

## Bio-efficacy of Thiophanate methyl 70% WP against Blast, Sheath rot and Grain Discoloration diseases of Paddy

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**ABSTRACT:** Paddy is an important food crop of the world including India. Under field condition, the productivity of rice is affected by many biotic and abiotic factors. Among the different biotic constraints, diseases caused by fungal pathogens such as blast and sheath rot, grain discoloration are more frequent and ferocious disease in irrigated rice of both temperate and subtropical areas and which cause damage at all stages of crop growth. Blast, sheath rot and grain discoloration are major constrain of paddy production reported to cause extensive damage in crop production. An experiment was conducted to assess the Bio-efficacy of Thiophanate methyl 70% WP against blast, sheath rot and grain discoloration diseases of Paddy at ARS, Gangavathi. Results revealed that, among the various treatments evaluated, Thiophanate methyl 70% WP @ 1143 g/ha (T<sub>3</sub>) and Thiophanate methyl 70% WP @ 857 g/ha (T<sub>2</sub>) were found to be the best treatments to control blast, sheath rot and grain discoloration during both the seasons.

**Keywords:** Paddy, Blast, Sheath rot, Grain discoloration, bio efficacy, Thiophanate methyl 70 % WP.

### INTRODUCTION

Rice (*Oryza sativa* L.) is an important food crop of the world including India. Ever growing population in the world particularly in India is further demanding more rice production and continuous reduction in the availability of cultivable land demanding higher productivity. Under field condition, the productivity of rice is affected by many biotic and abiotic factors. Among the different biotic constraints, diseases caused by fungal pathogens such as blast, sheath rot, grain discoloration are more frequent and ferocious diseases in irrigated rice of both temperate and subtropical areas and cause damage at all stages of crop growth. Rice blast caused by *Pyricularia oryzae* Cavara [synonym *Pyricularia grisea* Sacc. the anamorph of *Magnaporthe grisea* (Herbert) Yaegashi and Udagawa], is one of the most destructive and wide spread disease of rice (Jia *et al.*, 2000). Blast epidemic causes the complete defeat of seedling at the nursery and in field condition (Teng 1991) and causes upto 80% of total yield reduction (Koutroubas *et al.*, 2009). Sheath rot, caused by *Sarocladium oryzae* is important destructive disease of rice occurs in all rice growing areas of the world. In India, amodest estimation of losses due to the sheath rot disease alone has been up to 54.3% (Rajan *et al.*, 1987). The disease is particularly important in intensive rice production systems due to excess use of nitrogenous fertilizers. The grains are infected by various organisms viz., *Drechslera oryzae*, *D. rostratum*, *Curvularia lunata*, *Sarocladium oryzae*, *Alternaria tenuis*, *Fusarium moniliforme*, *Cladosporium herbarum*,

*Phoma* sp. and *Nigrospora* sp. before or after harvesting causing discoloration. The infection may be external or internal causing discoloration of the glumes or kernels or both causing both quantitative and qualitative losses of grains. Dark brown or black spots appear on the grains causing red, yellow, orange, pink or black discoloration depending upon the organism involved and the degree of infection (TNAU agriportal).

### MATERIAL AND METHODS

The fungicides were applied as foliar spray treatment in the replicated plots just after the appearance of Blast, Sheath rot and stem rot diseases in the main field and standard agronomic practices were adopted for the *Rabi Summer* 2017-18 cultivation season. The plots were inspected regularly to see the disease development and further two more spray were applied at an interval of 7 days.

To know the effect of Thiophanate methyl 70% WP on the Blast, Sheath rot and Grain Discoloration of rice crop observation for disease incidence were recorded from the randomly selected ten hills per plot and efficacy of molecule in controlling of these diseases. Observation were recorded on the basis of scoring of the diseases as per the disease rating scale of SES, IRRI, (2002).

Observation on intensity of diseases were observed in each replicated plot for each treatment and per cent disease incidence were calculated based on following formula.

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

In order to record the yield, crop was harvested from the individual replicated plots and average paddy yield was recorded and expressed as q/ha.

