Evaluation of Some improved Wheat (*Triticum aestivum* L.) Genotypes for Growth and Yield Potential

ABSTRACT

An experiment was conducted at the Research Farm of the Department of Genetics and Plant Breeding of Hajee Mohammad Danesh Science and Technology University, Dinajpur, Bangladesh during 2015-2016 to study the performance of the selected wheat variety based on some morphological traits. Twenty four wheat varieties were used in the experiment where they were collected from Wheat Research Centre, Bangladesh Agriculture Research Institute, Dinajpur. The experiment was conducted in randomized completely blocked design with three replications. Different yield contributing traits like thousand grain weight (g), number of grains per spike, number of spikelet's per spike, days to anthesis, heading days, plant height (cm), days to maturity and grain yield (g/plot) were assayed. The result of the analyses of variance for all the traits showed significant differences among the genotypes. The experimental result demonstrated that the variety PYT-15, BARI Gom 25 and PYT-12 performed better among the tested genotypes in relation to yield and yield contributing traits and those could be recommended for further popularization in different parts of Bangladesh.

Key words: Genotypes, Growth, Performance, Yield and Wheat

1. INTRODUCTION

Being the king of cereals, wheat is the staple food all over the world [1] that contributes more calories and proteins than any other cereal crops to the world diet [2, 3, 4]. All over the world wheat is a very nutritious food grain among the all grains and grows across the globe due to its wider genotypic adaptability. It is consumed as staple food by more than 35% of world population [5]. Wheat plays an important role in the nutrition of rapidly growing population both in our country and the world as used for both human and animal nutrition [6]. All over the world wheat product(s) are consumed in one of these forms viz. chapati, bread, biscuit, pasta and fermented products [7]. Besides this, wheat is considered a good sink of protein, minerals, B-group vitamins and dietary fiber [8, 9]. The wheat germ or embryo is relatively rich in protein, fat and several of the B-vitamins [10]. Nowadays the production of wheat is increasing in many countries due to its higher demand as a consequence of faster population growth [11]. After rice, wheat is the second most important cereal crop in Bangladesh [12] and per year its consumption rate is increasing about 3% [13]. But in Bangladesh the annual wheat production is about only 1.4 million tons [14] which is much lower than the national annual demand. Despite to higher yield potentiality the average yield of Bangladeshi wheat

From production and industry point of view, to achieve the maximum production from a limited land there is a necessity to improve the productivity of wheat per unit area. To improve productivity the traditional plant breeding techniques are affordable, sustainable and eco-friendly. For selection of better type a plant breeding program needs enough genetic variation. Careful selection may help to obtain lines higher in yields with better quality. Genetic variability can offer opportunity for the effective selection for high yielding wheat variety rich in grain quality. It may require maximizing wheat production rather than economic yield, depending on global food policy and production. In order to explore the varietals potentiality in maximizing wheat yield and to assist breeding program in selecting lines with higher yield potentials, the yield potentiality of newly developed wheat varieties and promising lines are needed to investigate. Keeping these points in mind the present investigation was undertaken to evaluate the performance of some selected genetically diverged wheat genotypes.

2. MATERIALS AND METHODS

By using 24 wheat base materials this field research was conducted at the Research Farm of the department of Genetics and Plant Breeding of Hajje Mohammad Danesh Science and Technology University (Table 1). The seeds were collected from WRC (Wheat Research Centre) of Bangladesh Agricultural Research Institute. The experiment was conducted in a Randomized Complete Block Design (RCBD) with three replications. The experimental soil was sandy loam with the unit plot size 2.0 m x 5.0 m. The plot to plot distance was 0.75 m and block to block was 1.5 m. The manures and fertilizers like Cow dung, Urea, TSP, MOP, Gypsum and Boric acid were applied at the rate of 1000, 163, 170, 100 and 6 kg/ha, respectively. After final land preparation, full doses of P, K, S, Zn, B and one third of N were mixed thoroughly into the soil. The rest amount of N was applied at 21 and 53 days after seedlings emergence split into two equal amounts. The seeds of the selected genotypes were sown on 23 November 2015 in rows of 20 cm apart, at the rate of 120 kg per ha. Recommended wheat production procedure was followed [16].

