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EFFECT OF DIFFERENT LEVELS OF BLACK POINTED SEED ON PREVALENCE OF BIPOLARIS LEAF BLIGHT OF WHEAT

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ABSTRACT

A field experiment was conducted to evaluate the effect of different levels of black pointed seed on seeding emergence and prevalence of Bipolaris leaf blight disease of wheat. The treatments considering the levels (weight basis) of black pointed seed were T_0 = apparently healthy with Vitavax -200 treated seed, T_1 = 3% black pointed seed, T_2 = 6% black pointed seed, T_3 = 10% black pointed seed, T_4 = 15% black pointed seed, T_5 = 20% black pointed seed and T_6 = 25% black pointed seed. The maximum emergence of seedling and plant population / m^2 (246.64 - 268.68) were recorded in T_0 and those were minimum (182.58 -190.75) in T_6 after 7 and 15 days of sowing. Tendency of decreasing seedling emergence was observed with increasing the level of black pointed seed. Percent diseased leaf area (%DLA) and percent disease incidence (PDI) on flag leaf (F) and flag penultimate leaf (F-1) increased with increasing age of the plant. The maximum and minimum, grain yield, apparently healthy seed, area under disease progress curve (AUDPC) for flag leaf and penultimate leaf were in T_6 and T_0, respectively.

Key words*: Leaf blight, black point, Bipolaris sorokiniana, wheat seed, AUDPC.*

INTRODUCTION

Bipolaris sorokiniana is a destructive pathogen of wheat in Bangladesh (Alam *et al.*, 1994). Like other humid tropical countries, *Bipolaris sorokiniana* causes yield loss of about 8 to 100 % depending on variety, plant growth stage and environmental condition (Ahmed and Meisner, 1996; Ahmed *et al.*, 2003; Ahmed and Hossain, 2005; Hossain and Azad, 1994). The fungi, *B. sorokiniana* is generally considered highly seed transmitted pathogen expressed as black point on seed and possesses a potential threat to the subsequent crops. It produces seedling blight, leaf spot, leaf blotch and leaf blight on standing crop. It also causes black point, seed rot, shriveling of seed resulting poor seedling emergence, plant stand and low yield of subsequent crops (Aulakh *et al*., 1988). Virtually, it is impossible to produce black point free seed; however, seed with a reduced level of black point can be produced that may ensure good germination high seedling vigour. Considering the above facts, the present research program has been designed to determine the effect of different levels of black pointed seed on germination potential and subsequent disease severity of the crop.

MATERIALS AND METHODS

The experiment was conducted in a field of Hajee Mohammad Danesh Science and Technology University, Dinajpur, Bangladesh during November 2007 to March 2008. Wheat seeds variety Kanchan were collected from the University farm and divided into seven groups. Each group was considered as a treatment. The treatments were T_0 = The best seeds (apparently healthy seed) treated with vitavax- 200 (0.2% of seed weight), T_1 = The seeds containing 3% black pointed seed, T_2 = The seeds containing 6% black pointed seed, T_3 = The seeds containing 10% black pointed seed, T_4 = The seeds containing 15% black pointed seed, T_5 = The seeds containing 20% black pointed seed and T_6 =

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The seeds containing 25% black pointed seed. The experimental plot was prepared with ploughing and cross ploughing. The soil was fertilized with Urea, Triple Super Phosphate (TSP), Muriate of Potash (MOP), Gypsum for N, P, K and S, respectively at 220, 132, 68 and 125 kg/ha (Ahmed and Meisner 1996). The experiment was laid out in the Randomized Complete Block Design (RCBD) having four replications (plots) for each treatment. Each plot size was 2.5 m × 1.2 m. Six gram seed of wheat (120 kg /ha) was sown at 3 cm depth in a 2.5 m row maintaining 20 cm distance between rows. Weeding, irrigation and other intercultural operations were done properly as needed. Data on seedling emergence and plant population per square meter were recorded at 7 and 15 days after sowing. Severity of Bipolaris leaf blight was recorded as percent diseased leaf area (%DLA) of the flag leaf (F) and penultimate leaf F-1) of 10 tillers selected randomly in each plot. The disease severity (percent diseased leaf area) was recorded 5 times, starting from first initiation of disease (booting stage) and ending at grain dough stage at an interval of four days by using a 0-7 scale (Hetzler 1992). Where, 0 = Leaf free from lesion, 1 = Few isolated lesions covering not more then 1% leaf area, 2 = 5% leaf area covered, 3 = 10 % leaf area covered, 4 = 25 % leaf area blighted, 5 = 50 % leaf area blighted, 6 = 75% leaf area blighted and 7 = Severe infection with more 80 % leaf area damaged. The area under the disease progress curve (AUDPC) was calculated according to the following formula (Dubin *et al*. 1998).

$$\text{AUDPC} = \sum_{i=1}^{n}[(Y_{i+1} + Y_i) \times 0.5][T_{i+1} - T_i]$$

Where, Yi = Disease severity at i th observation

Ti = Time (days) of the i th observation and

n = Total number of observations.

