



Plant Archives

Journal homepage: <http://www.plantarchives.org>

DOI Url : <https://doi.org/10.51470/PLANTARCHIVES.2026.v26.no.1.143>

IN-VITRO EFFICACY OF NEW FUNGICIDES AGAINST *HELMINTHOSPORIUM ORYZAE* AND *SCLEROTIUM ORYZAE*

A. Ramakrishna*, T. Kiran Babu, N.R.G. Varma and K. Aravind

Institute of Rice Research (IRR), Agricultural Research Institute (ARI), PJTAR, Rajendranagar,
Hyderabad-500030, Telangana, India

*Corresponding author email: drramakrishna31@gmail.com

(Date of Receiving : 11-12-2025; Date of Revision : 03-02-2026; Date of Acceptance : 26-02-2026)

ABSTRACT

The efficacy of seven new fungicide formulations was evaluated against two economically important rice diseases, brown spot (*Helminthosporium oryzae*) and stem rot (*Sclerotium oryzae*), under laboratory conditions using the poisoned food technique. The formulations tested included, Azoxystrobin 18.2% w/w + Difenoconazole 11.4 % w/w SC @ 1.0 ml/L, Picoxystrobin 7% + Propiconazole 12% EC @ 2.0 ml/L, Pyraclostrobin 100 g/L @ 2.0 ml/L, Flupyroxad 62.5 g/L + Epoxiconazole 62.5 g/L EC @ 1.5 ml/L, Trifloxystrobin 50 % + Tebuconazole 25 % w/w (75 WG) @ 0.4g/L, Propiconazole @ 1.0 ml/L and Isoprothiolane @ 1.5 ml/L. For *Helminthosporium oryzae*, the highest mean per cent of mycelial inhibition was observed with Propiconazole @ 1.0 ml/L and Flupyroxad 62.5 g/L + Epoxiconazole 62.5 g/L EC @ 1.5 ml/L, followed by Picoxystrobin 7% + Propiconazole 12% EC @ 2.0 ml/L at both the recommended and half-recommended concentrations. Other effective treatments included Trifloxystrobin 50% + Tebuconazole 25% w/w (75 WG) @ 0.4 g/L and Azoxystrobin 18.2% w/w + Difenoconazole 11.4% w/w SC @ 1.0 ml/L. The lowest inhibition was recorded for Isoprothiolane @ 1.5 ml/L at both concentrations, showing minimal effect compared to the control. In the case of *Sclerotium oryzae*, 100% inhibition was achieved with Propiconazole @ 1.0 ml/L and Flupyroxad 62.5 g/L + Epoxiconazole 62.5 g/L EC @ 1.5 ml/L, followed by Picoxystrobin 7% + Propiconazole 12% EC @ 2.0 ml/L. Treatments (T5) Trifloxystrobin 50% + Tebuconazole 25% w/w (75 WG) @ 0.4 g/L and (T1) Azoxystrobin 18.2% w/w + Difenoconazole 11.4 % w/w SC @ 1.0 ml/L, moderately effective against *Sclerotium oryzae* at both concentrations. Some treatments, however, did not inhibit mycelial growth, including Isoprothiolane @ 1.5 ml/L (T7) and Pyraclostrobin 100 g/L @ 2.0 ml/L (T3), which showed no significant effect at either concentration.

Keywords : Rice, Brown spot, stem rot, *in vitro* and new fungicides

Introduction

Rice is a crucial cereal crop grown in a wide range of ecological conditions, from areas with limited rainfall to those with flooded or submerged conditions. However, it is highly susceptible to various fungal, bacterial, and viral diseases. One of the major diseases affecting rice is *brown leaf spot*, caused by *Bipolaris oryzae* (formerly *Helminthosporium oryzae*, teleomorph *Cochliobolus miyabeanus*). This disease, first reported in Japan in 1900, is commonly known as "nai-yake" (seedling blight), sesame leaf spot, or *Helminthosporiosis*. In India, brown leaf spot has been recognized in all rice-growing states, with the first

report dating back to 1922 from Madras by Sundararaman. The disease is of significant concern worldwide and has been responsible for severe yield losses up to 90% especially when the leaf spotting phase reaches epidemic levels, as seen during the Great Bengal Famine of 1942.

