RESPONSE OF SOWING DATE AND VARIETY AGAINST BIPOLARIS LEAF AND HEAD BLIGHT OF WHEAT

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ABSTRACT

Ahmed, M. A., Rashid, M. M., Malaker, P. K., Akter, S., Adde, M. N. and Mohamed, M. O.2021. Response of sowing date and variety against Bipolaris leaf and head blight of wheat. Bangladesh J. Plant Pathol. 37(1&2):93-98

An experiment was conducted to evaluate the effect of five sowing dates viz. November 15, December 01, December 15, January 01 and January 15 and six varieties namely BARI Gom 21 (Shatabdi), BARI Gom 26, BARI Gom 27, BARI Gom 28, BARI Gom 29 and BARI Gom 30 on Bipolaris leaf and head blight of wheat caused by *Bipolaris sorokiniana* during the period of 2016-17. Spilt-plot design was followed, where the varieties were assigned in the main plots and the sowing dates in the sub-plots. Data were collected on leaf blight severity at Zadoks growth stages GS-71, GS-75 and GS-83, while the head blight infection and 1000-grain weight were recorded after harvest. The final leaf blight severity at GS-83 was found significantly highest (68.09%) in BARI Gom 30 followed by BARI Gom 28 (61.67%) and lowest (38.73%) in BARI Gom 21. In case of sowing date, the highest (59.73%) leaf blight severity was found in Jan. 01 sowing, while the lowest (52.49%) was recorded in Nov. 15 sowing. Head blight severity was found highest (5.06%) in BARI Gom 28 while the lowest (3.56%) was recorded in BARI Gom 21. In case of sowing date, the highest percentage (5.17%) of head blight infection was found in Jan. 15 while the lowest percentage (3.23%) was observed in Nov. 15. Grain health test was done after three months of harvesting and processing of grains by dry inspection and blotter method. In dry inspection method, the highest percentage of infected grains (5.15%) was found in the grain sample of BARI Gom 29 while BARI Gom 26 showed the lowest percentage (3.51%) of grain infection. For the dates of sowing, the highest percentage (4.70%) of infected grains was found in Dec. 15 and the lowest (4.04%) in Nov. 15. When tested by blotter method, the highest percentage (3.60%) of *B. sorokiniana* infected grains was found in BARI Gom 28 and the lowest (2.53%) in BARI Gom 27. Considering the date of sowing, the highest percentage (3.37%) of grain infection by *B. sorokiniana* was found in Dec. 15 and the lowest (2.87%) in Nov. 15. Weight of 1000 grains was found highest (46.83 g) in Nov. 15 while the lowest (35.59 g) was recorded in Jan. 15. The overall research findings concluded that the varieties have little effect on disease severity but BARI Gom 21 performed better, whereas the date of sowing played a significant role in disease development where November 15 may be employed to minimize disease severity.

Keywords: Wheat, Leaf and Head blight, *Bipolaris* sorokiniana, Date of sowing, Varieties

INTRODUCTION

Bipolaris leaf blight caused by *Bipolaris sorokiniana* is one of the most important biotic constraints affecting wheat production in Bangladesh (Ahmed and Meisner 1996). The disease appears at the seedling stage and locally transmitted to the subsequent stages including heads and grains (Alam *et al.* 1994). Disease symptoms appear as numerous small, circular to oval and grey-brown spots on green leaves. The centres of the spot fade soon, becoming light gray to straw coloured with distinct dark brown margins. Early symptoms are characterized by small, dark brown lesions 1 to 2 mm long without chlorotic margin. In susceptible genotypes, these lesions extend very quickly into oval to elongated spindle shaped blotches, light brown to dark brown in colour. *Bipolaris sorokiniana* is an aggressive pathogen that causes spot blotch, root and crown rots, node cankers and head and seedling blight (Zillinsky 1983). If spikelets are affected, it can result in shriveled and black pointed grains. The pathogen has been reported to be highly seed-borne as well as soil-borne in nature. This fungus act as a causal agent for various diseases like seedling blight, foliar blight/ spot blotch, head blight, common root rot and black point of wheat, barley, other small

