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Comparative evaluations of foliar spray with different dose of fungicides and biocides against spot blotch of wheat caused by *Bipolaris sorokiniana*

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Abstract
The different concentrations of fungicide *i.e*. Raxil 060FS, Trifloxystrobin 500SC, Tebuconazole 2% DS, Trifloxystrobin + Tebuconazole 080 FS, Nativo (Trifloxystrobin 25% + Tebuconazole 50%) 75 WG, Flint (Trifloxystrobin) 75 WG, Vitavax, *Neem excel* and Bioagent (*T. harzianum*) have been revealed that the minimum disease intensity was recorded in foliar spray with Trifloxystrobin + Tebuconazole080 FS @ 0.12%, 0.25% showing, 60.33% disease severity which was followed by foliar spray with Nativo (Trifloxystrobin + Tebuconazole 75 WG) 75 WG (60.53%) and Tebuconazole 2% DS (61.88%). On foliar spray in field condition neem excel was apparently showing superior to minimize disease severity than control but inferior to others. Foliar spray with trifloxystrobin (flint) 50WG @0.25% was next to superiority in checking foliar disease followed by Vitavax @ 0.25%.The result showed that trifloxystrobin + Tebuconazole 080 FS is the best fungicides among all chemical for management of spot blotch disease by Nativo 75 WG.

Keywords: spot blotch, fungicide, foliar spray, yield, wheat and *Bipolaris sorokiniana*

Introduction
Wheat (*Triticum aestivum* L.) is important cereal food crop grown in India during *Rabi* season. It contributes major part to the food security system and provides more than 50 per cent calories to the people those are mostly dependent on wheat as a staple food (Sahai, 2009) [8]. India occupies the second place in term of production and area among the major wheat growing countries of the world after china. However, in the background of increasing population, the demand for wheat is increasing day by day, but production and productivity in India are remained stringent for last few decades which solely contributed due to some biotic and abiotic factors like, insect, diseases, weeds and nutritional deficiencies. Among the disease especially spot blotch caused by *Bipolaris sorokiniana* is the most devastating in India and several other countries. The disease adversely affect wheat yield particularly under late sown condition due to the practice of most popular rice – wheat cropping system. The pathogen affects all areal part of the plant and causes considerable losses in India. Nema and Joshi (1971) [6] reported that 3-20% loss under different agro-climatic condition. The management of disease can be done through cultural, chemical, biological and use of resistant variety. The cultivation of wheat with resistant verity is cheap and best method but resistant variety against the disease is scant. Cultural practices (sanitation, crop rotation and summer ploughing) prevented the development to spot blotch disease in the field condition but the method fail where it has already appeared in the standing crop. Biological control is easy and cheap method but bio agent are unfit for control of phyllosphere disease like spot blotch in standing crop (Singh, 2003) [11]. Hence, application of chemical is one of the most effective and widely recommended methods of disease management. But continuous uses of same chemical are not advisable which encorourage development of resistant strain of among the pathogen. Therefore, there is need to change of chemical at a frequent interval of time. Hence, many new fungicides with biocides have been under taken to evaluate in the present investigation.

Materials and Methods

Isolation of *Bipolaris sorokiniana*

Naturally infected wheat leaf was collected from Student's Experimental Research Farm of Chandra Shekhar Azad University Agriculture and Technology, Kanpur. The disease portion of leaves were cut into 2 mm. long pieces by sterilized blade and washed 3-4 times with sterilized water in order to remove the dust and other contaminant. The pieces were dipped in 0.1% $HgCl_2$ for about 20-30 second then washed thoroughly in 3-4 times with distilled water to remove the remaining trace of $HgCl_2$. The pieces were then transferred with the help of sterilized needle in sterilized Petri-dishes containing 2% PDA medium previously poured aseptically and were incubated in BOD at 25 ±1 ^{0}C. The pure culture was established by hyphal tip isolation method (Rangaswami, 2008) [7]. Fungus was identified by comprising its morphological character with old identified culture of *Bipolaris sorokiniana* and authentic description as given by Ellis (1971) [3]. The stock culture of *B. sorokiniana* were revived after every fort night and maintained through on PDA in sealed culture tubes at 5^{0}C in refrigerator.

Collection of fungicide and biocide

The fungicides like Raxil 060FS, Trifloxystrobin 500SC, Tebuconazole 2% DS, Trifloxystrobin + Tebuconazole 080 FS, Nativo (Trifloxystrobin 25% + Tebuconazole 50%) 75 WG, Flint (Trifloxystrobin) 75 WG and Vitavax and Neem based commercial formulation *Neem excel* was also collected from local market at Rawatpur, Kanpur. Bioagent (*T. viride*) was collected from Department of Plant Pathology C. S. Azad University of Agriculture and Technology, Kanpur for the present investigation.

