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Short Research Article

Effect of Chemicals and Bio-agent on Spot Blotch Disease of Wheat (*Triticum aestivum* L.)

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Abstract

Wheat (*Triticum aestivum* L.) crop in eastern India, suffers with many fungal diseases, namely, Spot blotch (Bipolaris sorokiniana), Alternaria leaf blotch (*Alternaria triticina*), Curvularia leaf spot (Curvularia lunata), covered smut (*Ustilago hordei*) and loose smut (Ustilago segetum tritici). Out of these fungal diseases, spot blotch caused by Bipolaris sorokiniana is most important and in badly affected field, the entire plant is blighted. Under favourable conditions the losses may be as high as 20−22%. Studies were conducted at main experimental station of N.D. University of Agriculture and technology, Kumarganj, Faizabad during *rabi* 2013−2015. Effect of seed treatment and foliar spray with fungicides and *T. viride* on disease intensity of spot blotch and yield contributing characters like ear length, number of grains/ear, thousand grain weight, yield and avoidable yield losses were studied. Results showed that the seed treatment with vitavax power @ 3 g kg^{-1} of seed followed by two spray of propiconazole @ 0.1% at the time of disease initiation on $flag^{-1}$ leaf and at soft dough stage were best and per cent disease intensity (39.03%) was minimum. Maximum ear length (8.22 cm), no. of grains ear^{-1} (56), thousand grains weight (51.74 g), yield (42.81 q ha^{-1}) and avoidable yield loss (29.49) were also highest in this treatment as compared to other treatments. The maximum benefit cost ratio (7.55) was found in seed treatment with *T. viride* because the cost of treatment was very low.

1. Introduction

Wheat (*Triticum aestivum* L.) is the most important cereal crop after rice in India and is well recognized as a world's major cereal crops and staple food of many regions, grown under both irrigated and rain-fed conditions. It belongs to family Poaceae or Graminae (Yadawad et al., 2015). The world's population is increasing by one billion in every 11 years and at the present rate, it is expected to be 8.5 billion by the year 2025. The demand for wheat will grow faster than any other major crop as it is estimated that around 1,050 mt. of wheat will be required globally for ever growing population by 2020 (Kronstad, 1998), while Indian demand will be between 105 to 109 mt (Shoran et al., 2005). To fulfill the demand of wheat for rapidly increasing population, emphasis should be given to minimize the crop losses due to several diseases, insect pests and terminal heat at the time of anthesis. Grain yield reductions due to spot blotch are variable but are of great significance in warmer areas of South Asia (Saari, 1998, Sharma and Duveiller, 2004). Wheat crop suffers with many fungal diseases such as spot blotch, alternaria leaf blotch, stripe disease, net blotch, curvularia leaf spot, covered smut and loose smut etc., in eastern part of India. Out of these fungal diseases spot blotch caused by Bipolaris sorokiniana is most important. The average yield losses due to spot blotch in India were reported to be 17% (Saari, 1998). Many fungicides were tested by different workers for the management of this disease but information on management of spot blotch disease through use of bio agents are meagre.

2. Materials and Methods

A susceptible wheat variety (Raj, 1415) was sown in randomized block design with 8 treatments and 4 replications during 2014–15 and 2015–16 at MES, Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad. Seed @ 100 kg ha^{-1} was used. Seeds were treated with vitavax power @ 3 g kg^{-1} seed or with *Trichoderma viride* @ 4 g kg^{-1} seed. These treated seeds were sown in 2×2 m^2 plot and sprayed with propiconazole @ 0.1% or T. viride @ 4 g l^{-1} of water. Only water spray worked as control. Spraying was initiated after first appearance of disease. The spraying solution was prepared in required quantity of water for each treatment.

Disease severity was recorded before spraying and 10 days after each spraying. Observations were taken on all the leaves of 10 randomly selected plants from each treatment in each replication. The percent disease intensity (PDI) was calculated using the formula:

$$PDI=\frac{\text{Sum of total numerical ratings}}{\text{Total number of leaves examined}\times \text{higest disease grade}}\times 100$$

$$PDC=\frac{\text{PDI in control-PDI in treatment}}{\text{PDI in control}}\times 100$$

Avoidable yield losses were calculated by the formula-

$$AYL=\frac{YP-YU}{YP}\times 100$$

Where,

YP = Yield under protected conditions

YU = Yield under unprotected conditions

Benefit cost ratio was also calculated by using formula-

$$\text{Benefit cost ratio}=\frac{\text{net return (₹ ha}^{-1})}{\text{Total cost (₹ ha}^{-1})}$$

Two yeas data were subjected to statistical analysis after taking mean of replications. ANOVA was performed for all the data using the statistical procedure and calculations were made after applying the test of significance for the treatment means. The data taken into percentage were first transformed into angular value and then analyzed for test of significance.