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cereal grains and grasses (Zillinsky 1983; Wiese, 1998). Pathogenicity studies on a global collection of *B. sorokiniana* monoconidial strains on a differential set of wheat entries showed differences between strains without clear host specialization. This pathogen causes grain rot, and reduces seedling emergence and yield of subsequent crop (Aulakh *et al.* 1988; Chaudhary *et al*., 1984; Gill and Tyagi 1970; Nestrov 1981). The sources of *B. sorokiniana* inoculum include infected grain, infected crop residues, volunteer plants, secondary hosts and free dormant conidia in the soil (Reis 1991). The yield loss due to this disease in Bangladesh has been reported to be 14.97% (Alam *et al*. 1995). In case of severe attack, it may result 100% yield loss (Hossain and Azad 1994). Leaf blight of the world (Duveiller and Gilchrist 1994). The yield loss has been reported to be 20% in variety Sonalika, and 14% and 8% in Akbar and Kanchan, respectively (Razzaque and Hossain 1991). In farmer's field, 29% yield reduction was estimated in Kanchan during the 1991-1992 crop seasons (Alam *et al*. 1994). Rashid and Fakir (1998) estimated 57.6% and 64.5% yield reduction of wheat at maximum disease incidence due to *B. sorokiniana* in Kanchan and Sonalika, respectively. Though growing resistant varieties is the chief and eco-friendly option for disease management, the level of resistance in high yielding wheat genotypes is still unsatisfactory and needs to be improved significantly in the warmer humid regions in South Asia (Joshi *et al.* 2007). Consequently, an integrated approach with host resistance as a major component is generally considered best for controlling the disease (Joshi and Chand 2002). Considering the above facts, the present investigation was undertaken with the objectives of assessing Bipolaris leaf and head blight intensity and level of grain infection in some important wheat varieties under different dates of sowing.

MATERIALS AND METHODS

The field experiment was conducted at the central farm of the Wheat Research Centre, Bangladesh Agricultural Research Institute (BARI), Nashipur, Dinajpur and grain health test was done at the Department of Plant Pathology, Hajee Mohammad Danesh Science and Technology University (HSTU), Dinajpur during November, 2016 and June, 2017. The initial soil (0-15 cm depth) test at the Soil Resource Development Institute (SRDI), Dinajpur revealed that the soil contained 0.10% total nitrogen, 1.06% organic matter, 24.00 µg/g phosphorus, 0.26 meq/100g potassium, 3.2 µg/g sulphur, 0.27 µg/g boron, 5.30 µg/g iron and 0.90 µg/g zinc with pH 5.51. The rainfall was scanty during the period of experimentation (70 mm). The experiment was laid out in a split-plot design with three replications, where six varieties were assigned in the main plots and five dates of sowing in the sub-plots. The whole experimental plot was divided into three blocks, each having 30 sub-plots comprising a total of 90 unit plots with 3m× 2m size of each. The space kept between the blocks was 1.0 m and between the plots it was 0.5 m.