Preparation of bio-agent solution

Seven days old culture was used to prepare homogenous suspension of bio agent. The suspension containing conidia and mycelium bit was churned in a warning blender and strained with cheese cloth. The suspension containing approximately 10^3-10^5 conidia was used for this study.

Solution preparation of fungicides

Different fungicides *viz.* Raxil 060FS, Trifloxystrobin 500SC, Tebuconazole 2% DS, Trifloxystrobin +Tebuconazole 080 FS, Nativo (Trifloxystrobin 25% + Tebuconazole 50%) 75 WG, Flint (Trifloxystrobin) 75 WG and Vitavax and *Neem excel* of were tested in laboratory to find out the effect spore germination & mycelial growth of pathogen. Exactly 0.03 mg, 0.06 mg, 0.12 mg and 0.25 mg of six fungicides, were weighted and dissolved in water separately in 100 ml of water to prepare 0.03, 0.06, 0.12 and, 0.25% concentrations of fungicides.

Evaluation on the effect of foliar spray of fungicides and biocides against spot blotch pathogen disease development

A pot culture experiment was conducted at glass house complex of department of plant pathology, CSAUA&T Kanpur, Wheat seed of variety K9107 was soaked overnight on water at room temperature and sown in 30 cm earthen pot which was previously filled sterilized soil.

At three and four leaf stage seedling were inoculated with spore suspension of *Bipolaris sorokiniana.* After inoculation plants were cover with polythene bags for 48 hrs to give suitable humidity for development of disease. Then plants were sprayed with different fungicides biocides separately. Then the entire seedling was kept in the glass house bench. Three replications were kept for each treatment and in one uses plant without any spray serve as control. The final observation on disease severity was taken after 10 days

Field trial

The field trail were conducted at E.B.R. Section, Nawabganj Research Farm, C.S. Azad University of Agriculture and Technology, Kanpur to evaluate the efficacy of seven fungicides and two biocides against foliar diseases of wheat. The experiment was laid out in Randomized Block Design (RBD) with three replications using a variety K-9107 (Deva). The spray was done three times with two doses i.e. 0.12% and 0.25% at 45-50 days of sowing with ten days intervals. The time of sowing of variety K-9107 (Deva) was on 21st December 2009. The plot size was 2 x 2 m, recommended agronomical practices were followed. The first spray was done after initiation of disease and second and third spray after 10 days interval. Control plants were sprayed with water only.

Measurement of disease severity

For evaluation on the effect of foliar spray, with fungicides and biocides against spot blotch and alternaria blight on development of disease, experiment was also laid out in field condition on same variety of wheat. The disease severity rated as per nine point scale (0-9) (Cook & Timian 1962) [1] and total disease leaf area was calculated from ten randomly selected leaves of diseased plant separately. Similarly disease area of total leaf area was calculated. The disease severity of individual plant was calculated by the following formula (Chenvlu and Singh, 1964) [1].

$$\text{Percent Disease Index (PDI)} = \sum \frac{\text{Class rating X class frequency}}{\text{Total no. of leaves X maximum class rating}} \times 100$$

Grain Yield and Phytotoxicity Effect

The grain from ears was separated by manual method. The cleared grain of each net plot was weight and finally converted in q/ha. The phytotoxicity effect also evaluated from ten randomly selected leaves of diseased plant separately.

Results and Discussion

Effect of foliar spray, with fungicides and biocides on development of disease (glass house condition)

Foliar spray of fungicides and biocides on the wheat plants revealed that the drastatic decline in lesion formation of *B. sorokiniana* under glass house condition (Table 1).

Table 1: Effect of fungicides and biocides against foliar blight (*B. sorokiniana)* of wheat under glasshouse condition.

