J. Wheat Res. 5 (2) : 18-21

Received: 30 August 2013/ Accepted: 20 September 2013

Efficacy of different fungicides against spot blotch of wheat in terai region of West Bengal

Sunita Mahapatra* and Saikat Das

Uttar Banga Krishi Viswavidyalaya, Pundibari
Coochbehar-736 165, India

Abstract

Field experimentation of ten different treatments with combination of five different fungicides e.i. Captan 50% WP, Propiconazole 25% EC, Tebuconazole 25% EC and Mancozeb 75%WP and another two fungicides mixture Carboxin 37.5 % + Thiram 37.5% with untreated control (check) were evaluated against spot blotch of wheat for two consecutive years (2011-12 and 2012-13) in terai region of West Bengal. The disease incidence (DLA%) and disease severity (AUDPC) indicate that seed treatment with Carboxin 37.5% + Thiram 37.5%WS @ 2.5 gm kg^{-1} seed with two sprays of Propiconazole 25% EC @ 0.1 % at boot leaf stage and 20 days after first spray reduced disease incidence (DLA%= 31.89%) and severity (AUDPC= 467.67). The 1000 grain weight and the seed yield were also highest in the above treatment (44.69 g and 4.35 t ha^{-1} respectively) in comparison to other treatment combinations.

Keywords: Wheat, spot blotch, disease severity, fungicide, efficacy and yield

Introduction

Wheat is the second important cereal crop in India, total production is about 84.27 million tons in the year of 2010-11, having a projected demand of 1000 million tonnes by 2030 (Sharma,2011). Spot blotch of wheat caused by *Bipolaris sorokiniana* (Sacc.) Shoem has been a major disease of wheat grown under humid subtropical climate (Duveiller, 2002; Roshyara *et al*., 2009). The disease has a special significance in eastern Gangetic plains of South Asia that includes India, Nepal and Bangladesh (Sharma and Duveiller, 2004; Joshi *et al*., 2007). The average yield losses due to spot blotch in India were reported to be 15.5 per cent (Dubin and Van Ginkel,1991) and 17 per cent (Saari, 1998), even the grain yield losses ranging from 17.63-20 per cent under favourable conditions (Goel *et al*., 2006). In India, management of spot blotch is highly dependent on chemical fungicides like Mancozeb, Zeneb and adequate levels of host plant resistance are available only in wild alien species of wheat (Harding, 1972). However continuous and indiscriminate use of same fungicides often leads to development of fungicide resistance in pathogen (Gangawane, 1997). Yet scheduling the spraying of different fungicides against this disease is insufficient to minimize the yield loss. The objective of this investigation was to find out the suitable fungicide and mode of application as well as a spraying schedule for reducing the disease and increase yield.

Materials and methods

The field experiment was conducted for two consecutive years (2011-12 and 2012-13), during *rabi* season at UBKV Instructional Farm, Pundibari, Coochbehar under natural field condition. In order to create artificial epiphytotic condition in the field the spore suspension ($4.3x10^3$ spore ml^{-1}) was sprayed in the field with the help of hand sprayer in the evening after initiation of flag–1 leaf. The variety PBW343 was used for the study in both the years. Ten treatments of fungicides with one check were laid out in randomized block design (RBD) with three replications. The plot size was maintained at 5 x 1.5 sq.m. and recommended agronomic practices were followed to raise the crop. Four fungicides namely Captan 50% WP, Propiconazole 25% EC, Tebuconazole 25% EC and Mancozeb 75% WP and another two fungicides mixture Carboxin 37.5% + Thiram 37.5% were applied in the field in different mode with a different spraying schedule. The ten different treatments were, T1 = untreated control, T2 = seed treatment by Captan50%WP @ 3gm kg^{-1} seed, T3 = seed treatment by Carboxin 37.5% + Thiram 37.5%WS @ 2.5gm kg^{-1} seed, T4 = seed treatment by Carboxin 37.5% + Thiram 37.5%WS @2.5gm kg^{-1} seed + one foliar spray of Propiconazole 25%EC @0.1% at boot leaf stage, T5 = seed treatment by Carboxin 37.5% + Thiram 37.5%WS @2.5gm kg^{-1} seed + two foliar sprays of Propiconazole 25% EC @0.1% one at boot leaf stage and 20 days after 1st spray, T6= one foliar spray of Propiconazole 25%EC @0.1% at boot leaf stage, T7= two foliar sprays of Propiconazole 25% EC @ 0.1% one at boot leaf stage and 20 days after 1st spray, T8= one foliar sprays of Tebuconazole 25%EC @0.1% at boot leaf stage, T9= two foliar sprays of Tebuconazole 25%EC @0.1% one at boot leaf stage and 20 days after 1st spray, T10= three foliar sprays of Mancozeb 75%WP @ 0.25% one at boot leaf stage and 2nd and 3rd at 10 days interval. The disease data was recorded in three stages (flowering, dough and hard dough) from randomly selected 25 plants from each plot tagged. So, 25 plants $plot^{-1}$ were tagged for disease rating using the

