



## Integrated disease management of wheat against Foliar Blight disease caused by *Bipolaris sorokiniana*

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### ABSTRACT

Foliar blight of wheat is probably the most serious diseases of wheat in the ME 5A mega environment characterized by high relative humidity. A number of pathogens viz. *Bipolaris sorokiniana*, *Alternaria triticina*, *Dreschlera gigantea*, *Alternaria alternata*, *Pyrenophora tritici-repentis* are associated with the disease. Considering the complexity of the disease an integrated disease management strategy incorporating non conventional chemicals, biocontrol agents and fungicides was attempted. Three isolates of *Trichoderma harzianum* and two isolates of *Pseudomonas fluorescens* with proven antagonism against some fungi were screened under in vitro condition against *Bipolaris sorokiniana* by dual culture method. Among them, *T.harzianum* isolate 2 was most effective in inhibiting the pathogen. Among different non-conventional chemicals viz. nickel chloride, cadmium chloride, sodium molybdate, cupric chloride and salicylic acid, plants treated with cupric chloride and salicylic acid substantially reduced diseased symptoms. Among thirteen fungicides tested against the pathogen, propiconazole was the most effective chemical. Finally, integrated disease management against the disease was formulated and seeds treated with carboxin followed by single foliar spray of propiconazole at panicle initiation stage with soil application of 120:60:60 Kg/ha NPK was suggested.

Key words: Wheat, foliar blight, Integrated disease management

### INTRODUCTION

Wheat the second important staple food of the world, is known to suffer from a large number of diseases. Foliar blight of wheat has been recognized as one of major disease constraint to wheat (*Triticum aestivum*) in the Gangetic plains of India particularly in rice-wheat system (Nagarajan and Kumar, 1998, Duveiller and Gillchrist 1994, Duveiller, 2004). *Helminthosporium* Leaf blight disease occurs as a complex of spot blotch (*Bipolaris sorokiniana*), leaf blight (*Alternaria triticina*) Zonate eye spot (*Dreschlera triticina*) and tan spot (*Pyrenophora tritici-repentis*). Among these pathogens, *B.sorokiniana* is the most devastating pathogen (Chowdhury *et al.*, 2008) Foliar blight takes a heavy toll by reduction of annual yields by 20% in

the warm, humid climates particularly in eastern India (Saari, 1998). Yield loss assessment conducted at Cooch Behar, WB 2003 showed 42% yield loss in highly susceptible variety in experimental plot (Anonymous, 2005). Considering the importance of the disease, an attempt was made to manage the disease through an integrated approach by combining biocontrol and economic use of chemicals.

#### MATERIAL AND METHODS :

**Evaluation of antagonists against pathogen (*in vitro*)** The antagonistic effects of three isolates of *Trichoderma harzianum* and two isolates of *Pseudomonas fluorescence*, collected from Department of Plant Pathology Uttarbangga Krishi Viswavidyalaya (UBKV) were tested against *Bipolaris sorokiniana* by standard dual culture method. The petridishes were incubated 28°C for 3 days. Inhibition of fungal growth was assayed by measuring the radial growth of the fungus to obtain the percent growth inhibition as compared to control.

**Management through non-conventional chemicals :** To manage the foliar blight of wheat five non-conventional chemicals viz. Nickel chloride, Salicylic acid Cadmium chloride, Sodium molybdate and Cupric chloride at a range of three concentrations against *Bipolaris* infection in three susceptible cultivars of wheat viz. Sonalika, HUW 234 and Raj 3765 were used to assess the disease following the methods of Chowdhury (2000).

#### **Evaluation of fungicides against foliar blight in field condition :**

A field experiment was conducted with 13 fungicides laid out in Randomized Block Design at the experimental farm of UBKV. The sowing was done in 2 sq m plot having spacing of 23 cm between rows. The test fungicides in the trial were copper oxychloride, tricyclazole, Diathane Z-78, Hexconazole, Propiconazole, Diathene M-45 (mancozeb), Polyram (metiram), Carbendazim, Ridomil MZ, Chlorothalonil, Zineb 78, Ipridione 50 and Tridemorph. Sowing was done in the first week of November. First prophylactic spray was administered when disease appeared in the 3<sup>rd</sup> week of December and repeated at 15 days intervals.