The varieties were: V_1 = BARI Gom 21 (Shatabdi), V_2 = BARI Gom 27, V_3 = BARI Gom 26, V_4 = BARI Gom 28, V_5 = BARI Gom 30 and V_6 = BARI Gom 29, and the dates of sowing were: S_1= November 15, S_2= December 1, S_3= December 15, S_4 = January 1, and S_5 = January 15. As such the treatment combinations of varieties and sowing dates were: V_1S_1 (BARI Gom 21 × Nov. 15), V_1S_2 (BARI Gom 21 × Dec.1), V_1S_3 (BARI Gom 21 × Dec. 15), V_1S_4 (BARI Gom 21 × Jan. 1), V_1S_5 (BARI Gom 21 × Jan. 15), V_2S_1 (BARI Gom 27 × Nov. 15) , V_2S_2 (BARI Gom 27 × Dec. 1), V_2S_3 (BARI Gom 27 × Dec. 15), V_2S_4 (BARI Gom 27 × Jan. 1), V_2S_5 (BARI Gom 27 × Jan. 15), V_3S_1 (BARI Gom 26 × Nov. 15), V_3S_2 (BARI Gom 26 × Dec. 1), V_3S_3 (BARI Gom 26 × Dec.15), V_3S_4 (BARI Gom 26 × Jan. 1), V_3S_5 (BARI Gom 26 × Jan 15), V_4S_1 (BARI Gom 28 × Nov. 15), V_4S_2 (BARI Gom 28 × Dec. 1), V_4S_3 (BARI Gom 28 × Dec. 15), V_4S_4 (BARI Gom 28 × Jan. 1), V_4S_5 (BARI Gom 28 × Jan. 15), V_5S_1 (BARI Gom 30 × Nov. 15) , V_5S_2 (BARI Gom 30 × Dec.1), V_5S_3 (BARI Gom 30 × Dec. 15), V_5S_4 (BARI Gom 30 × Jan. 1), V_5S_5 (BARI Gom 30 × Jan.15), V_6S_1 (BARI Gom 29 × Nov.15), V_6S_2 (BARI Gom 29 × Dec.1), V_6S_3(BARI Gom 29 × Dec.15), V_6S_4 (BARI Gom 29 × Jan. 1) and V_6S_5 (BARI Gom 29 × Jan. 15).

Recommended fertilizer dose of N 100 + P 26.5 + K 40 + S 20 + Z 4 + B 1 was applied during land preparation where the one-third urea was applied at the time of first irrigation as top dressing.

The seeds were sown at the rate of 120 kg ha^{-1} in line sowing method with 3 cm depth and 20 cm spacing between rows. Intercultural operations, such as weeding, thinning, irrigation, pest management, etc. were done uniformly in the plots. Three irrigations were applied at 20, 55 and 75 days after sowing. Weeding was performed twice during the growing period.

The parameters considered for data collection were percent leaf blight severity (leaf area diseased), percent head blight incidence and 1000-grain weight. Data on leaf blight severity and head blight incidence were recorded from five randomly selected and tagged plants in each plot. Grain health quality were tested after three months of storage in plastic drum container by dry inspection and blotter methods to determine percent grain infection. Data on percent leaf blight severity was recorded at Zadoks growth stages (Zadoks *et al.* 1974) GS-71 (water ripe), GS-75

(medium milk) and GS-83 (early dough) by visual observation of symptoms on 10 flag leaves of 10 plants. Percent leaf blight severity was calculated by using the following formula and standard scale:

$$\% \text{ Leaf blight severity} = \frac{\text{Leaf area infected}}{\text{Total leaf area assessed}} \times 100$$

Data on percent head blight incidence was recorded by visual observation of symptoms after harvesting of the selected plants from each plot and calculated using the formula as follows.

$$\% \text{ Head infection} = \frac{\text{Number of infected spike}}{\text{Total number of spike}} \times 100$$

Head blight severity was recorded on a 0-3 scale as outlined by Rashid and Fakir (1998) and expressed in percentage.

The crop was harvested when 80% of the plants showed the symptom of maturity. Plants were sun-dried and threshed after harvesting. Grains obtained from different plots were properly sun-dried at 12% moisture content. Weights of randomly counted 1000 grains from each plot were taken by a digital electric balance and expressed in gram (g). Four hundred grains from each of the 90 grain samples, three for each of the 30 treatments were randomly taken for grain health testing by dry inspection method. The grains were examined by naked eyes to detect the presence of black point at the embryo region and percent grain infection was calculated. Moreover, 400 grains were taken randomly from each of the 90 grain samples for grain health testing by blotter method using standard technique (ISTA, 2000). Grains were placed on three layers of moist blotting paper (Whatman no. 1) contained in 9 cm petridishes. In each petridish, 25 grains were placed at equidistance. All the plates with grains were incubated at room temperature (25 ± 2C) under 12/12 hours of alternate light and darkness cycle for seven days. Each grain was examined under stereo-binocular microscope to detect the presence of *Bipolaris sorokiniana* and the level of grain infection was expressed in percentage. The collected data for different parameters were compiled and analyzed statistically by SPSS and R Language Program. The treatments were compared by Least Significant Difference (LSD) test.

