.73)	18.45 (25.44)	66.97	3.50	85.11
T3	Pyraclostrobin 10% + Thifluzamide 10% SC	90+90	12.00 (20.27)	13.50 (21.56)	15.30 (23.03)	16.25 (23.78)	17.10 (24.43)	69.38	3.00	87.23
T4	Pyraclostrobin 100 g/l CS	100	12.30 (20.53)	19.00 (25.84)	22.50 (28.32)	24.00 (29.33)	26.00 (30.66)	53.45	8.00	65.96
T5	Thifluzamide 24% SC	90	11.80 (20.09)	20.50 (26.92)	24.50 (29.67)	28.50 (32.27)	30.20 (33.34)	45.93	9.65	58.94
T6	Azoxystrobin 18.2% + Difenoconazole 11.4% SC	0.03%	12.75 (20.93)	22.00 (27.97)	26.00 (30.66)	29.50 (32.90)	32.50 (34.76)	41.81	11.00	53.19
T7	Control	-	11.00 (19.37)	25.50 (30.33)	30.50 (33.52)	41.50 (40.11)	55.85 (48.36)	-	23.50	-
	SEm ±		**-**	**0.23**	**0.28**	**0.48**	**0.53**	-	**0.33**	-
	CD at 5%		**NS**	**0.72**	**0.86**	**1.47**	**1.60**	-	**0.98**	-

BS - Before spray; DAS - Days after spray; DASS - Days after second spray; PDI: Per cent disease Index; ROC - Reduction over control

Table 6. Bio-efficacy of Pyraclostrobin 10% + Thifluzamide 10% SC on rice against blast during *summer* 2022.

Tr. No.	Treatments	Dosage (g a.i./ha)	Leaf Blast (PDI)						Panicle blast (PDI)	% ROC of Panicle blast
			First Spray			Second spray				
			BS	5 DAS	10 DAS	5 DAS	10 DAS	% ROC @ 10 DASS		
T1	Pyraclostrobin 10% + Thifluzamide 10 % SC	70+70	9.00 (17.46)	13.50 (21.56)	16.50 (23.97)	19.00 (25.84)	22.00 (27.97)	49.43	4.50	75.68
T2	Pyraclostrobin 10% + Thifluzamide 10% SC	80+80	8.50 (16.95)	10.75 (19.14)	12.50 (20.70)	14.00 (21.97)	14.60 (22.46)	66.44	2.00	89.19
T3	Pyraclostrobin 10% + Thifluzamide 10% SC	90+90	9.50 (17.46)	10.30 (18.72)	11.50 (19.82)	12.10 (20.36)	12.75 (20.92)	70.68	1.50	91.89
T4	Pyraclostrobin 100 g/l CS	100	9.30 (17.76)	14.00 (21.97)	18.00 (25.10)	20.50 (26.92)	23.50 (29.00)	45.98	5.75	68.92
T5	Thifluzamide 24% SC	90	8.75 (17.20)	16.65 (24.08)	20.20 (26.71)	25.00 (30.00)	28.00 (31.95)	35.63	7.00	62.16
T6	Azoxystrobin 18.2% + Difenoconazole 11.4% SC	0.03%	10.50 (18.91)	18.00 (25.10)	22.00 (27.97)	26.50 (30.98)	30.20 (33.34)	30.57	9.75	47.30
T7	Control	-	9.75 (18.20)	20.50 (26.92)	24.50 (29.67)	32.50 (34.76)	43.50 (41.27)	-	18.50	-
	SEm ±		**-**	**0.26**	**0.34**	**0.41**	**0.65**	-	**0.44**	-
	CD at 5%		**NS**	**0.80**	**1.02**	**1.26**	**1.95**	-	**1.33**	-

BS - Before spray; DAS - Days after spray; DASS - Days after second spray; PDI: Per cent disease Index; ROC - Reduction over control

Table 7. **Bio-efficacy of Pyraclostrobin 10% + Thifluzamide 10% SC on rice against sheath blight during *kharif* 2021.**