*Corresponding author's email: *sunitamahapatra@yahoo.co.in*

double digit scale (00-99) developed (Eyel *et al.,* 1987) and then converted to percent diseased leaf area (%DLA) according to the following formula given by Sharma and Duveiller (2003),

DLA% = (A/9 X B/9) X 100,

where, A= First digit of the score and B= Second digit of the score.

There after Area Under Disease Progress Curve (AUDPC) was calculated based on %DLA at three different stages of data recorded. The AUDPC was calculated based on the following formula by Wilcoxon *et al.(*1975),

$AUDPC = \sum [(Y_{i+1} + y_i)/ 2 (X_{i+1} - X_i)]$

Y_i = severity at 1st observation, X_i = time (days) at first observation, N = total number of observation.

The yield data *i.e.* grain yield (t ha^{-1}) and 1000 grain weight (g) was recorded after harvesting for all the three replications of each treatments. The data on various parameters were analyzed using analysis of variance (Panse and Sukhatme, 1978) to find out the variation obtained from different treatments. Statistical significance was tested by F value at 5 per cent level of probability. Critical difference value at 0.05 probability levels were worked out for testing significance of differences among treatments.

Results and discussion

The results showed that all the treatments reduced the percent diseased leaf area (% DLA) which also reflected on Area Under Disease Progress Curve as well as increase the yield (t ha^{-1}) and yield parameters like 1000 grain weight (g) significantly in comparison to untreated control. The two years data of all the parameters showed differential reaction significantly may be due to different environmental conditions. So, all the recorded parameters of two years data were presented separately and discussion was made using the pooled data of two years. The disease incidence i.e. percent diseased leaf area (% DLA) were calculated at hard dough stage, AUDPC were calculated on the basis of all the three stages as mentioned above.

The results showed that all the fungicides applied plots reduced the disease incidence i.e. percent diseased leaf area (% DLA) as well as severity i.e. Area Under Disease Progress Curve (AUDPC) significantly in comparison to untreated control irrespective of their mode of applications.

Disease incidence or diseased leaf area percent (% DLA): In the year 2011-12, among the ten treatments minimum % DLA was recorded in T7(two foliar sprays of Propiconazole 25% EC @ 0.1% one at boot leaf stage and 20 days after 1st spray)(37.86%) which is statistically at par with ($p< 0.5$) T5 (seed treatment by Carboxin 37.5% + Thiram 37.5%WS @ 2.5gm kg^{-1} seed + two foliar sprays of Propiconazole 25% EC @ 0.1% one at boot leaf stage and 20 days after 1st spray) treated plots (43.21%) followed by T3 (seed treatment by carboxin 37.5% + Thiram 37.5%WS @2.5gm kg^{-1} seed) and T9 (two foliar sprays of Tebuconazole 25% EC @ 0.1% one at boot leaf stage and 20 days after 1st spray) statistically at par with each other (44.41 and 43.46% respectively). In the year 2012-13 similar trends were observed, here also minimum % DLA was recorded in T_5 (Seed treatment by carboxin 37.5% + thiram 37.5%WS @ 2.5 gm kg^{-1} seed + foliar sprays of Propiconazole @ 0.1% (two spray) treated plots (26.85%). The two years pooled mean showed that minimum % DLA was recorded in T5 (seed treatment by Carboxin 37.5% + Thiram 37.5 % WS @ 2.5gm kg^{-1} seed + two foliar sprays of Propiconazole 25% EC @0.1% one at boot leaf stage and 20 days after 1st spray) treated plots (33.96%) followed by T7 and T3 (38.23% and 39.95% respectively) (Table 1).

