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Curtailing Effects of Fungicides against *Rhizoctonia Solani* f.sp. *sasakii* Inciting Banded Leaf and Sheath Blight of Maize in Manipur

Paluru Pavani, L. Nongdrenkhomba Singh, Nabakishor Nongmaithem, Pooja Bathula, Gopimohan Singh

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ABSTRACT

Using the technique of poisoned food in four different concentrations, seven fungicides were tested *in vitro* against *R. solani*. Seven fungicides viz., Dithane M-45 75 WP , Zineb 75% WP, Propiconazole 25% EC, Kresoxim methyl 44.3% SC, Azoxystrobin 11% + Tebuconazole 18.3% SC, Azoxystrobin 18.2 w/w+Difenoconazole11.4% w/w SC and Tebuconazole 25% EC. Highest inhibition percentage was showed by Propiconazole 25% EC and Tebuconazole 25% EC in all concentrations with 100% growth inhibition followed by Azoxystrobin 11% + Tebuconazole 18.3% SC, Azoxystrobin 18.2 w/w+Difenoconazole11.4% w/w SC with 92 – 98% growth inhibition and least inhibition percentage was showed by Zineb with 65.29% at 0.25% respectively.

Keywords Banded leaf, Fungicide, Poisoned technique *R. solani*, Sheath blight.

INTRODUCTION

Maize (*Zea mays* L.; 2n=20) is one of the most significant cereal crops in the global agricultural economy. It arrived in India during the start of the 17th century. The "queen of cereals" is a remarkable C4 crop with a very high potential for yield. In India, maize is largely a *kharif* crop, and during the growing season, 85% of the country's land is cultivated. It currently ranks third in production and fifth in area among India's key crops. There are numerous bacterial, fungal, and viral diseases that damage the maize plant, including the banded leaf and sheath blight (BLSB) caused by *Rhizoctonia solani* f.sp. *sasakii* (*Thanatephorus cucumeris*), one of the most harmful and frequent reasons of decreased yield. *R. solani* is a persistent and lethal plant pathogen due to its unusual combination of competitive saprophytic skills and high pathogenic potential. The disease first manifests itself on maize plants that are 30 to 40 days old and in the pre-flowering stage, though it can also be seen on younger plants. The initial sign is the appearance of little patches that are discolored and have irregular, alternating black bands. The first and second leaf sheaths above ground show the symptoms first, and subsequently they spread to the ear, causing ear rot. If an infection develops before the ear emerges, it will be deformed and unable to develop. Banded leaf and sheath blight is now widespread in Himachal Pradesh, Assam, Meghalaya, Manipur, Uttar Pradesh, Nagaland, Jammu Kashmir, Haryana, Uttarkhand, Punjab, Sikkam, Madhya Pradesh, Delhi, Rajasthan, Orissa, Andhra Pradesh and West Bengal, and has been designated as a dangerous maize disease. Grain yield losses could be anywhere between 11 and 40%

Paluru Pavani*[1], L. Nongdrenkhomba Singh[2], Nabakishor Nongmaithem[3], Pooja Bathula[4], Gopimohan Singh[5]
Research Scholar[1], Prof.[2], Asst. Prof.[3], Research Scholar[4], Assoc. Prof.[5]
Department of Plant Pathology, College of Agriculture, Central Agricultural University, Imphal 795004, Manipur, India
Email : pavani09021999@gmail.com
*Corresponding author

Plate 1a. *In vitro* efficacy of fungicides on growth of *R. solani* C. Control, 1. Mancozeb (0.10%), 2. Mancozeb (0.25%), 3. Mancozeb (0.50%).