Percent Disease Index (PDI) for leaf blight was calculated according to the standard formula (Mian 1995)

$$\text{PDI} = \frac{Sum\ of\ all\ disease\ ratings}{Total\ number\ of\ ratings \times Maximum\ disease\ grade} - \times 100$$

After harvest, the seeds were categorized as black pointed, under sized and apparently healthy seeds. Data were analyzed statistically and means were compared by Duncan's Multiple Range Test (DMRT) following the MSTATC computer program.

RESULTS AND DISCUSSIONS

Seedling emergence and plant populations

The maximum emergence of seedlings and plant population per square meter were recorded when apparently healthy seeds were sown and minimum was found when 25% black point infected seeds were sown. There was a general tendency in decreasing seedling emergence and plant population with the increasing level of black point infected seed (Fig. 1).

Leaf blight severity:

Leaf blight severity for both of flag (F) and penultimate leaf (F-1) varied significantly according to treatments under all the five observations. At all the observations, highest leaf blight severity was recorded under the treatment T_6 and lowest was under T_0. Percent diseased leaf area (%DLA) of F varied from 0.1 – 0.17%, 0.35 – 1.42%, 1.75 – 4.40%, 4.72 – 16.02% and 15.80 – 42.25% at five different observations (Table 1). In all the observations, the minimum leaf area infection was found at treatment T_0 and maximum at T_6. At the first observation, the infection did not significantly differ among the treatments T_0, T_1, T_2, T_3, T_4 and T_5 and at the second observation T_6 was statistically similar to T_5. In the 3rd observation, the lowest leaf area infection in T_0 which was similar with T_1. In the 4th and 5th observation, maximum %DLA was recorded under T_6 which was similar to T_5 (Table 1).

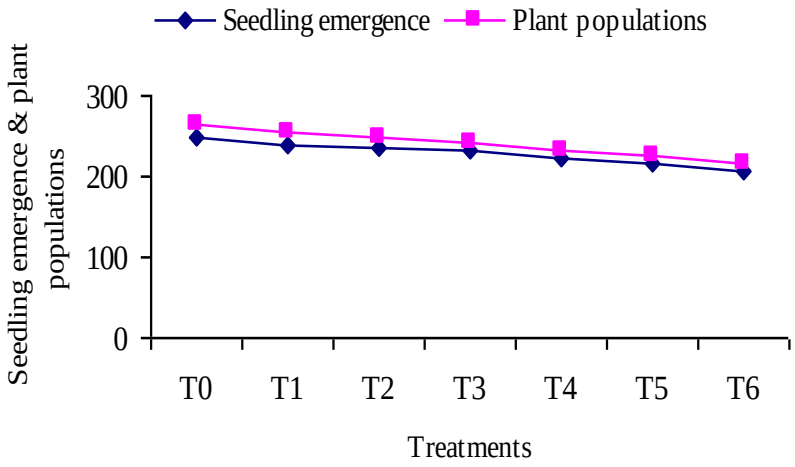

Figure 1. Seedling emergence and plant population under different treatments

Percent diseased leaf area (%DLA) of F-1 ranged from 0.00 – 1.08%, 0.53 – 3.58%, 1.55 – 22.98, 12.85 – 42.98% and 28.83 – 76.13% at all the five observations. Minimum %DLA was recorded under treatments T_0 and maximum was under T_6 (Table 1). There was no infection of F-1 in T_0 at the first observation, however, only 28.82 % infection was found at fifth observation. The information indicates the severe diseased condition that might greatly hamper the yield and quality of wheat production.