**a. Bio-efficacy study:**

Tr. No.	Treatment	Dosage per ha		Dilution in water (Liters)
		a.i. (g/ml)	Formulation (g/ml)/ha	
T <sub>1</sub>	Thiophanate methyl 70% WP	400	571	500
T <sub>2</sub>	Thiophanate methyl 70% WP	600	857	500
T <sub>3</sub>	Thiophanate methyl 70% WP	800	1143	500
T <sub>4</sub>	Tricyclazole 75% WP	225	300	500
T <sub>5</sub>	Hexaconazole 75% WG	50	66.7	500
T <sub>6</sub>	Hexaconazole 4% + Zineb 68% WP	(40 + 680)	1000	500
T <sub>7</sub>	Untreated Control	Water spray	Water spray	500

**Experiment details:**

**Location:** ARS Gangavathi

**Season:** *Kharif, Rabi-Summer*

**Year:** 2017-18

**Crop:** Rice

**Variety:** BPT-5204

**Soil type:** Black clay

**Irrigated / Rainfed:** Irrigated

**Date of sowing:** 08.08.2017

**Date of Transplanting:** 06.09.2017

**No. of applications:** Three at 15 days interval

**RESULTS AND DISCUSSION**

*A. Bio-efficacy of Thiophanate methyl 70% WP*

**Blast disease.** Among the various treatments evaluated, Thiophanate methyl 70% WP @ 1143 g/ha and Thiophanate methyl 70% WP @ 857 g/ha were found to be the best treatments during both the seasons as they recorded 9.33 and 10.56 PDI, respectively as compared to 33.67 PDI in untreated control at terminal observation during *Kharif* 2017-18 (Table 1a); 11.67 PDI and 12.33 PDI, respectively as compared to 41.85 PDI in untreated control at terminal observation during *Rabi-Summer* 2017-18 (Table 1b). Thiophanate methyl 70% WP @ 1143 g/ha and Thiophanate methyl 70% WP @ 857 g/ha were recorded its superiority in both the seasons during all the observation days. The effect of foliar treatment on blast disease control with Thiophanate methyl 70% WP @ 1143 g/ha and Thiophanate methyl 70% WP @ 857 g/ha were

statistically on par with each other during both the seasons. The next best treatment in reducing the blast disease was Tricyclozole 75% WP with incidence of 11.34 PDI during *Kharif* 2017-18, 13.67 PDI for leaf blast disease during *Rabi-Summer* 2017-18.

Similar investigations on paddy blast disease have been carried out by earlier workers viz., Pramesh *et al.* (2020) who evaluated the efficacy of Prochloraz 27% + Tricyclazole 23% SE, Tricyclazole 75% WP, Carbendazim 50% WP, and Carbendazim 12% + Mancozeb 63% at different concentrations against blast of paddy during *Rabi* and *Kharif* 2016 under field conditions. The study revealed that the three successive sprays of Prochloraz 27% + Tricyclazole 23% SE at 1250 ml/ha at ten days interval from the initiation of disease was found most effective in reducing the disease up to 98.24% and 97.13% in *Rabi* and *Kharif* seasons respectively. Similarly, Kongcharoen *et al.*, (2020) reported that Fluopyram + tebuconazole, difenoconazole + propiconazole, flutriafol and azoxystrobin achieved stronger fungicidal activity against rice blast disease, reducing its severity by 32–33% when applied twice by foliar spraying. Pramesh *et al.*, (2016) tested a new combination fungicide Nativo 75 WG composed of Trifloxystrobin 25% (Strobilurin) and Tebuconazole 50% (Triazole) against rice blast and sheath blight diseases under field condition during *Autumn* 2014 and - 2015.

**Table 1a: Efficacy of Thiophanate methyl 70% WP on blast disease incidence of Rice during *Kharif* 2017-18 (1<sup>st</sup> Season).**

Sr. No.	Treatment	Dosage per ha		Percent Disease Index (PDI)			
		a.i. (g/ml)	Formulation (g/ml)/ha	Before 1 <sup>st</sup> spray	7 days after 1 <sup>st</sup> spray	7 days after 2 <sup>nd</sup> spray	7 days after 3 <sup>rd</sup> spray
T1	Thiophanate methyl 70% WP	300	720	5.13 (13.09)	9.47 (17.92)	11.33 (19.67)	13.33 (21.42)
T2	Thiophanate methyl 70% WP	400	960	4.05 (11.61)	7.17 (15.53)	8.56 (17.01)	10.56 (18.96)
T3	Thiophanate methyl 70% WP	500	1200	4.23 (11.87)	6.22 (14.41)	7.42 (15.81)	9.33 (17.79)
T4	Tricyclazole 75% WP	225	300	4.67 (12.47)	7.69 (16.12)	8.60 (17.10)	11.34 (19.68)
T5	Hexaconazole 75% WG	50	66.7	5.05 (12.99)	9.90 (18.34)	12.18 (20.42)	14.66 (22.51)
T6	Hexaconazole 4% + Zineb 68% WP	(40 + 680)	1000	5.07 (13.00)	10.54 (18.94)	13.67 (21.70)	15.11 (22.87)
T7	Untreated Control	Water spray	Water spray	4.93 (12.83)	16.65 (24.08)	26.78 (31.16)	33.67 (35.47)
	CD (0.05)			NS	2.15	2.37	3.73