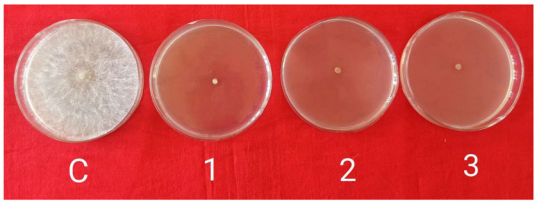

Plate 1b. *In vitro* efficacy of fungicides on growth of *R.solani.* C. Control, 1. Propiconazole (0.10%), 2. Propiconazole (0.25%), 3. Propiconazole (0.50%).

and as high as 100% (Madhavi *et al*. 2011, Izhar and Chakraborty 2013). Effective banded leaf and sheath blight management strategies are therefore essential to reducing crop loss and avoiding losses that are economically significant (Singh and Shahi 2012).

A variety of techniques have been used to control BLSB. The most often used methods for managing this disease are cultural practices, chemical control, and biological control. Furthermore, it is common practice to use higher doses of fungicides on farms than are recommended for the specific crop. There have been numerous examples of work on disease management, but given the careless use of chemicals and the current devastation caused by the illnesses, it is imperative to establish a strategy that uses the fewest pesticides feasible without endangering losses in agricultural output (Howell 2003). The current investigation was conducted in light of the BLSB disease's rising importance. The study's objective was to evaluate different fungicides in a lab setting in order to choose the most effective one for actual application. The results of this study will help maize farmers choose the most effective control strategy.

MATERIALS AND METHODS

Isolation of fungus

Symptomatic plants with banded leaves and sheaths of blight were gathered and studied under a microscope. The diseased samples were then lacerated into small pieces (about 0.5 to 1.0 cm) and washed twice under running tap water. Surface sterilization was accomplished by dipping the pieces in a 1% sodium hypochlorite solution and then rinsing them with sterile distilled water three times in one minute intervals. Using blotting paper, the pieces were dried. Finally, sterile forceps were used to arrange the fragments aseptically on sterilized potato dextrose agar (PDA) Petri dishes. The inoculated Petri dishes were then

Table 1. List of the systemic and non-systemic fungicides.

Sl. No.	Trade name	Common name	Mode of action	Active ingredient (%) and formulation
1.	Dithane M-45	Mancozeb	Non-systemic	75% WP
2.	Ergon	Kresoxim methyl	Systemic	44.3% SC
3.	Dithane Z-78	Zineb	Contact and systemic	75% WP
4.	Quadris top fungicide	Azoxystrobin+ Difenoconazole	Systemic	18.2% w/w + 11.4% w/w SC
5.	Tilt	Propiconazole	Systemic	25% EC
6.	Elite	Tebuconazole	Systemic	25% EC
7.	Groza	Azoxystrobin+ Tebuconazole	Systemic	11% + 18.3% w/w SC

Table 2. *In vitro* efficacy of fungicides on growth of *R. solani*.

Sl. No.	Fungicide	Concen-tration (%)	Inhibi-tion (%)
1	Mancozeb 75% WP	0.10	61.37
		0.25	81.18
		0.50	88.43
		0.75	91.80
2	Zineb 75% WP	0.10	65.29
		0.25	71.96
		0.50	74.90
		0.75	81.57
3	Propiconazole 25% EC	0.10	100
		0.25	100
		0.50	100
		0.75	100
4	Kresoxim methyl 44.3% SC	0.10	88.63
		0.25	90.51
		0.50	90.82
		0.75	92.16
5	Azoxystrobin 18.2 w/w +Difenocona-zole11.4% w/w SC	0.10	92.90
		0.25	95.29
		0.50	97.25
		0.75	98.03
6	Tebuconazole 25% EC	0.10	100
		0.25	100
		0.50	100
		0.75	100
7	Azoxystrobin 11% + Tebuconazole 18.3% SC	0.10	92.90
		0.25	95.29
		0.50	97.25
		0.75	98.43
	Fungicide	Concen-tration	Fungicide× Concentra-tion
SEd±	0.38	0.29	0.77
CD (1%)		0.77	0.58 1.44

incubated for two days in a BOD incubator at 25±1° C to check for fungal growth.