S. No.	Seed Treatment	Average No. of spot per leaf	Total Diseased affected area (cm^2)	Disease Seventy
1.	Raxil 060 FS	5	15.25	62.02
2.	Trifloxystrobin 500 SC	7	17.50	63.04
3.	Trifloxystrobin+ Tebuconazole 080 FS	4	12.75	60.33
4.	Vitavax	7	18.75	63.32
5.	Flint 50 WG (Trifloxystrobin)	6	17.25	63.03

6.	Nativo(Trifloxystrobin 25% + Tebuconazole 50%) 75 WG	3	12.50	60.53
7.	Neem excel	8	19.00	65.61
8.	Tebuconazole 2% DS	6	15.75	61.88
9.	Control	12	25	68.68
10.	Healthy	0	0	0
	C. D. at 5%			1.58

The minimum disease intensity was recorded in foliar spray with Trifloxystrobin + Tebuconazole 080 FS showing, 60.33% disease severity which was followed by foliar spray with Nativo (Trifloxystrobin + Tebuconazole 75 WG) 75 WG (60.53%) and Tebuconazole 2% DS (61.88%). Singh and Sharma (1973) [10] reported that systemic activity of Brestanol, Brestan and Duster on rice seedling and suggested possibility of control by these fungicides. Malik *et al*. (2008) [4, 5] reported that foliar spray of triazole fungicides (propaconazole) were found quite effective in controlling the disease causing *Bipolaris sorokiniana*.

Effect of foliar spray with fungicide and biocide against spot blotch of wheat (In field condition).

Table 2: Effect of foliar spray with fungicides and biocides against foliar diseases of wheat in field condition on dose 0.12%.

S. No.	Seed treatment	Dose (%)	Disease severity of spot blotch	Disease severity of *Alternaria* blight
1.	Raxil 060 FS	0.12	62.02	42.01
2.	Trifloxystrobin 500 SC	0.12	63.43	43.60
3.	Trifloxystrobin + Tebuconazole 080 FS	0.12	60.33	40.41
4.	Vitavax	0.12	63.62	42.80
5.	Flint (Trifloxystrobin) 50 WG	0.12	63.03	43.08
6.	Nativo (Trifloxystrobin 25% + Tebuconazole 50%) 75 WG	0.12	60.52	40.60
7.	Neem excel	0.12	65.61	45.80
8.	Tebuconazole 2% DS	0.12	61.88	41.66
9.	Control	0.12	68.68	48.39
	C.D. at 5%		2.42	5.27

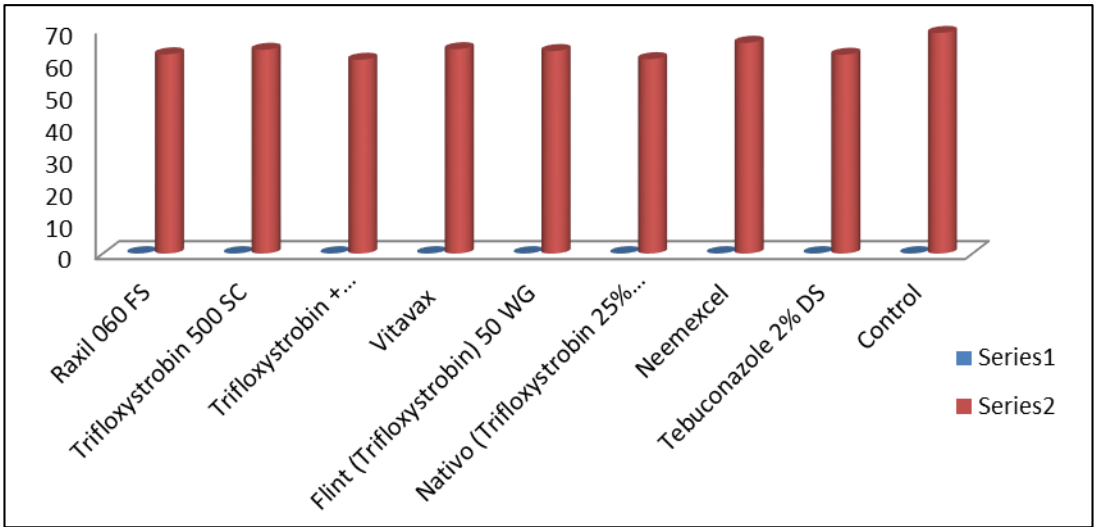

Fig 1: Effect of foliar spray with fungicides and biocides against foliar diseases of wheat in field condition on dose 0.12%.