RESULTS AND DISCUSSION

The effect of five different dates of sowing and six varieties and their interaction on the leaf blight, head blight and grain health quality of wheat caused by *Bipolaris sorokiniana* was investigated in the present study. Leaf blight severity was significantly influenced by different dates of sowing and varieties at three different growth stages. The final leaf blight severity (recorded at GS-83) was found highest in the variety BARI Gom 30 (68.09%) which was followed by BARI Gom 28 (61.67%) and BARI Gom 29 (58.93%), while the lowest was recorded in BARI Gom 21 (38.73%). The disease severity was increased with the advance in growth stages (GS-71→GS-75→GS-83, increase in age) of the plant, which was in agreement with the findings of Alam *et al*. (1994). The variety BARI Gom 21 showed relatively lower disease severity in all the growth stages of the plant (Table 1). With respect to date of sowing, the highest final leaf blight severity was found in Jan. 1 sowing (59.73%), while the lowest disease severity was recorded in Nov. 15 sowing (52.49%). However, the initial disease severity (recorded at GS-71) was statistically similar for all dates of sowing. It is clear from results that Nov. 15 is the optimum date of sowing for minimizing leaf blight severity (Table 2). The Interaction effect between the dates of sowing and varieties on leaf blight severity indicates that the highest final leaf blight severity was recorded in BARI Gom 30 in Dec. 15 sowing (68.58%), whereas the lowest was found in BARI Gom 21 with Nov. 15 sowing (32.49%). Rashid *et al.* (1994) studied on five different wheat varieties to find out the effect of *B. sorokiniana* on yield components where they found maximum disease index in cultivar MS1, while cultivar Nevaprata showed the lowest disease index. Singh *et al.* (1998) found low incidence of leaf blight in early sowning as compared to late sown wheat, which supports the findings of the present study. In case of head blight, the highest (5.06%) disease incidence was found in BARI Gom 28 and the lowest (3.41%) was recorded in BARI Gom 26 which was statistically similar to BARI Gom 21 (Table 1). However, for dates of sowing, the highest (5.17%) incidence of head blight was found in Jan. 15, while the lowest (3.23%) was recorded in Nov. 15. This result indicated that Nov. 15 sowing is suitable for reducing head blight disease (Table 2). In case of the interaction effect of the date of sowing and varieties, the highest (49.10%) head blight severity was assessed in BARI Gom 21 with Dec. 1 sowing, while the lowest (26.20%) was found in BARI Gom 26 with Jan. 15 sowing (Table 3). In grain health test by dry inspection method, the highest percentage of black point infected grain was found in BARI Gom 29 (5.15%) and the lowest grain infection was recorded in BARI Gom 26 (3.51%) which was statistically similar to BARI Gom 21 (Table 1). However, sowing dates showed no significant variation in black point infection. It is noted that the black point infected grain was associated with the

concerned pathogen but healthy looking grains which are supposed to be free of the pathogen might have also been infected with the same pathogen. In this connection, the grains were tested by blotter method where fungal growth was found on the grain. Table 3 revealed that when grains were tested by blotter method, the highest percentage of infected grain was found in BARI Gom 28 with Dec. 15 sowing (4.27%), while the lowest percentage of grain infection was recorded in BARI Gom 26 with Dec. 1 sowing (2.05%). Khanum *et al.* (1987) also stated that natural infection of wheat grains caused by *Bipolaris sorokiniana* was found in all tested varieties with varying levels of incidence. Weights of 1000 grains had significant variation among the different dates of sowing and varieties (Tables 1 and 2). The highest 1000-grain weight was recorded in BARI Gom 21 (45.46 g) while the lowest 1000-grain weight was found in BARI Gom 26 (35.38 g). In case of date of sowing, the highest 1000-grain weight (46.83 g) was recorded in Nov. 15, while the lowest 1000-grain weight (35.59 g) was found in Jan. 15. In interaction effect, the highest 1000-grain weight was assessed in BARI Gom 21 with Dec. 1 sowing (49.10 g) while the lowest 1000-grain weight was recorded in BARI Gom 26 with Jan. 15 sowing (Table 3). Therefore, 1000-grain weight was to some extent influenced by the levels of field disease severity. Santa Islam (2015) while working with irrigation and leaf blight of wheat caused by *Bipolaris sorokiniana*, found that the grain yield increased with the reduction in disease severity. The overall results of the present study indicated a decreasing trend in 1000-grain weight with the increase in disease severity and delay in sowing.