In addition to brown leaf spot, stem rot caused by *Sclerotium oryzae* is another serious threat to rice production in India. This pathogen has been reported to cause substantial yield losses ranging from 5% to 80% (Kumar *et al.*, 2003). Factors such as continuous rice cultivation across multiple seasons, excessive use of nitrogenous fertilizers, the prevalence of graminaceous

weeds (Chen, 1971), and inadequate irrigation and drainage systems have exacerbated the spread of stem rot in recent years. Rice diseases can be managed through the use of resistant cultivars, appropriate cultural practices, and chemical treatments. Among these, chemical control is considered one of the most effective methods for managing diseases and safeguarding crop yields (Kumar *et al.*, 2003). This study aims to evaluate the efficacy of various fungicides against the brown spot and stem rot pathogens under controlled *in vitro* conditions.

Materials and Method

Isolation of the Pathogens

Infected rice plants showing symptoms of brown spot and stem rot were collected from the Agricultural Research Institute (ARI), Rajendranagar. The pathogens responsible for these diseases were isolated from the infected plants using the tissue segment method on Potato Dextrose Agar (PDA) medium (Rangaswamy and Mahadevan, 1999). Small tissue segments, approximately 3 mm in size, were excised from the infected areas, ensuring that a small portion of healthy tissue was also included. These tissue pieces were carefully cut with a sterile scalpel. To prevent contamination, the tissue segments were surface sterilized by immersing them in a 1% sodium hypochlorite solution for one minute, followed by three washes with sterile distilled water to remove any residual sodium hypochlorite. After sterilization, the tissue bits were placed onto PDA agar plates and incubated at $28 \pm 2^\circ\text{C}$. The plates were observed periodically to monitor fungal growth. To ensure purity of the fungal culture, the isolates were further purified using the single hyphal tip method.

In vitro evaluation of fungicides against *H. oryzae* and *Sclerotium oryzae*

The *in vitro* efficacy of fungicides against the pathogens was evaluated using the poisoned food technique (Nene and Thapliyal, 1993). The list of fungicides and their respective concentrations used in this study are provided below. To prepare the poisoned medium, the required quantity of each fungicide (at double the recommended dose) was added to 50 ml of sterilized distilled water and mixed thoroughly. This solution was then incorporated into 50 ml of sterilized, cooled, double-strength Potato Dextrose Agar (PDA) medium, mixed well, and poured into Petri plates. A 5 mm disc from a seven-day-old culture of the pathogen was placed at the centre of the Petri plate containing the poisoned medium. The plates were incubated at $28 \pm 2^\circ\text{C}$, and observations on radial growth of the pathogens were recorded. Each fungicide treatment

was replicated three times. Plates without fungicide served as the control. The percentage of growth inhibition was calculated using the following formula (Vincent, 1947).

$$I = \frac{C-T}{C} \times 100$$

Whereas,

I=Per cent inhibition of mycelium

C= Growth of mycelium in control

T= Growth of mycelium in treatment

Results and Discussion

Among the new fungicides evaluated, the highest mean percentage of mycelial inhibition was observed with Propiconazole at 1.0 ml/L (94.1%), which was statistically similar to Flupyroxad 62.5 g/L + Epoxiconazole 62.5 g/L EC at 1.5 ml/L (93.7%) and Picoxystrobin 7% + Propiconazole 12% EC at 2.0 ml/L (93.3%). These were followed by Trifloxystrobin 50% + Tebuconazole 25% w/w (75 WG) at 0.4 g/L (93.2%). The lowest mean percentage of inhibition of *Helminthosporium oryzae* was recorded with Isoprothiolane at 1.5 ml/L (57.1%) (Table 2, Fig. 1). Similarly, when the fungicides were tested against *Sclerotium oryzae*, the maximum mean percentage of mycelial inhibition was recorded with Propiconazole 25% EC (100%), followed by Flupyroxad 62.5 g/L + Epoxiconazole 62.5 g/L EC at 1.5 ml/L and Picoxystrobin 7% + Propiconazole 12% EC at 2.0 ml/L. The least mean percentage of inhibition was observed with Azoxystrobin 18.2% w/w + Difenconazole 11.4% w/w SC at 1.0 ml/L (81.3%) (Table 3, Fig. 2). The results of this study are consistent with findings from previous research. Gupta *et al.* reported that Propiconazole (25% EC) was highly effective in inhibiting the mycelial growth of *H. oryzae*, with a 97.89% inhibition at a concentration of 250 ppm. Similarly, Hunjan *et al.* tested systemic and combination fungicides against *H. oryzae* and found that the combination of Tebuconazole 50% + Trifloxystrobin 25% WG (Nativo 75% WG) completely inhibited the mycelial growth of *H. oryzae*. These findings align with those of Gopika and Jagadeeshwar (2017), who evaluated fungicides against *S. oryzae*, reported that both Hexaconazole at 200 ppm and Propiconazole at 100 ppm completely inhibited *S. oryzae* in poisoned media.