When all the plants turned brown and matured properly then the crop was harvested. The harvesting for the collection of yield data was completed on 26 March, 2016. Data were collected on the following characters: thousand grain weight (g), number of grains per spike, number of spikelet's per spike, days to anthesis, heading days, plant height (cm), days to maturity and grain yield (g/plot).

Table 1. Name and sources of the wheat genotypes

Sl. No.	Name	Source	Sl. No.	Name	Source
1	Aghrani	WRC, BARI	13	PYT-6	WRC, BARI
2	Protiva	WRC, BARI	14	PYT-11	WRC, BARI

6	Sufi	WRC, BARI	18	PYT-15	WRC, BARI
7	Bijoy	WRC, BARI	19	PYT-16	WRC, BARI
8	Prodip	WRC, BARI	20	PYT-18	WRC, BARI
9	BARI Gom 25	WRC, BARI	21	PYT-19	WRC, BARI
10	BARI Gom 26	WRC, BARI	22	PYT-20	WRC, BARI
11	BARI Gom 27	WRC, BARI	23	PYT-21	WRC, BARI
12	BARI Gom 28	WRC, BARI	24	BAW-1135	WRC, BARI

2.1 Data analysis

R- Program version 3.2.2. was used to prepare analysis of variance and to test the differences among genotypes Duncan's Multiple Range Test (DMRT).

3. RESULTS AND DISCUSSION

3.1 Performance of the traits on the basis of analysis of variance

The analysis of variance and mean performance of the traits viz. 1000-grain weight (g), number of grains per spike, number of spikelets per spike, days to anthesis, heading days, plant height (cm), days to maturity and grain yield (g/plot) are presented in the table 2 and 3 respectively. The results exhibit that there was significant variation among the varieties for almost all the traits indicating considerable amount of genetic variation in the experimental materials. So, there has a great scope for the improvement of such traits through selection. The co-efficient of variation was low for most of the traits but differed from the lowest value (2.03%) in plant height (cm) to the highest 7.54% in 1000-grains weight (g).

3.2 Mean performance of the wheat genotypes

The mean performance of the 24 wheat varieties for yield and yield related traits showed significant variation. These are described below-

1000-grain weight

The 1000-grain weight (g) is one of the most important characters for choosing the wheat cultivar. It was ranged from 60.46-39.09 (g). The highest thousand grain weight was recorded in the genotype PYT-12 (60.46 g) and lowest was found in Sawrav (39.09 g) followed by the genotypes Sufi, Aghrani and PYT-18 (Table 3). Also found the similar observation [17].

genotype PYT-15 (53.43), Sawrav (52.07) while the lowest from the Protiva (40.33) followed by the Bijoy (42.77), BAW-1135 (43.20) and PYT-18 (44.33) statistically similar with PYT-16 and BARI Gom 25 (Table 3). It has been observed in recently developed genotypes produced more grains per spike [18] and significant differences among the cultivars in the grains per spike [19] and [20].

Number of spikelet per spike

A wide range of variation was found among the genotypes in relation to number of spikelet per spike. It was ranged from 22.50-16.80. PYT-16 (22.50) produced the highest spikelets per spike which was statistically similar to Protiva. On the contrary, Gourav (16.80) followed by PYT-19 and BARI Gom 26 produced the lowest spikelets per spike (Table 3).

Days to anthesis

Significant variation in respect of days to anthesis was observed among the selected varieties indicating the presence of wide variability. Days to anthesis of genotypes ranged from 84.00-74.33. The highest anthesis day was recorded in the variety BARI Gom 25 (84.00) statistically similar with BARI Gom 26, Shatabdi, Sufi, Bijoy, Protiva, Sawrav, Gourav, PYT-6, PYT-11, PYT-12, PYT-13, PYT-14, PYT-16 and PYT-21. On the other hand, lowest days to anthesis was found in the genotype PYT-19 (74.33) which also statistically similar with PYT-21, PYT-15, BAW-1135 and Aghrani (Table 3). The Bangladesh Agriculture Research Institute (BARI) developed the wheat genotypes which are taking maximum days to anthesis [17].