Table 3: Effect of foliar spray with fungicides and biocides against foliar diseases of wheat in field condition (on the dose of 0.25%)

S. No.	Seed treatment	Dose (%)	Disease severity of spot blotch	Disease severity of *Alternaria* blight
1.	Raxil 060 FS	0.25	62.02	42.01
2.	Trifloxystrobin 500 SC	0.25	63.34	43.60
3.	Trifloxystrobin + Tebuconazole 080 FS	0.25	60.33	40.41
4.	Vitavax	0.25	63.62	42.80
5.	Flint (Trifloxystrobin) 50 WG	0.25	63.03	43.02
6.	Nativo (Trifloxystrobin 25% + Tebuconazole 50%) 75 WG	0.25	60.52	40.60
7.	Neem excel	0.25	65.61	45.80
8.	Tebuconazole 2% DS	0.25	61.88	41.66
9.	Control		68.68	48.39
	C.D. at 5%		3.22	3.04

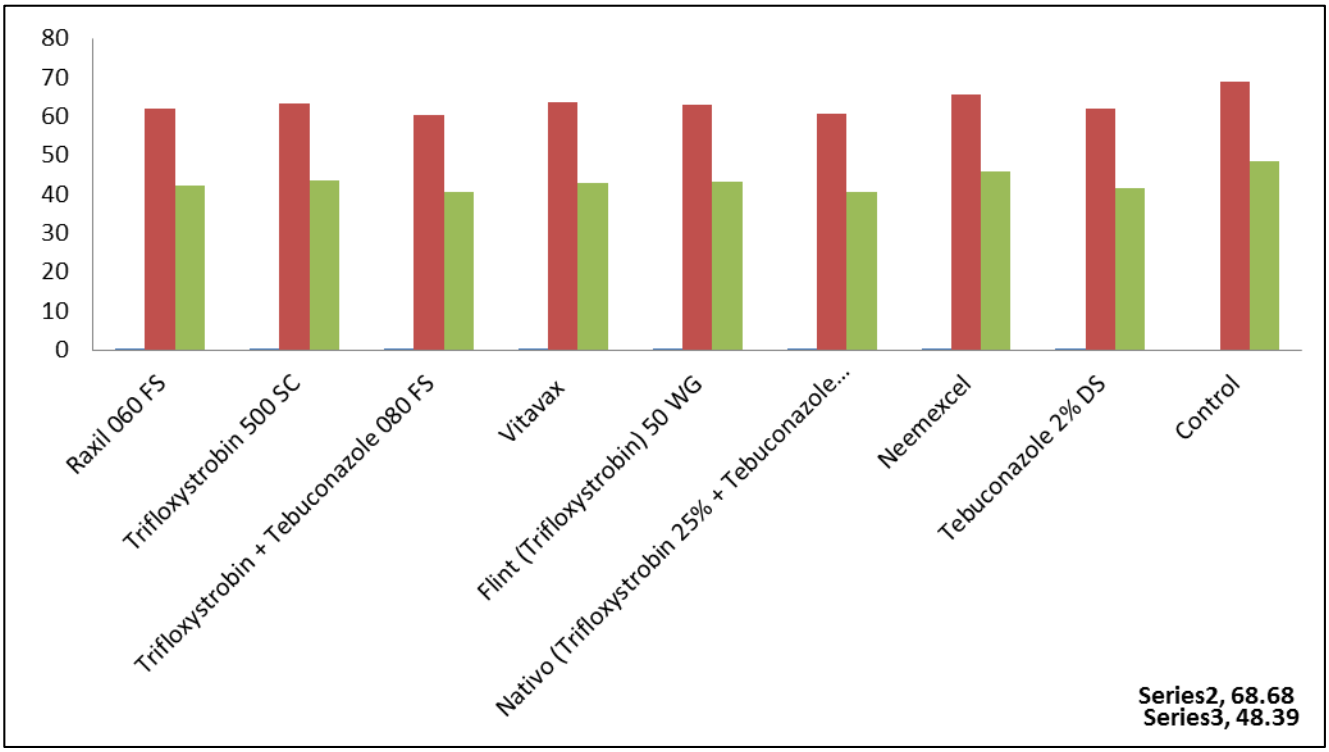

Fig 2: Effect of foliar spray with fungicides and biocides against foliar diseases of wheat in field condition (on the dose of 0.25%)

Table 4: Effect of foliar spray with fungicides and biocides against foliar diseases of wheat in field condition

S. No.	Seed treatment	Dose (%)	Disease severity of spot blotch	Disease severity of powdery mildew	Disease severity of *Alternaria* blight	Disease severity of rust	Disease severity of loose smut	Disease severity of flag smut
1.	Raxil 060 FS	0.12	++++	+	+++	+	+	+
2.	Trifloxystrobin 500 SC	0.12	++++	+	+++	+	+	+
3.	Trifloxystrobin + Tebuconazole 080 FS	0.12	++++	+	+++	+	+	+
4.	Vitavax	0.12	++++	+	+++	+	+	+
5.	Flint (Trifloxystrobin)50 WG	0.12	++++	+	+++	+	+	+
6.	Nativo (Trifloxystribin 25% + Tebuconazole 50%) 75 WG	0.12	++++	+	+++	+	+	+
7.	Neem excel	0.12	++++	+	+++	+	+	+
8.	Tebuconazole 2% DS	0.12	++++	+	+++	+	+	+
9.	Control	0.12	++++	+	+++	+	+	+
	C.D. at 5%		2.68					