\*Data in the parenthesis is angular transformed value

**Table 1b: Efficacy of Thiophanate methyl 70% WP on blast disease incidence of Rice during Rabi Summer 2017-18 (2<sup>nd</sup> Season).**

Sr. No.	Treatment	Dosage per ha		Percent Disease Index (PDI)			
		a.i. (g/ml)	Formulation (g/ml)/ha	Before 1 <sup>st</sup> spray	7 days after 1 <sup>st</sup> spray	7 days after 2 <sup>nd</sup> spray	7 days after 3 <sup>rd</sup> spray
T1	Thiophanate methyl 70% WP	300	720	4.40 (12.11)	9.47 (17.92)	11.33 (19.67)	13.33 (21.42)
T2	Thiophanate methyl 70% WP	400	960	3.33 (10.52)	8.76 (17.22)	10.56 (18.96)	12.33 (20.56)
T3	Thiophanate methyl 70% WP	500	1200	3.87 (11.36)	7.42 (15.81)	9.80 (18.28)	11.67 (19.98)
T4	Tricyclazole 75% WP	225	300	4.29 (11.29)	9.45 (17.33)	12.67 (20.85)	13.67 (21.70)
T5	Hexaconazole 75% WG	50	66.7	4.33 (12.01)	11.76 (20.06)	16.78 (24.18)	18.33 (25.35)
T6	Hexaconazole 4% + Zineb 68% WP	(40 + 680)	1000	4.67 (12.47)	14.66 (22.51)	18.25 (25.29)	19.62 (26.29)
T7	Untreated Control	Water spray	Water spray	3.67 (11.04)	23.55 (29.03)	35.33 (36.47)	41.85 (40.31)
CD (0.05)				NS	1.38	1.42	1.28

\*Data in the parenthesis is angular transformed value

They found that the combination fungicide Trifloxystrobin 25% + Tebuconazole 50% (Nativo 75 WG) @ 0.4 g/l was found effective against blast and sheath blight diseases recording least Percent Disease Index (PDI) of 17.02 and 24.7 respectively. Significant increase in the grain yield was observed in the plots treated with test chemical Navito 75 WG @ 0.4 g/l (55.13 q/h) compared to the other fungicidal treatments which recorded the yield in the range of 40.75 to 48.12 q/h.

**Sheath rot disease.** Lowest sheath rot disease intensity of 8.33 per cent during *Kharif* 2017-18 (Table 2a), and 8.32 per cent during *Rabi-Summer* 2017-18 (Table 2b) was recorded in the treatment of Thiophanate methyl 70% WP @ 1143 g/ha followed by in Thiophanate methyl 70% WP @ 857 g/ha which recorded disease intensity of 10.43 per cent during *Kharif* 2017-18 and 9.55 per cent during *Rabi-Summer* 2017-18. Both these treatments were found significantly superior to rest of the treatments and provided higher reduction in disease incidence in both the seasons. Hexaconazole 75% WG @ 66.7g/ha recorded disease intensity of 8.98 per cent during *Kharif* 2017-18 and 8.56 per cent during *Rabi-Summer* 2017-18 which was at par with above treatments and provided at par disease intensity during both the seasons. While, control treatment exhibited disease intensity of 30.34 per cent during *Kharif* 2017-18 and 28.52 per cent during *Rabi-Summer* 2017-18.

Similar investigations on paddy sheath rot have been carried out by earlier workers viz., Berhan *et al.*, 2020 conducted. The experiment in order to study the efficacy of various fungicides against Rice Sheath Rot Disease (*Sarocladium oryzae*) in Rain Fed Low Land Rice in Fogera hub. The result revealed that seed dressing fungicides were by far better over foliar fungicides. Proseed plus 63 WS (carboxin+ thiram + imidacloprid), Joint 246 FS (imidacloprid + tebuconazol) and ImidalmT 450 WS (imidaclopride 250 gm/kg) fungicides were effective against rice sheath rot disease control, respectively. Pramesh *et al.* 2020 evaluated new combination fungicide, Tricyclazole 22.5% W/V (20.36% W/W) + Azoxystrobin 7.5% W/V (6.79% W/W) against rice sheath blight disease under field condition during *Kharif* 2015 and *Rabi* 2015-16. The combination fungicide Tricyclazole 22.5% W/V (20.36% W/W) + Azoxystrobin 7.5% W/V (6.79% W/W) at 1000 ml/ha was found effective against sheath blight diseases by recording least Percent Disease Index (PDI) of 14.44 during *Kharif* 2015 and 13.35 during *Rabi* 2015-16. Significant increase in grain yield (61.53 q/h) was also observed in the plots treated with Tricyclazole 22.5% W/V (20.36% W/W) + Azoxystrobin 7.5% W/V (6.79% W/W) at 1000 ml/ha in *Kharif* 2015 (61.53 q/ha) and *Rabi* 2015-16 (64.62 q/ha).