3. Results and Discussion

Data presented in Table 1 revealed that all the treatments were significantly superior to check. Average of two years data showed that in control plots PDI was 40% which was significantly higher than the seed treated with vitavax power (T_1) or *T. viride* (T_2) and percent disease control was in range of 29.5–39.6. The fungus is seed and soil borne therefore, seed treatment helped in management of primary infection and gave better germination. After 10 days of first spraying, observations were recorded and it showed that seed treatment with vitavax power and one spray of 0.1% propiconazole is better than other treatments and PDC was 30.12. After second spray of 0.1% propiconazole or *T. viride*, significantly higher control was observed in treatment T_5 (vitavax seed treatment+2 spray of propiconazole) followed by T_6 (seed treatment with *T. viride*+2 spray of propiconazole) and T_3. Use of bio agent *T. viride* in seed treatment and spraying without any fungicides resulted in 39.1% disease control. In unsprayed plot (control) PDI was 80.37. PDC was maximum in T_5 (51.43) followed by T_6 (50.15). It was observed that due to frequent rain fall during 2015−16 disease pressure was more in comparison to 2014–15 crop season.

Effect of seed treatment and foliar spray with fungicides and *T. viride* on yield contributing characters like ear length, no. of grains/ear, TGW, yield and avoidable yield losses were also studied. A perusal of data presented in Table 2 showed that ear length was maximum (8.23 cm) in treatment T_5 followed by T_6, T_3 and T_4 respectively. Maximum number of grains, Thousand Grain Weight (TGW) and grain yield were also found in treatment T_5 follwowed by T_6, T_3, T_4. Avoidable yield losses were maximum in treatment T_5 followed by T_6 and T_3. Minimum avoidable yield loss was found with T_2 (seed treatment with *T. viride*).

Results presented in Table 3 showed that maximum benefit cost ratio (7.55) was found in treatment T_2 (seed treatment with *T. viride*) because the cost of treatment was very low so benefit cost ratio was more, followed by treatments T_1 (5.11), T_3 (3.56) and T_4 (3.38). Minimum benefit cost ratio was found in treatment T_7.

Similar observations were recorded by other workers. Singh and (Singh, 2007) reported that Propiconazole 25 EC applied @ 0.750 l ha^{-1} at booting and soft dough stages proved most economical when disease intensity was higher (79.77%).

Table 1: Effect Chemicals and bio-agent treatment on percent disease intensity (pooled data)

Treatments	PDI*			PDC*		
	Before spray	After first spray	PDI after second spray	Before spray	First spray	Second spray
T_1 seed treatment with vitavax power @ 3 g kg^{-1}	24.15 (29.38)	38.03 (38.06)	56.73 (48.88)	39.62	25. 37	29.41
T_2 seed treatment with *T. viride* @ 4 g kg^{-1}	27.38 (31.52)	39.78 (39.09)	57.67 (49.41)	31.55	21.93	28.24
T_1+one spray of propiconazole @ 0.1%	25.09 (30.03)	35.61 (36.63)	43.04 (40.99)	37.50	30.12	46.44
T_2+one spray of propiconazole @ 0.1%	28.49 (32.25)	36.65 (37.24)	46.27 (42.85)	28.77	28.08	42.44
T_1+two spray of propiconazole @ 0.1%	25.09 (30.03)	35.02 (36.28)	39.03 (38.65)	37.50	31. 31	51.43
T_2+two spray of propiconazole @ 0.1%	28.19 (32.06)	36.00 (36.86)	40.06 (39.26)	29.52	29. 35	50.15
T_2+two spray of *T. viride*	27.05 (31.32)	38.52 (38.33)	48.91 (44.37)	32.50	24.41	39.14
Control	40.00 (39.22)	50.96 (45.54)	80.37 (63.71)			
CD (p=0.05)	3.38	4.08	4.50			

Table 2: Effect of Chemicals & bio-agent treatment on yield contributing characters (pooled data)