Disease severity or area under disease progress curve (AUDPC): In case of disease severity (AUDPC), the ten treatments showed different disease reactions in both the two years and their pooled mean. In the year 2011-12, minimum AUDPC (512.40) was recorded in T7 (two foliar sprays of Propiconazole 25% EC @ 0.1% one at boot leaf stage and 20 days after 1st spray) which is statistically at par with ($p< 0.5$) T5 (seed treatment by Carboxin 37.5% + Thiram 37.5%WS @2.5gm kg^{-1} seed + two foliar sprays of Propiconazole 25% EC @ 0.1% one at boot leaf stage and 20 days after 1st spray) treated plots (620.38) followed by T3 (seed treatment by Carboxin 37.5% + Thiram 37.5%WS @2.5gm kg^{-1} seed) (632.83) (Table1). But in the year 2012-13, AUDPC data were quite less than previous year due to change in weather factors. Here the minimum AUDPC was recorded also in T5 (314.93) followed by T4 and T6 (462.98 and 546.35, respectively). The two years pooled mean showed that the minimum disease severity AUDPC was calculated in T5 (467.67) followed by T4 (575.73), T3 (600.49) and T7 (603.47) and the were statistically at par with each other.

Grain yield (tha^{-1}): The effect of different fungicides also reflected on yield attributes like grain yield as well as in 1000 grain weight. All the treatments showed increase in the yield attributes significantly as compared to untreated control and were negatively correlated with the disease data, in both the two years and their pooled mean (Table 1).

The grain yield were to some extent more in the year 2012-13 due to less disease severity as compare to previous year. In both the years (2011-12 and 2012-13) the maximum grain yield was harvested on T5 (Seed treatment by Carboxin 37.5% + Thiram 37.5% WS @ 2.5gm kg^{-1} seed + two foliar sprays of Propiconazole 25% EC @0.1% one at boot leaf stage and 20 days after 1st spray) (4.38 and 4.32 respectively) followed by T7= two foliar sprays of Propiconazole 25% EC @ 0.1% one at boot leaf stage and 20 days after 1st spray (4.20 and 4.30 respectively).

Table 1. Effect of different fungicides on diseased leaf area (DLA%), AUDPC, seed yield and 1000 grain weight due to spot blotch of wheat for two consecutive years and their pooled mean

Treatment	DLA% (Hard dough)			AUDPC		Seed yield (t ha-1)			1000 Grain weight (g)		
	2011-12	2012-13	Pooled	2011-12	2012-13	Pooled	2011-12	2012-13	Pooled	2011-12	2012-13	Pooled
T1	78.60 (62.89)	59.26 (59.38)	68.93 (56.63)	1160.58	1043.20	1101.89	3.05	3.18	3.11	40.34	42.87	41.61
T2	51.03 (45.59)	39.09 (38.69)	45.06 (42.14)	762.35	719.18	740.77	3.87	4.12	3.99	40.66	42.67	41.67
T3	48.97 (44.41)	33.75 (35.49)	41.36 (39.95)	632.83	568.15	600.49	3.22	3.36	3.29	42.28	43.32	42.80
T4	56.79 (48.91)	26.34 (30.85)	41.56 (39.88)	688.48	462.98	575.73	3.92	4.31	4.11	40.36	44.78	42.57
T5	43.21 (41.08)	20.58 (26.85)	31.89 (33.96)	620.38	314.93	467.67	4.38	4.32	4.35	44.06	45.32	44.69
T6	72.02 (58.13)	38.27 (38.20)	55.15 (48.16)	941.40	546.35	743.88	3.45	3.42	3.44	41.03	43.67	42.35
T7	37.86 (37.78)	39.09 (38.69)	38.48 (38.23)	512.40	694.53	603.47	4.20	4.30	4.25	42.84	43.82	43.33
T8	59.26 (50.38)	51.85 (46.06)	55.56 (48.22)	947.60	839.58	893.59	3.44	3.80	3.62	42.26	43.40	42.97
T9	47.32 (43.46)	39.09 (38.69)	43.21 (41.08)	777.73	626.58	702.15	4.62	3.99	4.31	43.67	42.73	43.19
T10	54.32 (47.49)	48.15 (43.93)	51.23 (45.71)	938.28	750.05	844.17	3.73	3.60	3.67	42.26	43.73	42.99
SEm(±)	3.63	2.17	2.11	89.96	73.28	58.01	0.08	0.09	0.06	0.28	0.39	0.24
CD(5%)	7.62	4.56	4.28	188.99	153.95	117.65	0.18	0.20	0.13	0.59	0.84	0.49

