J. Sher-e-Bangla Agric. Univ., 2(2): 1-5, July 2008 ISSN 1997-6038

EFFECT OF SOME SELECTED ECO-FRIENDLY TREATMENTS ON LEAF BLIGHT (*Bipolaris sorokiniana*) SEVERITY AND GRAIN YIELD OF WHEAT

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ABSTRACT

An Experiment was conducted during 2006-2007 to study the effect of some eco-friendly treatments on severity of leaf bight (*Bipolaris sorokiniana*), number and weight of grain per spike and grain health of wheat. Seeds of wheat variety Kanchan were collected from a farmer of Barisal district. Apparently healthy seeds were sorted out from the seed lot. Both unsorted and apparently healthy seeds were treated with hot water at 50°C for 5 minutes, brine solution (2% w/v NaCl) for 15 minutes, sun drying for 14 hours and polythene solarization for 14 hours. Unsorted and apparently healthy seeds were planted and 0.05% boron solution was applied as foliar spray at tillering stage. Two checks were maintained, unsorted and apparently healthy seeds, and planted without any treatment. At all stages of data collection, the highest severity of leaf blight on flag leaf and penultimate leaf were recorded under control, where unsorted and untreated seeds were planted followed by the treatment where apparently healthy seeds were planted without any treatment. Other treatments caused significant reduction in leaf blight severity and percentage of diseased seeds as compared to control. The treatments gave significant increase in number and weight of grain per spike and percentage of healthy grain. Considering the above parameters, pre-sowing treatment of apparently healthy seeds with hot water, brine or sundrying were noted as effective eco-friendly methods to reduce leaf blight severity and to increase grain yield and healthy seeds of wheat.

Key words: Eco-friendly treatment, leaf blight severity, grain formation, wheat

INTRODUCTION

Wheat (*Triticum aestivum* L.) is the second most important cereal crop next to rice in Bangladesh. About 706.86 thousand hectares of land is covered by wheat cultivation with the annual production of 1570 thousand tons (BBS, 2005). According to FAO (2005), the average yield of wheat was 1.7 t ha^{-1} in Bangladesh, which is much lower than the yield of many other wheat growing countries. Per hectare yield of wheat in Japan, France, Germany and UK is 3.76, 7.12, 7.28 and 8.00, respectively (FAO, 2005). Various factors are responsible for low yield. Among them, diseases play vital role. In Bangladesh, wheat suffers from 26 seed-borne pathogens causing 14 seed-borne diseases (Fakir, 1999). Among the diseases, *Bipolaris* leaf blight (BpLB) caused by *Bipolaris sorokiniana* is the major constraint for wheat production in tropical and sub tropical regions of the world (Duveiller and Gilchrist, 1994; Mehta, 1997). *Bipolaris* Leaf blight is also a common disease of wheat in Bangladesh (Hossain *et al.*, 1993; Alam and Shah, 1991; Alam *et al.*, 1995). In the farmer's field, the yield loss of wheat due to leaf blight disease may be 14.97 % (Alam *et al.*, 1995). The yield loss in wheat due to leaf blight disease has been estimated to be 20% in var. Sonalika, where 14% and 8% in Akbar and Kanchan, respectively in Bangladesh (Razzaque and Hossain, 1991). In case of severe attack, it may result 100% yield loss. (Hossain and Azad, 1994). The acceptable method for controlling of BpLB disease is sowing of pathogen free seeds. Treatment of seed with seed-dressing fungicides was found to improve germination and decrease infection of seedling growth (Kabir, 2006).