Sl. No.	Treatments	PDI after second spray 10/03/2016	PDI after second spray 10/03/2016	No. of grains ear^{-1}	Thousand grain weight (g)	Yield (q ha^{-1})	Avoid-able yield loss (%)
T_1	Seed treatment with vitavax power @ 3 g kg^{-1}	56.73 (48.88)	7.31	49	46.08	36.50	10.27
T_2	Seed treatment with *T. viride* @ 4 g kg^{-1}	57.67 (49.41)	7.15	48	45.63	35.88	8.72
T_3	Seed treatment with vitavax power+one spray of propiconazole @ 0.1% l^{-1}	43.04 (40.99)	8.10	54	50.25	41.59	21.25
T_4	Seed treatment with *T. viride*+one spray of propiconazole @ 0.1% l^{-1}	46.27 (42.85)	8.00	51	48.05	39.90	17.91
T_5	Seed treatment with vitavax power+ two spray of propiconazole @ 0.1% l^{-1}	39.03 (38.65)	8.23	56	51.74	42.81	23.49
T_6	Seed treatment with *T. viride*+two spray of propiconazole @ 0.1% l^{-1}	40.06 (39.26)	8.12	55	51.05	42.29	22.55
T_7	Seed treatment with *T. viride*+two spray of *T.viride* @ 4 g l^{-1}	48.91(44.37)	7.35	50	46.33	37.28	12.15
T_8	Control	80.37 (63.71)	6.33	45	43.30	32.75	-
SEm±		1.53	0.34	1.58	1.36	1.07	
CD (p=0.05)		4.50	1.01	4.66	3.99	3.16	

Table 3: Benefit-cost ratio of treatment

Sl. No.	Chemicals & bio-agent used			Charge		Total cost (₹)	Yield (q ha^{-1})	Increase yield over control (q ha^{-1})	In-come (₹ ha^{-1})	B:C ratio
	Treatments	Amount kg ha^{-1} or l ha^{-1}	Cost (₹)	Sprayer (₹)	Labour (₹)					
T_1	Seed treatment with vitavax power @ 3 g kg^{-1}	0.3 kg	450	-	284	734	36.50	3.75	3750	5.10
T_2	Seed treatment with *T. viride* @ 4 g kg^{-1}	0.4 kg	80	-	284	364	35.50	2.75	2750	7.55
T_3	Seed treatment with vitavax power+one spray of propiconazole @ 0.1% l^{-1}	0.3 kg+1.0 lit.	1710	60	710	2480	41.59	8.84	8840	3.56
T_4	Seed treatment with *T. viride*+one spray of propiconazole @ 0.1% l^{-1}	0.4 kg+1.0 lit.	1340	60	710	2110	39.90	7.15	7150	3.38
T_5	Seed treatment with vitavax power+two spray of propiconazole @ 0.1% l^{-1}	0.3 kg+2.0 lit.	2970	120	1136	4226	42.81	10.06	10060	2.38
T_6	Seed treatment with *T. viride*+two spray of propiconazole @ 0.1% l^{-1}	0.4 kg+2.0 lit.	2600	120	1136	3856	42.29	9.54	9540	2.47
T_7	Seed treatment with *T. viride*+two spray of *T.viride* @ 4 g l^{-1}	4.40 kg	880	120	1136	2136	37.28	4.53	4530	2.12
T_8	Control	-	-	-	-	-	32.75	-	-	-

Two sprays of 0.750 l ha^{-1} favored all the yield contributory characters. Singh et al. (2009) conducted field trials during 2006–07 and 2007–08 and established that 3 sprays of tilt (Propiconazole 25 EC) @ 0.75 l ha^{-1} at maximum tillering, boot leaf and soft dough stages are most effective and economic spray on highly susceptible variety RD 2503. (Singh, 2014) used seed treatment with vitavax power+two spray of propiconazole @ 0.1% and found it to be best treatment. (Jegathambigai et al., 2009) tested the efficacy of seed treatment with Trichoderma against Helminthosporium infection. In the fungal growth test the isolates *T. harzianum* 1, T. *harzianum* 2, *T. viride* 1, *T. viride* 2 and *T. viride* 3 inhibited growth of the pathogen by 79.18, 69.03, 83.75, 82.99, 74.11% respectively. The seed treatments also significantly increased seed germination, seedling growth and seedling vigor.

4. Conclusion

Seed treatment with vitavax+two foliar sprays of propiconazole at heading and flowering stage proved significantly superior in managing spot blotch intensity and highest yield and yield contributing characters over untreated check during both the years. Treatment combinations with bioagent also, significantly reduced spot blotch intensity over untreated check in the both years. The result indicated that the treatment with fungicide give best disease management and increased the yield and yield contributing characters.

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