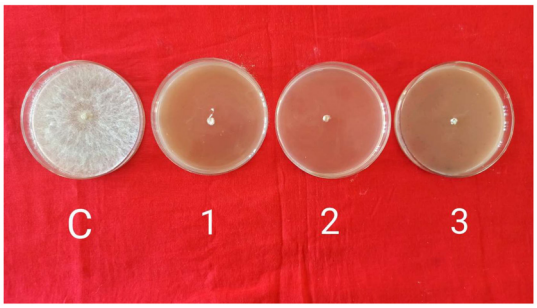

Plate 1c. *In vitro* efficacy of fungicides on growth of *R. solani*. C. Control, 1. Azoxystrobin+Difenoconazole (0.10%), 2. Azoxystrobin+Difenoconazole (0.25%), 3. Azoxystrobin+ Difenoconazole (0.50%).

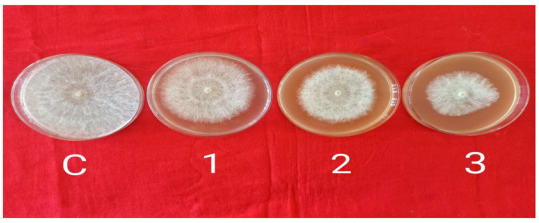

Plate 1d. *In vitro* efficacy of fungicides on growth of *R. solani*. C. Control, 1. Zineb (0.10%), 2. Zineb (0.25%), 3. Zineb (0.50%).

In-vitro efficacy of fungicides against banded leaf and sheath blight of maize

Seven fungicides namely Azoxystrobin 18.2 w/w + Difenoconazole 11.4% w/w SC, Mancozeb 75% WP, Kresoxim methyl 44.3% SC, Zineb 75% WP, Azoxystrobin 11% + Tebuconazole 18.3% SC, Propiconazole 25% EC and Tebuconazole 25% EC were studied in the laboratory for their effectiveness against *R. solani* with 0.1,0.25, 0.50 and 0.75% concentrations (Table 1). The "Food Poison Technique" was employed to understand the effect of the chemicals (fungicides) against *R. solani* growth. The radial growth of the test fungus was shown to be reduced by all fungicides utilized in this experiment. To conduct the assessment test, PDA medium was melted and cooled to a comfortable temperature and required dose of the chemicals (fungicides) were suspended. Under sterile circumstances, 20 ml of poisoned media were suspended in sterile Petri dishes and check was maintained without the use of any chemicals. A five-millimeter mycelial disc from a four-day-old colony culture was cut and kept in the center of poi-

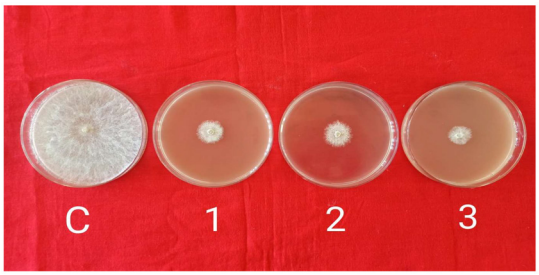

Plate 1e. *In vitro* efficacy of fungicides on growth of *R. solani*. C. Control, 1. Kresoxim methyl (0.10%), 2. Kresoxim methyl (0.25%), 3. Kresoxim methyl (0.75%).

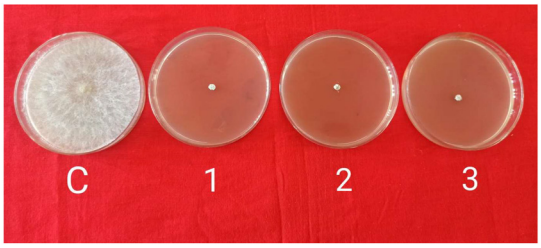

Plate 1f. *In vitro* efficacy of fungicides on growth of *R. solani*. C. Control, 1. Tebuconazole (0.10%), 2. Tebuconazole (0.25%), 3. Tebuconazole (0.50%).

soned medium Petri dishes. Then Petri dishes were incubated in BOD for three days at 25±1°C. For each concentration, three replications were maintained. When the fungus in the control plates reached maximal growth, the radial growth was measured. The average colony diameter was measured in two directions, and the percentage of inhibition was estimated using a formula (Bliss 1934).