Days to heading

Heading days is an important character in Bangladesh condition. The genotypes which head later are exposed to high temperature and grains become shriveled. So early heading is important. Days to heading showed significant variation among the genotypes. It ranged from 76.00-62.33 among the genotypes. The highest heading days was recorded in the genotype Shatabdi (76.00) followed by the genotype PYT-28 (75.67) and PYT-20 (75.00) those are statistically similar (Table 3). On contrast, the lowest heading days was found in the genotype PYT-19 (62.33). Revealed the same observation and reported that delay head is related to shriveling of wheat grain [21].

type suffers from lodging. BARI Gom 25, BARI Gom 28, PYT-6, PYT-12, PYT-13 and PYT-18 were considered as semi dwarf genotypes having the plant height within the range 92.02-116.1 (cm). The maximum plant height was showed by Protiva (116.1 cm) and minimum from BAW-1135 (92.02 cm) which are statistically different from other genotypes (Table 3). Reported significant variation in plant height of wheat genotypes and semi dwarf plant types are the desirable one [22].

Days to maturity

For identification of the early maturing genotypes, days to maturity are important. The variation in days to maturity among the different genotypes was found to statistically significant (Table 2). A wider range of variation was observed among the genotypes those ranked from 100.7-111.00 days (Table 3). Among the genotypes BAW-1135 (100.7) matured earlier followed by PYT-19 (101.0), PYT-18 (102.7), Aghrani (103.3), Gourav (103.7) and PYT-18 (104.3) those are statistically different from other genotypes for the highest value. Therefore, these genotypes could be considered as promising for breeding early matured wheat genotypes. Narrated that early mature genotypes are escaper from different environmental stresses especially in south Asian countries where short winter season prevails [23].

Yield per plot

Grain yield per plot is the ultimate goal for a breeding programme. Wide range of variation was found among the genotypes for yield per plot and ranged from 4460.0-5813.0 (g). The genotype PYT-15 was the best performer considering yield per plot (5813.0 g) and statistically similar with PYT-20, PYT-18, PYT-21, BARI Gom 26, PYT-13 and Shatabdi were also the high yielding genotypes those are statistically likewise with the highest performer genotypes. On the other hand, PYT-16 (4460.0 g) was lower performer which statistically alike with Sawrav, PYT-6, Prodip, Aghrani, Bijoy, Gourav, BARI Gom 27, BARI Gom 25 and BAW-1135. Stated variation for yield and yield contributing traits in wheat [22]. Found remarkable variation in wheat yield per plant [23].

4. CONCLUSION

popularization of these genotypes in Bangladesh especially in northern parts. Since the experiment is one site one season experiment, to generate more reliable information on performance of genotypes across location and year further studies using combination of locations and seasons is required.

Table: 2. Analysis of variance for different plant traits in wheat

Items	df	Thousand grains weight (g)	Number of grains per spike	Number of spikelet per spike	Days to anthesis	Days to heading	Plant height (cm)	Days to maturity	Yield per plot (g)
Replication	3	0.38^{NS}	25.45**	1.78^{NS}	6.11**	11.62**	51.14**	38.15**	8.19**
Genotypes	24	4.77**	4.38**	5.82**	2.27**	13.65**	21.96**	1.99^{NS}	3.88*
Error	72	13.766	7.704	0.794	13.007	2.070	4.300	10.536	93532.548
Coefficient of Variation		7.54%	5.82%	4.59%	4.56%	2.05%	2.03%	3.06%	6.04%