Tr. No	Treatments	Dosage (g a.i./ha)	Sheath blight (PDI)					
			First Spray			Second Spray		
			BS	5 DAS	10 DAS	5 DAS	10 DAS	% ROC @ 10 DASS
T1	Pyraclostrobin 10% + Thifluzamide 10 % SC	70+70	12.50 (20.70)	17.50 (24.73)	19.75 (26.35)	21.30 (27.49)	23.00 (28.66)	62.60
T2	Pyraclostrobin 10% + Thifluzamide 10% SC	80+80	13.35 (21.35)	15.95 (23.50)	17.20 (24.50)	18.50 (25.47)	19.75 (26.35)	67.89
T3	Pyraclostrobin 10% + Thifluzamide 10% SC	90+90	13.00 (21.13)	14.75 (22.54)	16.00 (23.58)	17.20 (24.50)	17.95 (25.03)	70.81
T4	Pyraclostrobin 100 g/l CS	100	12.75 (20.88)	25.50 (30.33)	28.00 (31.95)	30.20 (33.34)	31.50 (34.14)	48.78
T5	Thifluzamide 24% SC	90	12.50 (20.70)	26.50 (30.98)	28.50 (32.27)	30.00 (33.21)	33.00 (35.06)	46.34
T6	Azoxystrobin 18.2% + Difenoconazole 11.4% SC	0.03%	13.00 (21.13)	19.00 (25.84)	20.00 (26.57)	24.50 (29.67)	26.50 (30.98)	56.91
T7	Control	-	12.65 (20.79)	29.50 (32.90)	35.50 (36.57)	44.50 (41.84)	61.50 (51.65)	-
	SEm ±		**-**	**0.36**	**0.67**	**0.48**	**0.71**	-
	CD at 5%		**NS**	**1.08**	**2.05**	**1.45**	**2.15**	-

BS - Before spray; DAS - Days after spray; DASS - Days after second spray; PDI: Per cent disease Index; ROC - Reduction over control

Table 8. Bio-efficacy of Pyraclostrobin 10% + Thifluzamide 10% SC on rice against sheath blight during *summer* 2022.

Tr. No	Treatments	Dosage (g a.i./ha)	Sheath blight (PDI)					
			First Spray			Second spray		
			BS	5 DAS	10 DAS	5 DAS	10 DAS	% ROC @ 10 DASS
T1	Pyraclostrobin 10% + Thifluzamide 10 % SC	70+70	8.50 (16.95)	13.50 (21.56)	15.50 (23.18)	18.00 (25.10)	19.50 (26.21)	51.85
T2	Pyraclostrobin 10% + Thifluzamide 10% SC	80+80	7.75 (16.11)	10.50 (18.91)	11.00 (19.37)	12.00 (20.27)	12.50 (20.70)	69.14
T3	Pyraclostrobin 10% + Thifluzamide 10% SC	90+90	8.00 (16.43)	9.75 (18.15)	10.25 (18.63)	11.00 (19.37)	11.75 (20.00)	70.99
T4	Pyraclostrobin 100 g/l CS	100	8.25 (16.64)	15.50 (23.18)	17.00 (24.35)	21.00 (27.27)	22.75 (28.45)	43.83
T5	Thifluzamide 24% SC	90	8.75 (17.15)	17.00 (24.35)	19.00 (25.84)	22.50 (28.32)	25.00 (30.00)	38.27
T6	Azoxystrobin 18.2% + Difenoconazole 11.4% SC	0.03%	9.00 (17.46)	12.25 (20.44)	13.50 (21.56)	15.00 (22.79)	16.50 (23.97)	59.26
T7	Control	-	8.50 (16.95)	19.50 (26.21)	24.50 (29.67)	31.50 (34.14)	40.50 (39.52)	-
	SEm ±		**-**	**0.32**	**0.28**	**0.41**	**0.29**	**-**
	CD at 5%		**NS**	**0.96**	**0.86**	**1.25**	**0.89**	**-**

BS - Before spray; DAS - Days after spray; DASS - Days after second spray; PDI: Per cent disease Index; ROC - Reduction over control

Table 5: Bio-efficacy of Pyraclostrobin 10 % + Thifluzamide 10 % SC on grain yield of paddy crop during *kharif* 2021 and *summer* 2022.

Tr. No.	Name	Dosage g a.i./ha	Grain yield (q/ha)	
			***kharif* 2021**	***summer* 2022**
T1	Pyraclostrobin 10% + Thifluzamide 10 % SC	70+70	50.67	53.50
T2	Pyraclostrobin 10% + Thifluzamide 10% SC	80+80	53.25	57.50
T3	Pyraclostrobin 10% + Thifluzamide 10% SC	90+90	55.62	58.20
T4	Pyraclostrobin 100 g/l CS	100	45.74	50.60
T5	Thifluzamide 24% SC	90	45.92	51.70
T6	Azoxystrobin 18.2% + Difenoconazole 11.4% SC	0.03%	41.00	46.00
T7	Control	-	38.84	40.40
	S.Em.±		**0.87**	**0.31**
	C.D. at 5%		**2.62**	**0.92**

Q/ha - Quintal per hectare