Table 5: Effect of fungicides and biocides against foliar diseases of wheat in field condition

S.No.	Seed treatment	Dose (%)	Disease severity of spot blotch	Disease severity of powdery mildew	Disease severity of *Alternaria* blight	Disease severity of rust	Disease severity of loose smut	Disease severity of flag smut
1	Rexil 060 FS	0.25	+++	+	++	+	+	+
2	Trifloxystrobin 500 SC	0.25	+++	+	++	+	+	+
3	Trifloxystrobin+ Tebuconazole 080 FS	0.25	+++	+	++	+	+	+
4	Vitavax	0.25	+++	+	++	+	+	+
5	Trifloxystrobin 50 WG	0.25	+++	+	++	+	+	+
6	Trifloxystrobin + Tebuconazole 75 WG	0.25	+++	+	++	+	+	+
7	Neem excel	0.25	+++	+	++	+	+	+
8	Tebuconazole 2% DS	0.25	+++	+	++	+	+	+
9	Control		+++	+	++	+	+	+
	C .D. at 5%		2.32					

Where= 4 + = High, 3 + = Medium, 2 + = slightly low, + = Neglable

Table 6: Effects of fungicides and biocides on yield component and phytotoxicity effect.

S. No.	Treatments	Yield q / ha	Over Increased (%)	Phytotoxicity effect
1.	Raxil 060 FS	10.33	79.96	-
2.	Trifloxystrobin 500 SC	10.80	87.82	-
3.	Trifloxystrobin + Tebuconazole 080 FS	10.83	88.34	-
4.	Vitavax	10.20	77.39	-
5.	Flint (Trifloxystrobin) 50 WG	11.00	91.30	-
6.	Nativo (Trifloxystrobin 25% + Tebuconazole 50%) 75 WG	10.10	75.65	-
7.	*Trichoderma viride*	11.25	95.65	-
8.	Neem excel	11.10	93.04	-
9.	Tebuconazole 2% DS	10.00	73.91	-
10.	Control	5.75		
C.D. @ 5%			2.79	

Where, (-) it indicates no phytotoxicity effect.

On foliar spray with neem product neem excel was apparently showing superior to minimize disease severity than control but inferior to others The minimum disease intensity was recorded in foliar spray with Trifloxystrobin + Tebuconazole 080 FS @ 0.12%, 0.25%, showing 60.33% disease severity which was followed by foliar spray with Nativo (Trifloxystrobin + Tebuconazole 75 WG) 75 WG (60.52%) and Tebuconazole 2% DS (61.88%). Foliar spray with trifloxystrobin (flint) 50WG @0.25% was next to superiority in checking foliar disease followed by Vitavax @ 0.25%.The result showed that trifloxystrobin + Tebuconozole 080 FS is the best fungicides among all chemical for management of spot blotch disease by Nativo 75 WG. In combine evaluation other wheat diseases *viz*. powdery mildew, alternaria blight, rust, loose smut and flag smut, the best result were found with foliar spray of Trifloxystrobin + Tebuconazole 080 FS followed by Nativo (Trifloxystrobin + Tebuconazole 75 WG) 75 WG @ 0.12%, 0.25%, and Tebuconazole 2% DS. The yield evaluation @q/ha, out of 10 treatment maximum yield were found in *Trichoderma viride* (11.25q/ha) followed by Neemexcel (11.10 q/ha) and Trifloxystrobin+ Tebuconazole 080 FS (10.83 q/ha). No any phytotoxicity effect was found above uses fungicides. Malik *et al.* (2008) [4, 5] evaluated that leaf extract of neem moderately inhibited the spore germination and increased grain yield and the fungicidal (Triazole) sprays increased the yield and 1000 grain weight significantly over control. Singh *et al*. (2009) [9] recorded that three spray of Triazole fungicides (propaconazole (Tilt) 25 EC @ 0.75 liter per hectare) at maximum tillering, boot leaf and soft dough stage is the most effective, resulted in lowering disease severity, higher yield and maximum net return.

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