Table 1. Variety response to leaf blight, head blight, grain infection and 1000-grain weight of wheat

Variety	Percent leaf blight severity			Percent head blight infection	Percent infected grain by dry inspection method	Percent infected grain by blotter method	1000-grain weight (g)
	GS-71	GS-75	GS-83				
BARI Gom 21 (Shatabdi)	26.00 d	32.45 e	38.73 d	3.56 c	3.68 b	2.73 b	45.46 a
BARI Gom 27	29.54 c	37.28 d	57.66 c	5.23 a	3.81 b	2.69 b	43.25ab
BARI Gom 26	31.07 bc	38.46 d	58.61 bc	3.41 c	3.51 b	2.53 b	35.38 c
BARI Gom 28	32.83 ab	44.01 c	61.67 b	5.06 a	5.10 a	3.60 a	43.37ab
BARI Gom 30	34.53 a	50.34 b	68.09 a	5.03 a	5.12 a	3.53 a	44.15ab
BARI Gom 29	35.64 a	55.55 a	58.93 bc	4.11 b	5.15 a	3.42 a	41.62 b
LSD (.05)	3.19	3.96	3.51	0.37	0.96	0.61	3.68

Means within a column followed by same letter(s) do not differ significantly at 5% level of probability.

Table 2. Effect of sowing date on leaf blight, head blight, grain infection and 1000-grain weight of wheat

Date of sowing	Percent leaf blight severity			Percent head blight infection	Percent infected grain by dry inspection method	Percent infected grain by blotter method	1000-grain weight (g)
	GS-71	GS-75	GS-83				
November 15, 2016	31.67a	44.08ab	52.49 b	3.23 d	4.04 a	2.87 b	46.83 a
December 1, 2016	31.74a	42.00 b	57.65 a	4.15 c	4.48 a	3.08 ab	43.89 ab
December 15, 2016	31.36a	42.65 ab	57.75 a	4.88 ab	4.70 a	3.37 a	43.59 ab
January 1, 2017	30.90a	41.57 b	59.73 a	4.56 b	4.65 a	3.11 ab	41.12 b
January 15, 2017	32.34a	44.77 a	58.78 a	5.17 a	4.12 a	2.98 ab	35.59 c
LSD (.05)	2.71	2.74	2.01	0.33	0.68	0.47	4.22

Means within a column followed by same letter(s) do not differ significantly at 5% level of probability.

Table 3. Interaction effect of variety and sowing date on leaf blight, head blight, grain infection and 1000-grain weight of wheat

Variety	Date of sowing	Percent leaf blight severity	Percent head	Percent infected	Percent infected grain	