Percent inhibition = (C-T)/C ×100

Where,

C= Linear growth of the fungus in control
T= Linear growth of the fungus in treatment

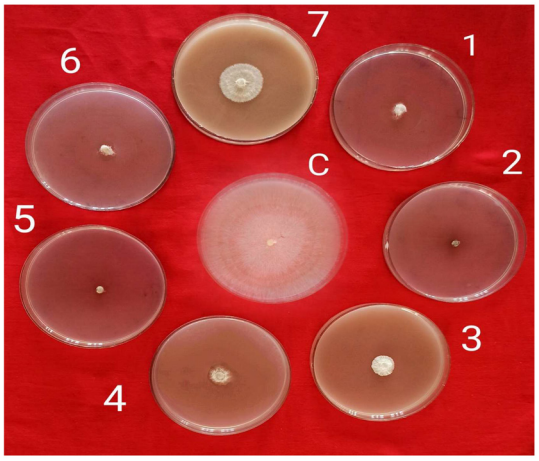

Plate 1g. *In vitro* efficacy of fungicides on growth of *R. solani*. C. Control, 1. Azoxystrobin+Difenoconazole (0.75%), 2. Propiconazole (0.75%), 3. Dithane M-45 (0.75%), 4. Kresoxim methyl (0.75%), 5. Tebuconazole (0.75%), 6. Azoxystrobin+Tebuconazole (0.75%), 7. Zineb (0.75%).

RESULTS AND DISCUSSION

Seven fungicides with 0.1%, 0.25%, 0.5% and 0.75% concentrations were tested against the test fungus of *R. solani* present in Table 2, Fig. 1 and Plate 1–1g. The results obtained showed significant difference among different treatments on incubation. Propiconazole and Tebuconazole had showed 100% of mycelial growth inhibition in all four concentrations followed by the concentrations of 0.1%, 0.25%, 0.5% and 0.75% of Azoxystrobin + Tebuconazole had showed 92.90, 95.29, 97.25 and 98.43% of mycelial growth inhibition respectively. Azoxystrobin + Difenoconazole had showed 92.90, 95.29, 97.25 and 98.03% of mycelial growth inhibition in the concentrations of 0.1%, 0.25%, 0.5% and 0.75% respectively. The concentrations of 0.1%, 0.25%, 0.5% and 0.75% of Kresoxim methyl had showed 88.63, 90.51, 90.82 and 92.16% of mycelial growth inhibition respectively. The concentrations of 0.1%, 0.25%, 0.5% and 0.75% of Mancozeb showed 61.37, 81.18, 88.43 and 91.80% of mycelial growth inhibition respectively. The concentrations of 0.1%, 0.25%, 0.5% and 0.75% of Zineb had showed, 65.29, 71.96, 74.90 and 81.57 % of mycelial colony growth inhibition respectively. The radial growth of the test fungus was shown to be reduced by all fungicides utilized in this experiment. The results were in harmony with results obtained in Propiconazole (0.1%) by Rajput 2013. Triazoles (Propiconazole, Difenoconazole and Hexaconazole) have the capacity to inhibit the formation of ergosterol, which changes the architecture of the cell membranes and renders the environment unfavorable for fungi. (Yoshiyuki *et al. (*2013). Strobilurins also referred to as QoIs (quinol oxidation inhibitors), include Azoxystrobin. By preventing electron transport at the quinol oxidation site (the QO site) in the cytochrome bc1 complex, they prohibit fungal mitochondria from generating ATP. As, Azoxystrobin moves both translaminarly and systemically (Bhuvaneswari and Krishnam 2012).

CONCLUSION

All the fungicides showed inhibitory effect against the radial growth of *R. solani*. Among seven different fungicides Propiconazole and Tebuconazole showed

100% inhibition against the pathogen in *in vitro* conditions.

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