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Indiscriminate use of chemicals may create health hazard and environment pollution. Use of alternate methods instead of seed treating chemicals is of great concern now a day to save soil environment. Therefore, search for eco-friendly, less expensive and non-chemical methods to treat seeds is necessary. Seed treatment with hot water followed by sun drying have been found potential in reducing the leaf blight severity and enhancing grain formation of wheat (Zobaer *et al.*, 2007). Pre-sowing seed treatment with common salt may be alternative of fungicidal seed treatment for controlling seed borne fungal pathogen. The present study was undertaken to find out the effect of some eco-friendly methods of seed treatments and foliar spray with boron on severity of *Bipolaris* leaf blight of wheat caused by *Bipolaris sorokiniana*.

MATERIALS AND METHODS

The experiment was conducted in the experimental farm of Sher-e-Bangla Agricultural University, Dhaka during 2006-2007 wheat growing season. The experiment field was thoroughly prepared for good tilt and recommended doses of fertilizers and manure were applied. The experiment was laid out in a randomized complete block design with three replications.

In this experiment twelve treatments were tested to find out eco-friendly treatments to control *Bipolaris* leaf blight. The treatments were T_1= unsorted and untreated seeds which served as a control, T_2= unsorted seeds + brine treatment, T_3=unsorted seeds + hot water treatment, T_4=unsorted seeds + sun drying, T_5=unsorted seeds + polyethylene solarization, T_6= sowing of unsorted and untreated seeds + foliar spray with 0.05% boron, T_7=apparently healthy seeds without any treatment, T_8=apparently healthy seeds + brine treatment, T_9=apparently healthy seed + hot water treatment, T_{10}=apparently healthy seeds + sun drying, T_{11}=apparently seeds + polyethylene solarization, and T_{12}= sowing of apparently healthy untreated seeds and foliar spry boron solution.

Seeds of wheat variety Kanchan were collected from a progressive farmer of the village Rahamotpur, Barisal. Apparently healthy seeds free from black pointed, deformed and abnormal sized grains were sorted out manually from the seed lot. Both apparently healthy seeds and unsorted farmer's seeds were treated with hot water (50°C) for 5 minutes, brine solution (2% w/v common salt) for 15 minutes, sun drying for 14 hours and polyethylene solarization. For sun drying, the seeds were spread on a concrete floor and exposed to sun for 14 hours in two consecutive days. For solarization, the seeds were spread on a polyethylene sheet, covered with another polyethylene sheet and exposed to the sun for 14 hours in two consecutive days. In other treatments, wheat plants were grown from unsorted as well as apparently healthy seeds and subsequent foliar spray of 0.05 % (w/v) boron solution was applied at tillering stage. Two treatments were maintained, where apparently healthy and unsorted seeds were planted without any pre sowing or post sowing treatment. Plants grown from unsorted and untreated seeds served as control. Seeds were sown in the field on 6th December, 2006 at the rate of 120 kg/ha. The seeds were sown in lines at a depth of 5 cm and covered by soil. The first irrigation was applied at 25 days after sowing and another one 45 days of sowing. Irrigation was followed by a weeding for conservation of soil moisture. Data on severity of *Bipoloaris* leaf blight on flag and penultimate leaves was recorded at flowering, milk and hard dough stages. Fifteen plants were randomly selected from each unit plot. Flag leaf and penultimate leaf of each selected plants were checked carefully and the severity of the disease was recorded following a standard 0-5 scale (Hossan and Azad, 1992), where 0= no infection, 1= few minute lesions on leaves, 2=black lesion with no distinct chlorotic halos and covering <10% of the leaf area, 3= typical lesions surrounded by distinct chlorotic halos and covering 10-50 % of the leaf area, 4= severe lesions on leaves with ample necrotic zones drying over

part of the leaf, covering 50% of the leaf area and 5=severe infection, drying of leaf, spike infected to some extend. Mean values of two leaves were presented. After harvest, number and weight of healthy grains and number and weight of diseased grains per ear were recorded.