		GS-71	GS-75	GS-83	blight incidence	grain by dry inspection method	by blotter method	1000-grain weight
BARI Gom 21 (Shatabdi)	Nov. 15, 2016	24.87fg	32.49 i	32.49 i	47.67abc	3.75 d-j	2.65 c-j	47.67a-c
	Dec.1, 2016	25.17fg	32.49 i	39.18 h	49.10 a	4.56 b-i	3.22a-i	49.10 a
	Dec. 15, 2016.	22.23g	32.29 i	40.90 h	47.91 a-c	2.81 j	2.29 g-j	47.91 a-c
	Jan. 1, 2017	27.85e-g	32.49 i	42.69 h	43.78 a-d	3.48 e-j	2.58 d-j	43.78a-d
	Jan.15, 2017	29.89d-f	32.49 i	38.41 hi	38.85 a-f	3.82d-j	2.90b-j	38.85 a-f
BARI Gom 27	Nov. 15, 2016	22.53g	32.49 i	52.84 fg	48.45 ab	3.82 d-j	2.70 c-j	48.45 ab
	Dec.1, 2016	29.89d-f	34.65 hi	59.56cde	44.66 a-d	3.51 e-j	2.48 e-j	44.66 a-d
	Dec. 15, 2016.	30.10 c-f	39.38 f-h	60.00 c	45.49 a-d	4.84 b-f	3.42 a-g	45.49 a-d
	Jan. 1, 2017	30.33 c-f	36.62 g-i	57.73 c-g	45.87 a-d	2.94 h-j	2.08 ij	45.87 a-d
	Jan.15, 2017	34.85b-d	43.27efg	58.18 c-f	31.81e-g	3.90 d-j	2.76 c-j	31.81 e-g
BARI Gom 26	Nov. 15, 2016	30.33c-f	36.82g-i	53.06 e-g	44.35 a-d	3.39 f-j	2.40 f-j	44.35 a-d
	Dec.1, 2016	29.89d-f	34.65 hi	60.00 c	38.33 b-f	2.90 ij	2.05 j	38.33 b-f
	Dec. 15, 2016.	30.13 c-f	36.82 g-i	59.78 cd	30.30 fg	3.72 d-j	2.63 c-j	30.30 fg
	Jan. 1, 2017	34.65 b-d	42.88 e-g	60.22 c	37.75 c-f	4.80 b-f	3.39 a-g	37.75 c-f
	Jan.15, 2017	30.33 c-f	41.1 f-h	60.00 c	26.20 g	2.72 j	2.17 h-j	26.20 g
BARI Gom 28	Nov. 15, 2016	35.06 b-d	45.18 d-f	55.61c-g	45.99 a-d	4.90 b-f	3.47 a-f	45.99 a-d
	Dec.1, 2016	32.29 c-e	43.65ef	67.24 ab	45.66 a-d	5.22 a-d	3.69 a-d	45.66 a-d
	Dec. 15, 2016.	30.13 c-f	41.30 f-h	57.69 c-g	46.48 a-d	6.04 ab	4.27 a	46.48 a-d
	Jan. 1, 2017	30.13 c-f	36.62 g-i	68.03 ab	36.84 d-f	4.58 b-h	3.24 a-h	36.84 d-f
	Jan.15, 2017	36.57 bc	53.28 bc	59.78 cd	41.88 a-e	4.76 b-g	3.37 a-g	41.88 a-e
BARI Gom 30	Nov. 15, 2016	32.49 c-e	57.29 ab	67.48 ab	48.21 ab	3.12 g-j	2.28 g-j	48.21 ab
	Dec.1, 2016	40.90 ab	55.42 a-c	68.31ab	44.95a-d	6.66 a	4.18 a	44.95 a-d
	Dec. 15, 2016.	34.66 b-d	48.84 c-e	68.58 a	47.45 a-c	5.62 a-c	3.97 ab	47.4 a-c
	Jan. 1, 2017	32.30 c-e	45.18 d-f	67.76 ab	43.53 a-d	5.30 a-d	3.75 a-c	43.53 a-d
	Jan.15, 2017	32.29 c-e	44.99 d-f	68.31 ab	36.60 d-f	4.913 b-f	3.47 a-f	36.60 d-f
BARI Gom 29	Nov. 15, 2016	44.76 a	53.47 a-c 60.22 c	60.22 c 53.47 a-c	37.76 a-c	5.24 a-d	3.70 a-d	46.34 a-d
	Dec.1, 2016	32.30c-e	51.11 b-d	51.63g	35.30 c-e	4.03 c-j	2.85 b-j	38.87 a-f
	Dec. 15, 2016.	40.90 ab	57.29 ab	59.56 c-e	36.90ab	5.13 a-e	3.63 a-e	45.74 a-d
	Jan. 1, 2017	30.13 c-f	55.64 ab	61.96 bc	34.13 c-f	6.77 a	3.64 a-d	38.94 a-f
	Jan.15, 2017	30.13 c-f	53.50 a-c	68.03 ab	35.13 c-f	4.57 b-i	3.23 a-h	38.21 b-f
LSD (.05)		6.64	6.71	2.01	0.81	1.67	1.15	10.34

Means within a column followed by same letter(s) do not differ significantly at 5% level of probability.

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