Conclusion

In the present study, the fungicides Propiconazole at 1.0 ml/L, Flupyroxad 62.5 g/L + Epoxiconazole 62.5 g/L EC at 1.5 ml/L, Picoxystrobin 7% + Propiconazole 12% EC at 2.0 ml/L, and Azoxystrobin 18.2% w/w +

Difenconazole 11.4% w/w SC at 1.0 ml/L, at both recommended and half-recommended concentrations, were found to be the most effective against the brown spot and stem rot pathogens *Helminthosporium oryzae* and *Sclerotium oryzae*. These fungicides likely function as antifungal agents, disrupting the metabolic processes of the pathogens and thereby inhibiting their growth.

Table 1: List of different new combination fungicides with recommended and half recommended doses against various pathogens in rice

S.No.	Chemicals	Dosage (g or ml/L of water)	
		Recommended dose	Half recommended Dose
1	Azoxystrobin 18.2% w/w + Difenconazole 11.4 % w/w SC	1.0 ml/L	0.5 ml/L
2	Picoxystrobin 7% + Propiconazole 12% EC	2.0 ml/L	1.0 ml/L
3	Pyraclostrobin 100 g/L CS	2.0 ml/L	1.0 ml/L
4	Flupyroxad 62.5 g/L + Epoxiconazole 62.5 g/L EC	1.5 ml/L	0.75 ml/L
5	Trifloxystrobin 50 % + Tebuconazole 25 % w/w (75 WG)	0.4 g/L	0.2 g/L
6	Propiconazole 25%EC	1.0 ml/L	0.5 ml/L
7	Isoprothiolane 40% EC	1.5 ml/L	0.75 ml/L

Table 2 : In-vitro evaluation of new fungicides against *Helminthosporium oryzae*

Trt. No.	Treatments	Percent Inhibition of mycelial growth over control		
		HR	R	Mean
T1	Azoxystrobin 18.2% w/w + Difenconazole 11.4 % w/w SC @ 1.0 ml/L	78.7 ^d (62.5)	82.8 ^d (65.5)	80.7 ^d (64.0)
T2	Picoxystrobin 7% + Propiconazole 12% EC @ 2.0 ml/L	93.0 ^e (74.6)	93.7 ^e (75.5)	93.3 ^e (75.1)
T3	Pyraclostrobin 100 g/L @ 2.0 ml/L	50.2 ^b (45.1)	83.1 ^c (65.9)	66.7 ^c (55.5)
T4	Flupyroxad 62.5 g/L + Epoxiconazole 62.5 g/L EC @ 1.5 ml/L	93.3 ^e (75.1)	94.1 ^e (75.9)	93.7 ^e (75.5)
T5	Trifloxystrobin 50 % + Tebuconazole 25 % w/w (75 WG) @ 0.4 g/L	92.8 ^e (74.4)	93.7 ^e (75.8)	93.2 ^e (75.0)
T6	Propiconazole 20% EC @ 1.0 ml/L	94.1 ^e (75.9)	94.1 ^e (75.9)	94.1 ^e (75.9)
T7	Isoprothiolane 40% EC @ 1.5 ml/L	59.6 ^c (47.7)	59.6 ^b (50.5)	57.1 ^b (49.1)
T8	Untreated Control	0.0 ^a (0.0)	0.0 ^a (0.0)	0.0 ^a (0.0)
		Fungicide (F)	Concentration (C)	F x C
	S _{Em} ±	0.8	0.4	1.2
	CD (p = 0.01)	2.2	1.1	3.2

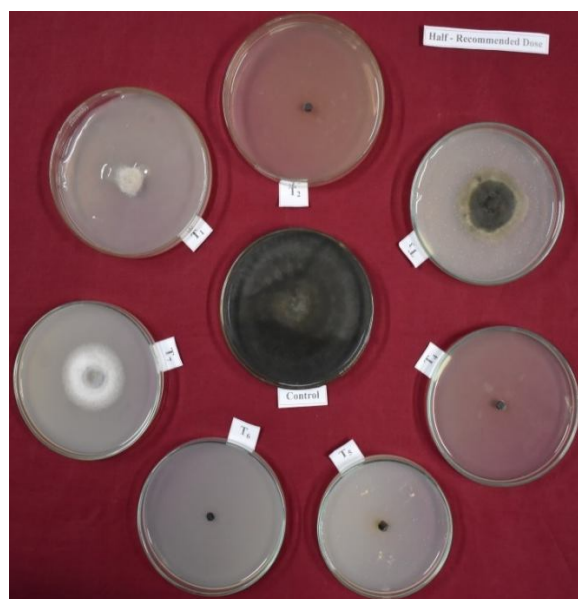
Figures in parenthesis are angular transformed values. Dunccan multiple range test (DMRT).