(Figures within the parenthesis are angular transformed value) where; T1 = Untreated control, T2 = Seed treatment by Captan50%WP @3gm/kg seed, T3 = Seed treatment by Carboxin 37.5% + Thiram 37.5%WS @2.5gm/kg seed, T4 = Seed treatment by Carboxin 37.5% + Thiram 37.5%WS @2.5gm/kg seed + one foliar spray of Propiconazole 25%EC @0.1% at boot leaf stage ,T5 = Seed treatment by Carboxin 37.5% + Thiram 37.5%WS @2.5gm/kg seed + two foliar sprays of Propiconazole25%EC @0.1% one at boot leaf stage and 20 days after 1st spray, T6= one foliar spray of Propiconazole 25%EC @0.1% at boot leaf stage, T7=two foliar sprays of Propiconazole25%EC @0.1% one at boot leaf stage and 20 days after 1st spray, T8= one foliar sprays of Tebuconazole 25%EC @0.1% at boot leaf stage, T9= two foliar sprays of Tebuconazole 25%EC @0.1% one at boot leaf stage and 20 days after 1st spray, T10= three foliar sprays of Mancozeb 75%WP @ 0.25% one at boot leaf stage and 2nd and 3rd at 10 days interval.

Similarly two years pooled mean showed that the highest grain yield (t ha^{-1}) was recorded in T5 (Seed treatment by Carboxin 37.5% + Thiram 37.5%WS @2.5gm kg^{-1} seed + foliar sprays of Propiconazole @0.1% (two spray) (4.35 tha^{-1}) which is statistically at par with ($p< 0.5$) T_9 foliar sprays of Tebuconazole @0.1% at (two spray) (4.31 tha^{-1}) followed by T7 (Propiconazol 25% EC 0.1% treated plots (4.25 tha^{-1}). Minimum grain yield was harvested on T3 (Seed treatment by Carboxin 37.5% + Thiram 37.5%WS @2.5gm kg^{-1} seed) for both the years and also in pooled mean (3.22, 3.36 and 3.29 tha^{-1} respectively) (Table2).

Thousand Grain weight (g): Yield attribute like 1000 grain weight (g) also showed the same trends as observed in grain yield. Both the years (2011-12 and 2012-13) maximum 100grain weight was observed in T5 (seed treatment by Carboxin 37.5% + Thiram 37.5%WS @2.5gm kg^{-1} seed + two foliar sprays of Propiconazole 25% EC @ 0.1% one at boot leaf stage and 20 days after 1st spray) (44.06 and 45.32 respectively) followed by T7 (two foliar sprays of Propiconazole 25% EC @ 0.1 percent one at boot leaf stage and 20 days after 1st spray) (42.84 and 43.82 respectively)(Table 2). The two years pooled mean showed that maximum 1000 grain weight was recorded in T_5 (Seed treatment by Carboxin (37.5 %) + Thiram (37.5%WS) @2.5gm kg^{-1} seed + foliar sprays of Propiconazole @0.1 percent (two spray) treated plots (44.69g) followed by T7 two sprays of Propiconazole @0.1 percent treated plots (43.33g) which was statistically at par with ($p< 0.5$) T_9 two foliar sprays of Tebuconazole @0.1 percent at (two spray) (43.19g). Minimum 1000 grain weight (g) was observed in T2 (Seed treatment by Captan 50 percent WP @ 3 gm kg^{-1} seed) in both the years (2011-12 & 2012-13) and also in pooled mean (40.67, 42.87 and 41.61 respectively).