**Integrated disease management:** Integrated disease management practice was carried out to manage foliar blight of wheat. For this purpose wheat seeds were dried and treated with carboxin and subsequently sprayed with *Trichoderma harzianum*, econeem, propiconazole (tilt) and salicylic acid in various combinations. The detail treatments are as follows:

T<sub>1</sub>: N 120: P60:K40 Kg/ha (No Spray & Seed Treatment) Control

T<sub>2</sub>: Application of N 120: P 60: K 60 Kg/ha + Seed Treatment (Carboxin@0.25%)

T<sub>3</sub>: Seed Treatment (Carboxin@0.25%) + Spray of *Trichoderma harzianum*, Isolate 2 (@10<sup>4</sup> spores/ml)

T<sub>4</sub>: Seed Treatment (Carboxin @0.25%) + Spray (Econeem @2.0%)

T<sub>5</sub>: Seed Treatment (Carboxin @0.25%) + Spray (*Trichoderma harzianum*, Isolate 2 @10<sup>4</sup> spores/ml + Econeem @2.0%)

T<sub>6</sub>: Seed Treatment (Carboxin @0.25%) + Spray (Propiconazole @0.15%)

T<sub>7</sub>: Seed Treatment (Carboxin @0.25%) + Spray (Salicylic acid @)10<sup>3</sup>M)

T<sub>8</sub>: Spray (Propiconazole @0.15%)

The observations on seedling blight, disease appearance date, AUDPC and grain yield were recorded.

## RESULTS AND DISCUSSION :

### Effect of biocontrol agents:

All the isolates of antagonists in dual culture inhibited the mycelial growth of the pathogen, *Bipolaris sorokiniana*. Isolate 2 of *Trichoderma harzianum* inhibited maximum mycelial growth (65.17) followed by isolate 1 and 3 ( 56.95% and 46.75%) of *T. harzianum*. Isolates of *Pseudomonas fluorescens* were found least effective (Table1)

**Table 1: Antagonistic effect of different isolates of *Trichoderma harzianum* and *Pseudomonas fluorescens* on the growth of *Bipolaris sorokiniana***

Sl. No.	Antagonist	Percent inhibition(reduction) in mycelial growth
1	<i>Trichoderma harzianum</i> , Isolate 1	56.95 (48.99)
2	<i>Trichoderma harzianum</i> , Isolate 2	65.17(53.85)
3	<i>Trichoderma harzianum</i> , Isolate 3	46.65(43.48)
4	<i>Pseudomonous fluorescens</i> , Isolate 1	37.55(37.79)
5	<i>Pseudomonous fluorescens</i> , Isolate 2	36.85(37.39)
	SE m±	0.60
	CD at 1%	2.37

### Effect of non conventional chemicals:

Results ( table 2) show that all the concentrations of 5 non-conventional chemicals tested has positive effect on foliar blight of wheat but the best result was recorded with salicylic acid at  $10^{-3}$ M followed by nickel chloride and these are at per propioconazole indicating the effectiveness of such treatments.

Table 2: Effect of non-conventional chemicals on symptom expression of *Bipolaris sorokiniana* in different varieties wheat

Chemical	Conc.	Varieties					
		Sonalika		HUW 234		Raj 3765	
		Blight scale	Lesion length (mm)	Blight scale	Lesion length (mm)	Blight scale	Lesion length (mm)
1. Nickel Chloride	10 <sup>-3</sup> M	5	4.6	4	4.1	5	4.7
	10 <sup>-4</sup> M	7	9.2	6	7.4	8	9.4
	10 <sup>-5</sup> M	7	9.1	7	8.5	7	9.1
2.Salicyclic acid	10 <sup>-3</sup> M	3	3.4	3	2.4	4	3.8
	10 <sup>-4</sup> M	5	4.1	4	4.1	5	6.1
	10 <sup>-5</sup> M	5	6.2	6	6.8	6	6.0
3.Cadmium chloride	10 <sup>-3</sup> M	5	4.6	5	4.6	6	5.9
	10 <sup>-4</sup> M	7	7.9	7	7.9	7	6.9
	10 <sup>-5</sup> M	7	8.2	7	9.1	6	6.5
4. Sodium molybdate	10 <sup>-3</sup> M	5	4.1	4	3.8	5	4.7
	10 <sup>-4</sup> M	7	6.2	6	7.8	7	9.1
	10 <sup>-5</sup> M	7	6.9	7	9.4	7	8.9
5.Cupric chloride	10 <sup>-3</sup> M	3	3.5	3	2.5	4	3.9
	10 <sup>-4</sup> M	5	5.7	5	4.9	6	5.4
	10 <sup>-5</sup> M	6	6.1	5	6.1	6	7.2
6.Propiconazole	0.1%	3	2.8	3	2.9	4	3.1
7.Control		9	9.7	9	9.5	9	10.1
	Chemical × Variety						
SEM±	0.063						
C.D. at 5%	0.18						