RESULTS AND DISCUSSION

Disease Severity

At all stages of data collection, the highest severity of *Bipolaris* leaf blight (BpLB) of wheat was recorded under control, where farmer's produced and saved seeds were sown without any treatment. All seed treatment methods and foliar spray with boron caused significant (P=0.05) reduction in disease severity over control. However, remarkable variations were observed in effectiveness of different treatments (Table 1). At flowering stage, the lowest disease severity was recorded, when apparently healthy seeds were sown after treatment with hot water (T_9), which was statistically similar to T_{10} (apparently healthy seeds sun dried without polyethylene covering). The disease severity index values in T_{10}, T_{11}, T_4 and T_3 ranged 0.18-0.22 and were not significantly different. The second highest severity was recorded in T_2, which was followed by T_6, T_8, T_5, T_{12} and T_7. The index values under those six treatments ranged 0.53-0.80 (Table 1).

Table 1. Effect of seed treatment with physical and chemical agents and foliar spray with boron on severity of *Bipolaris* leaf blight of wheat

Treatments	Flowering stage	Milk stage	Hard dough stage
T_1= Unsorted and untreated seeds (control)	1.05 a	1.28 a	2.05 a
T_2= Unsorted seeds treated with 2% brine	0.80 b	0.63 c	1.37 b
T_3=Unsorted seeds treated with hot water	0.22 g	0.20 h	0.51 e
T_4=Unsorted seeds and sun dry	0.20 g	0.75 b	1.11 cd
T_5=Unsorted seeds and polyethylene solarization	0.60 de	0.76 b	1.15 cd
T_6= Sowing of unsorted and untreated seeds and foliar spray with 0.05% boron	0.69 c	0.68 c	1.11 d
T_7=Apparently healthy seeds without any treatment	0.53 d	0.64 c	1.16 bc
T_8=Apparently healthy seeds treated with 2% brine	0.65 cd	0.32 f	0.66 de
T_9=Apparently healthy seed treated with hot water	0.16 h	0.17 h	0.46 e
T_{10}=Apparently healthy seeds and sun drying	0.18 gh	0.38 e	0.93 cd
T_{11}=Apparently healthy seeds and polyethylene solarization	0.22 g	0.30 g	0.66 ef
T_{12}= Sowing of apparently healthy untreated seeds and foliar spry with 0.05% boron	0.58 ef	0.46 d	0.95 cd

Means within the same column having a common letter(s) do not differ significantly (P = 0.05)

At milk stage, the highest severity value of 1.28 was recorded under control (T_1). Different treatments (T_2-T_{12}) reduced the value to a range of 0.17-0.76. The lowest severity was found in T_9. The second lowest was observed in T_3, which was followed by T_{11}, T_8, T_{10} and T_{12} showing severity index within the range of 0.20-0.46. Differences among those index values were significant. The second highest severity was found inT_5 followed by T_4, T_6, T_7 and T_2. The severity index values under those treatments were 0.63-0.76 (Table 1). At hard dough stage, the least severity of the disease was also recorded in T_9, which was statistically similar to T_3, T_8 and T_{11}. These four treatments showed 0.46-0.66 severity index values. The second highest disease severity was recorded in T_2, followed by T_7, T_5, T_6, T_4 and T_{10}, where the index values ranged 0.93-1.37 (Table 1).

Grain yield

An average of 31.10 healthy grains per ear was recorded in untreated control (T_1). The grain number increased to a range of 33.64-42.36/ear due to seed treatments with different methods and foliar spray with boron (T_2-T_{12}). The increase was significant as compared to control. Maximum increase was obtained in T_9, which was statistically similar to T_3, but significantly higher as compared to other treatments. The effect of T_3 on healthy grains was statistically similar to T_{10}. Number of healthy grains in T_4, T_5, and T_{11} were also statistically similar but significantly higher as compared to T_2, T_6, T_8 and T_{12}. The lowest increase was recorded in T_2, followed by T_6, T_{12} and T_8. The effect of the last four treatments on healthy grain number was significantly different (Table 2).