**Table 2a: Efficacy of Thiophanate methyl 70% WP on sheath rot disease incidence of Rice during Kharif 2017-18 (1<sup>st</sup> Season).**

Sr. No.	Treatment	Dosage per ha		Percent Disease Index (PDI)			
		a.i. (g/ml)	Formulation (g/ml)/ha	Before 1 <sup>st</sup> spray	7 days after 1 <sup>st</sup> spray	7 days after 2 <sup>nd</sup> spray	7 days after 3 <sup>rd</sup> spray
T1	Thiophanate methyl 70% WP	300	720	2.95 (9.91)	8.98 (17.46)	11.47 (19.81)	13.69 (21.73)
T2	Thiophanate methyl 70% WP	400	960	2.84 (9.72)	6.04 (14.24)	8.65 (17.12)	10.43 (18.86)
T3	Thiophanate methyl 70% WP	500	1200	3.87 (11.36)	5.33 (13.35)	7.69 (16.12)	8.33 (16.76)
T4	Tricyclazole 75% WP	225	300	2.95 (9.91)	11.44 (19.70)	17.89 (24.93)	18.92 (25.78)
T5	Hexaconazole 75% WG	50	66.7	3.33 (10.52)	5.44 (13.44)	7.22 (15.55)	8.98 (17.46)
T6	Hexaconazole 4% + Zineb 68% WP	(40 + 680)	1000	3.42 (10.67)	9.55 (17.96)	11.44 (19.70)	13.67 (21.67)
T7	Untreated Control	Water spray	Water spray	3.20 (10.31)	14.33 (22.26)	25.40 (30.70)	30.34 (33.44)
CD (0.05)				NS	2.01	1.82	2.28

\*Data in the parenthesis is angular transformed value

**Table 2b: Efficacy of Thiophanate methyl 70% WP on sheath rot disease incidence of Rice during Rabi Summer 2017-18 (2<sup>nd</sup> Season).**

Sr. No.	Treatment	Dosage per ha		Percent Disease Index (PDI)			
		a.i. (g/ml)	Formulation (g/ml)/ha	Before 1 <sup>st</sup> spray	7 days after 1 <sup>st</sup> spray	7 days after 2 <sup>nd</sup> spray	7 days after 3 <sup>rd</sup> spray
T1	Thiophanate methyl 70% WP	300	720	1.85 (7.83)	7.17 (15.55)	9.80 (18.24)	11.76 (20.06)
T2	Thiophanate methyl 70% WP	400	960	1.81 (7.75)	6.44 (14.58)	8.67 (17.14)	9.55 (17.56)
T3	Thiophanate methyl 70% WP	500	1200	2.01 (8.17)	4.67 (12.49)	6.89 (15.11)	8.32 (16.78)
T4	Tricyclazole 75% WP	225	300	2.84 (9.72)	8.67 (17.14)	15.14 (22.91)	19.62 (26.29)
T5	Hexaconazole 75% WG	50	66.7	1.85 (7.83)	4.73 (12.58)	7.22 (15.55)	8.56 (16.95)
T6	Hexaconazole 4% + Zineb 68% WP	(40 + 680)	1000	2.69 (9.46)	5.67 (13.76)	8.72 (17.18)	11.44 (19.70)
T7	Untreated Control	Water spray	Water spray	2.13 (8.41)	13.67 (21.73)	23.26 (28.85)	28.52 (32.28)
	CD (0.05)			NS	0.94	1.51	0.83

\*Data in the parenthesis is angular transformed value

**Grain discolouration.** During both the seasons the treatments Thiophanate methyl 70% WP @ 1143 g/ha and Thiophanate methyl 70% WP @ 857 g/ha recorded lower grain discolouration and found to be the best treatments as they recorded 7.12 PDI and 8.32 PDI during *Kharif* 2017-18 and 5.36 PDI and 6.22 PDI during *Rabi-Summer* 2017-18, respectively as compared to 33.67 PDI and 29.21 PDI in untreated control (Table 3a and 3b). Results obtained from the present investigation are in conformity with the earlier

workers viz., Gowdar *et al.* (2021) conducted an experiment to assess the Bio- efficacy of Thiophanate methyl 41.7% SC against blast, sheath rot, stem rot and grain discoloration diseases of Paddy at ARS, Gangavathi. Results revealed that, among the various treatments evaluated, Thiophanate methyl 41.7% SC @ 1200 ml/ha (T3) and Thiophanate methyl 41.7% SC @ 960 ml/ha (T2) were found to be the best treatments to control blast, sheath rot, stem rot and grain discoloration during both the seasons.