### Effect of fungicides on foliar blight:

The effect of thirteen fungicides on foliar blight of wheat presented in table 3 reveal that the disease severity is minimum (AUDPC: 123) with propiconazole spray followed by tricyclazole (AUDPC: 185), DiathaneZ-78 and Hexaconazole (AUDPC: 216) Ridomil MZ against (AUDPC: 604) in control. The fungicides Carbendazim, polyramand copper oxychloride had moderate effect on disease incidence. The other fungicides either had no or minimum effect on disease severity. The fungicidal spray had a stimulatory effect on grain yield and 1000 grain weight. Maximum grain (33.35q/ha) and 1000 grain weight (42.27g) were recorded in propiconazole treatment followed by Hexaconazole (31.00 q/ha and 41.1g), DiathaneM-45, DiathaneZ-78 as compared to control (23.60 q/ha and 39.2g).

Table 3 : Disease Severity and yield components in different fungicides treatments on cv. Sonalika

Treatment	Doss(%)	Foliar Blight(DD)		Plot yield/2 sq m.	1000 grains weight(g)	Yield(q/ ha)
		AUDPC 1	AUDPC 2			
Copper oxychloride	0.40	265.4	450.6	0.495	39.1	24.5
DiathaneZ-78	0.25	129.6	216.0	0.571	41.5	28.55
DiathaneM-45	0.25	160.4	296.2	0.573	41.1	28.65
Zineb-75	0.25	203.2	381.3	0.492	38.1	24.6
Hexaconazole	0.10	129.6	216.0	0.620	41.1	31.00
Propiconazole	0.15	49.3	123.4	0.667	42.27	33.35
Tricyclazole	0.10	80.2	185.1	0.552	40.2	27.60
Polyram	0.30	209.8	456.7	0.529	39.5	26.45
Carbendazim	0.15	191.3	370.3	0.519	40.2	25.95
Ridomil MZ	0.15	111.1	222.2	0.528	40.5	26.40
Chlorothalonil	0.25	185.2	325.0	0.501	38.2	25.05
Ipridione 50	0.25	219.9	516.3	0.478	38.4	23.90
Tridemorph	0.10	235.5	546.6	0.4730.472	39.2	23.65
Unsprayed		271.6	604.9	0.020	0.078	23.60
SE m±		24.05	49.96	0.059	NS	1.021
CD at 5%		72.4	148.9			2.91

### Integrated management:

Results (Table 4) of integration of biocontrol agents with chemicals to manage foliar blight of wheat presented in table 4 show that least disease development (AUDPC 230) was noticed in treatment with three spray of propiconazole, followed by seed treatment with carboxin and single spray with propiconazole at panicle initiation stage (AUDPC 265) in soil amended with NPK of 120:60:60 kg/ha. The seed treatment with carboxin followed by spray with salicylic acid also showed effective in reducing the disease symptoms. The spray *T. harzianum* and Econeem had moderate effect on disease incidence and grain yield. The highest grain yield (3.41t/ha) was recorded with carboxin as seed treatment with single spray with propiconazole.

### Influence of different treatments on leaf blight incidence and yield of cv. Sonalika

Sl. No.	Treatment	No. of plants	Seedling blight	Disease appearance date	AUDPC		Grain Yield(T/ha)
					Flowering after	14days flowering stage	
	N120:P60:K40 Kg/h (No S & ST) control	379	1	47	489	887	2.72
	N120:P60:K60 Kg/h+ Seed Treatment (Carboxin)	402	0	55	309	308	3.05
	Seed Treatment (Carboxin)+ Spray of <i>Trichoderma harzianum</i>	412	0	55	244	530	3.21
	Seed Treatment (Carboxin)+ Spray (Econeem)	395	0	59	280	591	3.25
	Seed Treatment (Carboxin)+ Spray ( <i>Trichoderma harzianum</i> + Econeem)	401	0	61	289	545	3.20
	Seed Treatment (Carboxin)+ Spray (tilt)	393	0	63	69	265	3.41
	Seed Treatment (Carboxin)+ Spray (Salicylic acid)	389	0	65	325		3.35
	Spray (Tilt) SE m± CD at 5%	382 9.06 26.09	0	65	230 11.75 33.84		3.40 0.18 0.52

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