Table 2. Effect of seed treatment with physical and chemical agents and foliar spray with boron on severity of *Bipolaris* leaf blight of wheat

Treatments	Number of healthy grains per ear	Number of diseased grains per ear	Weight of healthy grains (g/ ear)	Weight of diseased grains (g/ ear)
T_1 = Unsorted and untreated seeds (control)	31.10i	3.03a	1.30e	0.17a
T_2 = Unsorted seeds treated with 2% brine	33.64h	1.39c	1.36de	1.12abc
T_3 = Unsorted seeds treated with hot water	41.56ab	0.47g	1.66ab	0.02de
T_4 = Unsorted seeds and sun dry	38.85cd	1.07de	1.60abc	0.06de
T_5 = Unsorted seeds and polyethylene solarization	38.68cd	1.14d	1.40cde	0.13ab
T_6 = Sowing of unsorted and untreated seeds and foliar spray with 0.05% boron	34.80g	2.02b	1.45b-e	0.14a
T_7 = Apparently healthy seeds without any treatment	38.04de	1.20d	1.56a-d	0.08bcd
T_8 = Apparently healthy seeds treated with 2% brine	37.64e	1.18d	1.56a-d	0.08bcd
T_9 = Apparently healthy seed treated with hot water	42.36a	0.26h	1.70a	0.01e
T_{10} = Apparently healthy seeds and sun drying	40.82b	0.76f	1.64ab	0.03de
T_{11} = Apparently healthy seeds and polyethylene solarization	39.00c	0.98e	1.60abc	0.05de
T_{12} = Sowing of apparently healthy untreated seeds and foliar spry with 0.05% boron	36.63f	1.19d	1.57a-d	0.07cde

Means within the same column having a common letter(s) do not differ significantly (P=0.05)

Effect of the treatments on number of diseased grains was almost reverse. The maximum number of 3.03 diseased grains per ear was recorded in T_1 (control). The number was significantly reduced over control (T_1) due to treatments T_2 to T_{12}. The minimum number of diseased grains per ear was found in T_9, followed by T_3, T_{10} and T_{11}. The treatments showed 0.26, 0.47, 0.76 and 0.98 diseased grains/ear, respectively. Differences among those grain numbers were significant. The second highest diseased grains/ear was recorded in T_6 followed by T_2, T_7, T_{12}, T_8, T_5 and T_4. The treatments showed 1.07 to 2.02 diseased grains per ear (Table 2). Weight of healthy grain in T_3, T_4 and T_7-T_{12} ranged from 1.70 to 1.56 g/ear, which was statistically similar but significantly higher as compared to T_1, T_2, T_5 and T_6. Weight of diseased grains was maximam in T_1 (control), which was statistically similar to T_2, T_5 and

T_6. Other eight treatments significantly reduced weight of per ear diseased grains as compared to control. The most effective treatment to reduce weight of diseased grains was T_9, which was followed by T_3, T_{10}, T_{11}, T_4 and T_{12}. However, their efficacy was not significantly different (Table 2). Results of the present study showed that the most effective treatment to reduce severity of *Bipolaris* leaf blight of wheat was use of apparently healthy seeds after treatment with hot water, which was followed by use of unsorted seed after hot water treatment, apparently healthy seeds + sundry with and without polyethylene covering. Use of apparently healthy seed without any treatment was also effective to reduce severity of the disease. The above four treatments also caused significant reduction in number and weight of diseased grains, and increased number and weight of healthy grains per ear as compared to control. Findings of the present study corroborate with the findings of Kabir (2006) and Zobaer *et al.* (2007). Zobaer *et al.* (2007) found that the use of apparently healthy seed treated with hot water decreased number and weight of diseased grains and increased number and weight of healthy grains of wheat. Kabir (2006) reported that pre-sowing sorting out of apparently healthy seeds from a lot of farmer's seeds caused reduction in BpLB severity and increased grain formation and grain yield of wheat as compared to unsorted seeds.

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