Table 3 : In-vitro evaluation of new fungicides against *Sclerotium oryzae*

Trt. No.	Treatments	Percent Inhibition of mycelial growth over control		
		HR	R	Mean
T1	Azoxystrobin 18.2% w/w + Difenconazole 11.4 % w/w SC @ 1.0 ml/L	80.4 ^b (63.7)	82.2 ^b (65.1)	81.3 ^c (64.4)
T2	Picoxystrobin 7% + Propiconazole 12% EC @ 2.0 ml/L	100.0 ^d (90.0)	100.0 ^d (90.0)	100.0 ^a (90.0)
T3	Pyraclostrobin 100 g/L @ 2.0 ml/L	0.0 ^a (0.0)	0.0 ^a (0.0)	0.0 ^d (0.0)
T4	Flupyroxad 62.5 g/L + Epoxiconazole 62.5 g/L EC @ 1.5 ml/L	100.0 ^d (90.0)	100.0 ^d (90.0)	100.0 ^a (90.0)

T5	Trifloxystrobin 50 % +Tebuconazole 25 % w/w (75 WG) @ 0.4 g/L	83.0 ^c (65.6)	84.8 ^c (67.2)	83.9 ^b (66.4)
T6	Propiconazole 20% EC @ 1.0 ml/L	100.0 ^d (90.0)	100.0 ^d (90.0)	100.0 ^a (90.0)
T7	Isoprothiolane 40% EC @ 1.5 ml/L	0.0 ^a (0.0)	0.0 ^a (0.0)	0.0 ^d (0.0)
T8	Untreated Control	0.0 ^a (0.0)	0.0 ^a (0.0)	0.0 ^d (0.0)
		Fungicide (F)	Concentration (C)	F x C
	SEm±	0.4	0.2	0.5
	CD (p = 0.01)	1.1	0.5	1.5

Figures in parenthesis are angular transformed values. Dunccan multiple range test (DMRT).



Half recommended dose



Recommended dose

Fig. 1 : *In vitro* evaluation of fungicides against *Helminthosporium oryzae* (Brown spot)



Half recommended dose



Recommended dose

Fig. 2 : *In vitro* evaluation of fungicides against *Sclerotium oryzae* (Stem rot)

Acknowledgement

The authors are thankful to Institute of Rice Research, ARI, Rajendranagar and Professor Jayashankar Telangana Agricultural University, Rajendranagar, Hyderabad for providing necessary support.

Competing Interests

Authors have declared that no competing interests exist.

References

- Chen, C. C. (1971). Stem rot of rice. *Proceedings Symposium JCRR*, Jaipur, Taiwan, 77–78.
- Gopika, K., & Jagadeeshwar, R. (2017). Studies on disease incidence and efficacy of fungicides, herbicides and antagonists micro flora against stem rot of rice (*Sclerotium oryzae*) along with integrated management. *Agriculture Update*, **12**(7), 2077–2087.
- Gupta, V., Shamas, N., Razdan, V. K., Sharma, B. C., Sharma, R., Kaur, K., Singh, I., John, J., & Kumar, A. (2013). Foliar application of fungicides for the management of brown spot disease in rice (*Oryza sativa* L.) caused by *Bipolaris oryzae*. *African Journal of Agricultural Research*, **8**(25), 3303–3309.
- Hunjan, M. S., Lore, J. S., Pannu, P. P. S., & Thind, T. S. (2011). Performance of some new fungicides against sheath blight and brown spot of rice. *Plant Disease Research*, **26**(1), 61–67.
- Kumar, A., Singh, R., & Jalali, B. L. (2003). Management of stem rot of rice with resistance inducing chemicals and fungicides. *Indian Phytopathology*, **56**(3), 266–269.
- Nene, Y. L., & Thapliyal, P. N. (1993). *Fungicides in plant disease control* (3rd ed.). Oxford and IBH Publishing Company Private Limited.
- Rangaswami, G., & Mahadevan, A. (1999). *Diseases of crop plants in India* (4th ed.). Prentice Hall of India Private Limited.
- Vincent, J. M. (1947). The esters of 4-hydroxy benzoic acid and related compounds: Methods for the study of their fungistatic properties. *Journal of the Society of Chemical Industry, London*, **16**, 746–755.