Table1. Effect of different levels of black pointed seed on percent diseased leaf area (%DLA) on flag leaf and flag leaf -1 at different date of observation

Treatments	Percent diseased leaf area (%DLA) at different dates of observations									
	Flag leaf (F)					Penultimate leaf (F-1)				
	1st	2nd	3rd	4th	5th	1st	2nd	3rd	4th	5th
T_0	0.10 b	0.35 e	1.75 d	4.72 d	15.80 d	0.00 e	0.53 d	1.55 e	12.85 f	28.83f
T_1	0.10 b	0.57 d	1.85 d	7.95 c	23.87 c	0.03 e	1.10 c	4.13 d	23.80 e	36.95e
T_2	0.10 b	0.83 c	3.07 c	8.90 c	25.15 c	0.13 d	1.03 c	4.95 d	24.90de	44.03d
T_3	0.11 b	0.95 c	3.40bc	12.82 b	27.42bc	0.18 c	1.90 b	6.35 c	27.70cd	54.70c
T_4	0.12 b	1.20 b	3.62 b	13.65 b	29.00 b	0.48 b	2.13 b	12.78 b	29.53bc	54.55c
T_5	0.12 b	1.37 a	3.62 b	15.45 a	39.25 a	0.48 b	2.25 b	13.58 b	31.40 b	69.13b
T_6	0.17 a	1.42 a	4.40 a	16.02 a	42.25 a	1.08 a	3.58 a	22.98 a	42.98 a	76.13a
CV%	9.12	10.19	7.77	5.79	7.97	11.40	8.53	9.69	8.45	8.51

Figure in a column having dissimilar letter(s) differ significantly and those having similar letter(s) do not differ significantly at 5% level of significance

The severity of disease of F increased with increasing age of the plant. The disease progress at first and second observations was slow but it was very fast at the third, fourth and fifth observations. This may be happened due to effects of environment on organisms or on the host or on both. Disease index

recorded was maximum in treatment T_6 at all the observations and minimum in treatment T_0, where apparently healthy seed was used. Comparatively higher disease index was recorded in treatment T_6 and T_5 but that was lower in treatment T_0 and T_1 (Fig. 2).

Disease severity of F-1 recorded in five different occasions varied more or less among all the treatments. A sharp increase in disease development was observed with the progress of time after heading periods. Disease development was rather faster on the third observation compared to second observation and it continued up to fifth observation. Maximum disease severity was found in T_6 at all the five observations. The minimum disease severity was found in treatment T_0 at all the five observations. Comparatively higher disease index was recorded in treatment T_6 and T_5 but that was lower in treatment T_0 and T_1 (Fig. 3).

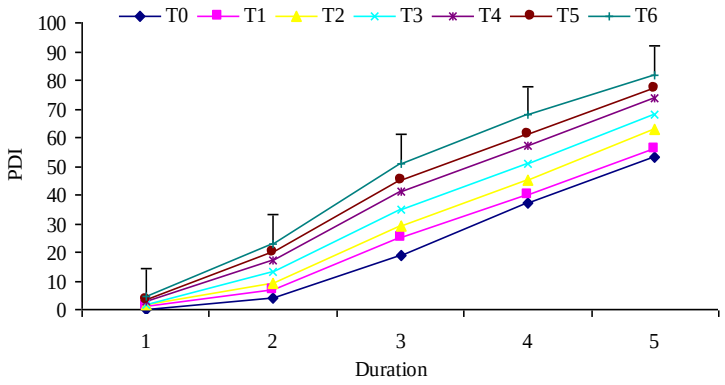

Figure 2. Effect of different levels of black pointed seed on percent disease index (PDI) for flag leaf at different dates of observations

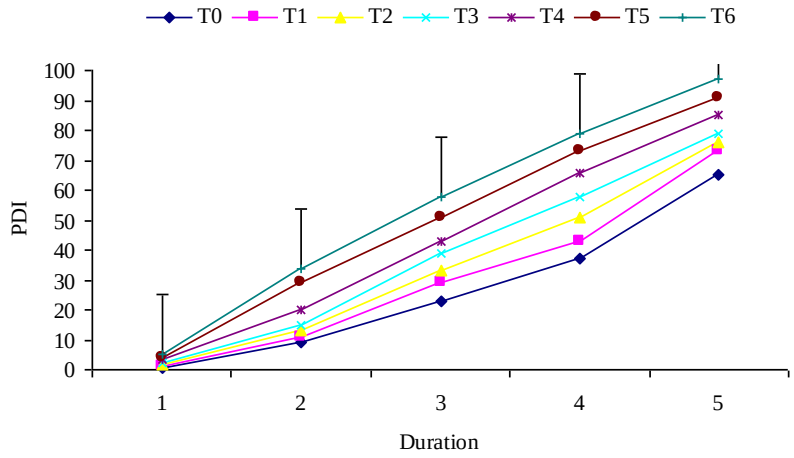

Figure 3. Effect of different levels of black pointed seed on percent disease index (PDI) for penultimate leaf at different dates of observations

Area under disease progress curve (AUDPC)

Area under disease progress curve (AUDPC) varied among all other treatments. The maximum area under disease progress curve (AUDPC) was calculated in treatment T_6 for both F and F-1 (Table 2). Minimum AUDPC was found when apparently healthy seeds were sown in the field. All other treatments gave lower, medium or higher AUDPC. Maximum AUDPC indicates that progress of

disease was rapid in treatment T_6 and minimum indicates that slow progress of disease compared to any other treatments.