The result therefore indicated that seed treatment by Carboxin 37.5 percent + Thiram 37.5 percent WS @ 2.5gm kg^{-1} seed + two foliar sprays of Propiconazole 25 percent EC @ 0.1percent one at boot leaf stage and 20 days after 1st spray gave highest result in reducing the spot blotch of wheat as well as increased the 1000 grain weight and grain yield of wheat. Only two foliar sprays of Propiconazole 25 percent EC @ 0.1 percent one at boot leaf stage and 20 days after 1st spray except seed treatment also gave good result and similar to that of above results in reducing the spot blotch of wheat. Though only two foliar sprays of Tebuconazole 25% EC @ 0.1% one at boot leaf stage and 20 days after 1st spray also gave good result next to Propiconazole. This result also confirmed the findings of AICW&BIP (Anonymous, 2012). This result was contradict with the result of Tewari and Zenkde (2000) that Tebuconazole was superior than Propiconazole in controlling foliar blighr of wheat. So, application of seed treatment by Carboxin (37.5%) + Thiram (37.5%WS)

@2.5gm kg^{-1} seed + two foliar sprays of Propiconazole 25 percent EC @0.1percent one at boot leaf stage and 20 days after 1st spray was effective against spot blotch of wheat in the terai region of West Bengal.

References

1. Anonymous (2012). Progress Report of AICW&BIP 2011-12, Vol. III, (Crop Protection). Eds.: Sharma AK, Singh DP, Singh AK, Saharan MS, Selvakumar, R and Sharma I. Directorate of Wheat Research (ICAR). Karnal, India P-65-66.
2. Duveiller E (2002). Helminthosporium leaf blight of wheat challenges and strategies for a better disease control. In: Advances of wheat breeding in China. *Proceedings of the first National Wheat Breeding Conference.* 10-12 May, 2000, pp. 57-66.
3. Eyal Z, Scharen AL, Prescott JM and Van Ginkel M (1987). The Septoria disease of wheat: concepts and methods of disease management. CIMMYT. Mexico. D.F.
4. Gangawane LV (1997). Management of fungicide resistance in Plant Pathogen. *Indian Phytopathology* **50:** 305-313.
5. Goel P, Swati , Pal S, Srivastava K and Jaiswal JP (2006). Assessment of losses by spot blotch (*Bipolaris sorokiniana*) with reference to resistance in wheat in Tarai region of Uttaranchal. Indian *Phytopathology* **59**:36-40.
6. Hartig H (1972). Reaction to common root rot of 14 *Triticum* species and incidence of *Bipolaris sorokiniana* and *Fusarium* spp. in sub crown internodes tissue. *Canadian Journal of Botany* **50**: 1805-1810.
7. Joshi AK, Ortiz Ferrara G, Crossa J, Singh G, Sharma R, Chand R and Prasad R (2007). Combining superior agronomic performance and terminal heat tolerance with resistance to spot blotch (*Bipolaris sorokiniana*) in warm humid Gangetic plains of South Asia. *Field Crop Research* **103**:53-61.
8. Panse VG and Sukhantma (1978). Statistical methods for Agricultural workers. Indian Council of Agricultural Research. New Delhi, 2nd edition. Pp 381.
9. Roshyara UR, Khadka K, Subedi S, Sharma RC and Duveiller E (2009). Field resistance to spot blotch is not associated with underside physio-morphological traits in three wheat spring population. *Journal of Plant Pathology* **91**(1): 113-122.
10. Saari EE (1998). Leaf blight diseases and associate soil borne fungus pathogens of Wheat in South and Southeast Asia. In: Duveiller E., Dubin N.J., Reeves J. and McNab A. (Eds.): Helminthosporium blight of wheat: spot blotch and Tan spot CYMMYT. Mexico, D.F.: 37-51.
11. Sharma I (2011). Vision 2030. Directorate of Wheat Research (ICAR). Karnal – Haryana. P-1.
12. Sharma RC and Duveiller E (2003). Selection index for improving Helminthosporium leaf blight resistance, maturity and Kernel weight in spring wheat. *Crop Science* **43**:2031-2036.
13. Sharma RC and Duveiller E (2004). Effect of Helminthosporium leaf blight on performance of timely and late seeded wheat under optimal and stressed levels of soil fertility and moisture. *Field Crops Research* **89**: 205-218.
14. Tewari AN and Zewde T (2000). Chemical control of foliar diseases of wheat by systemic fungicides. *Plant Disease Research* **15**: 78-80.
15. Wilcoxon RD, Skovm B and Atif AA (1975). Evaluation of wheat cultivars for the ability to retard development of stem rust. *Annals of Applied Biology* **80**: 275-287.