**Table 3a: Efficacy of Thiophanate methyl 70% WP on grain discolouration and yield of Paddy during Kharif 2017-18 (1<sup>st</sup> Season).**

Sr. No.	Treatment	Dosage per ha		Grain discolouration (PDI)	Yield (q/ha)
		a.i. (g/ml)	Formulation (g/ml)/ha		
T1	Thiophanate methyl 70% WP	300	720	11.23 (19.58)	56.80
T2	Thiophanate methyl 70% WP	400	960	8.32 (16.78)	59.10
T3	Thiophanate methyl 70% WP	500	1200	7.17 (15.55)	61.70
T4	Tricyclazole 75% WP	225	300	18.25 (25.29)	46.60
T5	Hexaconazole 75% WG	50	66.7	7.67 (16.12)	61.00
T6	Hexaconazole 4% + Zineb 68% WP	(40 + 680)	1000	15.08 (22.85)	47.80
T7	Untreated Control	Water spray	Water spray	33.67 (35.47)	37.10
	CD (0.05)			1.73	1.47

\*Data in the parenthesis is angular transformed value

**Table 3b: Efficacy of Thiophanate methyl 70% WP on grain discolouration and yield of Paddy during Rabi Summer 2017-18 (2<sup>nd</sup> Season).**

Sr. No.	Treatment	Dosage per ha		Grain discolouration (PDI)	Yield (q/ha)
		a.i. (g/ml)	Formulation (g/ml)/ha		
T1	Thiophanate methyl 70% WP	300	720	8.22 (16.64)	60.70
T2	Thiophanate methyl 70% WP	400	960	6.22 (14.42)	65.30
T3	Thiophanate methyl 70% WP	500	1200	5.36 (13.43)	67.90
T4	Tricyclazole 75% WP	225	300	14.55 (22.42)	48.00
T5	Hexaconazole 75% WG	50	66.7	6.33 (14.57)	65.10
T6	Hexaconazole 4% + Zineb 68% WP	(40 + 680)	1000	11.85 (20.14)	50.50
T7	Untreated Control	Water spray	Water spray	29.21 (32.75)	43.90
	CD (0.05)			1.25	2.19

\*Data in the parenthesis is angular transformed value

#### Rice yield

The results revealed that highest paddy yield was obtained from the treatment with Thiophanate methyl 70% WP @ 1143 g/ha i.e. 61.70 q/ha during *Kharif* 2017-18 and 67.90 q/ha during *Rabi-Summer* 2017-18 and was at par with Thiophanate methyl 70% WP @

857 g/ha that recorded 59.10 q/ha during *Kharif* 2017-18 and 65.30 q/ha during *Rabi-Summer* 2017-18 (Table 3a and 3b). All the treatments were significantly superior with respect to control. Minimum paddy yield i.e., 37.10 and 43.90 q/ha was recorded in untreated



control during *Kharif* 2017-18 and *Rabi-Summer* 2017-18.

Present results are in conformity with those of previous publication where, fungicides application increases the yield of rice (Tirmali *et al.*, 2001; Prabhu *et al.*, 2003, Usman *et al.*, 2009; Naik *et al.*, 2012; Bhuvaneshwari and Raju, 2012; Bag *et al.*, 2016; Prameshet *al.*, 2016). The increased yield is mainly due to reduced disease severity of stem rot disease of rice.

## CONCLUSION

The foliar application of Thiophanate methyl 70% WP @ 857 to 1143 g/ha were effective in control of Blast, Sheath rot and Grain Discoloration and resulting higher yield of rice. Thiophanate methyl 70% WP @ 857 g/ha and Thiophanate methyl 70% WP @ 1143 g/ha were found on par at all the observation days. Hence, considering the efficacy and economics of fungicide use it can be concluded that Thiophanate methyl 70% WP @ 1143 g/ha is effective in managing the Blast, Sheath rot and Grain Discoloration diseases of rice without any harmful effect on crop.

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