Table 2. Area under disease progress curve (AUDPC) for flag leaf and penultimate leaf under different treatments

Treatments	AUDPC for flag leaf (F)	AUDPC for penultimate leaf (F-1)
T_0	220.15	263.71
T_1	261.80	313.95
T_2	301.88	357.53
T_3	355.60	404.60
T_4	411.43	462.53
T_5	447.83	543.38
T_6	501.73	605.85

Categories of seed per spike under different treatments and grain yield

Significant differences were observed in categories of seed per spike under different treatments (Table 3). Total seed per spike and apparently healthy seed per spike ranged from 30.12 - 35.05 and 21.48 - 31.37, respectively, where the highest values were recorded under the treatment T_0 and the lowest ones were under the treatment T_6. On the other hand, number of black pointed seed and under sized seed ranged from 0.90 - 3.74 and 2.85 - 4.89, respectively, where the highest ones were found under the treatment T_6 and the lowest ones were under the treatment T_0. It was clearly observed that sowing of increasing the percentage of black pointed seed also increased the number of black pointed seed / spike and under sized seed per spike (Table 3). Yield of grain per spike was recorded maximum under the treatment T_0 which was statistically similar to T_1, T_2 and T_3 but the minimum grain yield was found under treatment T_6 followed by T_5 and T_4. In general, it was found that the treatments T_0, T_1, T_2 and T_3 were comparatively better than the other treatments on the increased grain yield.

Table 4. Effect of treatment on categories of seed per spike and grain yield

Treatments	Categories of seed per spike				
	Total	Black point	Under sized	Apparently healthy	Grain yield (g)/ spike
T_0	35.05 a	0.90 e	2.85 e	31.37 a	1.175 a
T_1	33.87 b	1.38 de	3.48 de	29.01 b	1.227 a
T_2	33.20 c	1.66 d	3.70 d	27.82 c	1.123 ab
T_3	32.74 d	1.84 d	3.76 d	27.13 c	1.121 ab
T_4	32.20 e	2.25 c	3.94 c	25.96 d	1.060 bc
T_5	31.63 f	2.95 b	4.27 b	24.40 d	1.013 bc
T_6	30.12 g	3.74 a	4.89 a	21.48 e	0.986 c

Figure in a column having dissimilar letter(s) differ significantly and those having similar letter(s) do not differ significantly at 5% level of significance

Result of the present study indicates that seedling emergence and plant populations were maximum when apparently healthy seeds were sown in the field and minimum when 25% black pointed seed was used. Seedling emergence and plant population gradually decreased with increasing level of black pointed seed. Hossain (2000) reported that black point infection greatly affected seed germination and seedling emergence of wheat and percent reduction in germination became higher with the increased level of black pointed seed. Chaudhary *et al*., (1984) also reported that germination of the diseased (black point) seeds both in blotter and pot soil decreased by 11.6 and 16.0 %, respectively. Seed germination reduction of wheat due to black point infection was also found by Zhang *et al*., (1990).

Significant variations in percent diseased leaf area (%DLA) and percent disease index (PDI) were found during present investigation at initial stage to maturity stage of wheat under natural conditions. Lower level of percent diseased leaf area and percent disease index (PDI) were recorded in plot where apparently healthy seeds were sown and higher level was found when 25% black pointed seeds were sown. Area under disease progress curve (AUDPC) indicated that comparatively higher progress of disease was in treatment T_6 containing higher percentage of black pointed seeds. Similar results were also reported by Bazlur Rashid, (1996); Bazlur Rashid and Fakir (1998) and Malaker (2003). They reported that higher level of Bipolaris infected seed causes higher level of disease in adult plant. Leaf spot / Leaf blight disease is consequence of seed to plant and again to seed transmission of *B. sorokiniana*. In the present study, increased number of black pointed seed / spike was found with the treatment of increased percentage of black pointed seed. This result was also reported by other workers (Nema and Joshi, 1974; Hossain, 2000).

CONCLUSION

Considering the findings of the research it has been concluded that the wheat seed having without or less black point infection affords good results in seedling emergence and minimum diseased condition in the field.

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