**** and * indicates significant at 0.01 and 0.05 level of probability, respectively; NS means not significant**

Table 3: Mean performance of different traits of wheat genotypes

Genotype	1000-grain weight(g)	Number of grains per spike	Number of spikelet per spike	Days to anthesis
Aghrani	43.38 efg	51.40 abcd	18.50 f-h	75.67 c-e
Protiva	48.96 bcde	40.33 i	21.37 ab	78.00 a-e
Sawrav	39.09 g	52.07 abc	20.20 b-f	77.00 a-e
Gourav	46.54 c-f	48.20 b-g	16.80 i	77.33 a-e
Shatabdi	47.39 b-f	47.27 c-h	19.67 c-g	81.67 a-d
Sufi	41.54 fg	48.60 b-g	19.60 c-g	76.00 c-e
Bijoy	50.12 b-e	42.77 hi	19.13 c-h	80.67 a-e
Prodip	52.47 bc	49.57 a-f	20.57 bc	81.33 a-e
BARI Gom 25	53.26 bc	44.87 e-i	20.63 bc	84.00 a
BARI Gom 26	47.36 b-f	54.43 a	17.97 g-i	79.33 a-e
BARI Gom 27	52.25 bc	46.60 c-h	18.43 gh	76.67 b-e
BARI Gom 28	46.04 c-f	47.07 c-h	19.27 c-h	75.33 de
PYT-6	51.20 b-d	46.00 d-h	20.40 b-d	82.00 a-d
PYT-11	46.45 c-f	48.07 b-h	19.13 c-h	83.67 ab
PYT-12	60.46 a	46.77 c-h	19.30 c-h	82.00 a-d
PYT-13	54.30 b	48.40 b-g	18.40 gh	82.67 a-c
PYT-14	54.31 b	49.87 a-e	20.27 b-e	81.67 a-d
PYT-15	48.90 b-e	53.43 ab	18.60 e-h	75.00 de
PYT-16	51.97 b-d	44.57 e-i	22.50 a	81.67 a-d
PYT-18	44.90 d-g	44.33 f-i	19.07 c-h	79.33 a-e
PYT-19	52.17 b-d	48.47 b-g	17.83 hi	74.33 e
PYT-20	47.45 b-f	49.43 a-f	19.37 c-h	81.67 a-d
PYT-21	53.15 bc	48.63 b-g	20.43 bc	75.33 de
BAW-1135	47.45 b-f	43.20 g-i	18.67 d-h	75.33 de
LSD (0.05)	6.098	4.562	1.464	5.927
Min	39.09	40.33	16.80	74.33
Max	60.46	54.43	22.50	84.00

Table 3: Mean performance of different traits of wheat genotypes

Genotype	Days to heading	Plant height(cm)	Days to maturity	Yield per plot(g)
Aghrani	67.67 f-h	97.58 gh	103.3 b-e	4633.0 d-f
Protiva	71.00 c-e	116.1 a	108.7 a-c	5073.0 b-e
Sawrav	72.67 bc	100.7 fg	108.0 a-c	4583.0 ef
Gourav	67.33 gh	97.17 gh	102.7 c-e	4863.0 c-f
Shatabdi	76.00 a	107.6 b-d	111.0 a	5283.0 a-c
Sufi	70.00 c-g	109.5 b	106.0 a-e	5227.0 b-d
Bijoy	70.67 c-e	108.4 bc	108.7 a-c	4853.0 c-f
Prodip	71.00 c-e	105.0 c-e	109.7 ab	4603.0 ef
BARI Gom 25	69.00 e-h	104.1 d-f	107.0 a-e	4920.0 c-f
BARI Gom 26	69.67 d-g	98.32 gh	109.3 ab	5393.0 a-c
BARI Gom 27	67.67 f-h	96.05 h	106.3 a-e	4903.0 c-f
BARI Gom 28	71.33 c-e	103.0 ef	105.0 a-e	5143.0 b-e
PYT-6	70.00 c-g	102.7 ef	105.3 a-e	4583.0 ef
PYT-11	72.33 cd	97.43 gh	107.0 a-e	5133.0 b-e
PYT-12	69.67 d-g	104.1 d-f	106.3 a-e	5117.0 b-e
PYT-13	69.33 e-g	102.7 ef	104.7 a-e	5283.0 a-c
PYT-14	70.67 c-e	98.57 gh	105.7 a-e	5167.0 b-e
PYT-15	67.33 gh	106.5 b-e	107.3 a-d	5813.0 a
PYT-16	70.33 c-f	96.50 h	107.0 a-e	4460.0 f
PYT-18	75.00 ab	104.1 d-f	104.3 b-e	5440.0 a-c
PYT-19	62.33 i	97.03 gh	103.7 b-e	5063.0 b-e
PYT-20	75.67 a	107.2 b-d	108.3 a-c	5637.0 ab
PYT-21	67.33 gh	95.23 hi	101.0 de	5433.0 a-c
BAW-1135	66.33 h	92.02 i	100.7 e	5003.0 c-f
LSD (0.05)	2.365	3.408	5.335	502.6
Min	62.33	92.02	100.7	4460.0
Max	76.00	116.1	111.0	5813.0

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