ISSN 0258-7122 (Print), 2408-8293 (Online)
Bangladesh J. Agril. Res. 45(1): 21-27, March 2020

PERFORMANCE AND POSSIBILITY OF GROWING WHEAT VARIETIES IN CHALAN BEEL AREA

M. A. K. MIAN[1] AND A. A. BEGUM[2]

Abstract

The experiment was conducted at Dobila, Tarash of Shirajgonj in Chalan Beel during *rabi* season of 2016-17 and 2017-18. The treatments were four wheat varieties *viz*. 'BARI Gom-25', 'BARI Gom-26', 'BARI Gom-28' and 'BARI Gom-30'. Wheat var. 'BARI Gom-30' produced the highest grain yield (5.02 t/ha in 2016-17 and 4.83 t/ha in 2017-18 with pooled value of 4.93 t/ha) associated with higher number of spikes/m^2 (372-444/m^2 with pooled value of 408/m^2) and higher number of grains/spike (pooled value of 45/spike). 'BARI Gom-30' required field duration of 113 days. Two years' results revealed that 'BARI Gom-30' performed better in Chalan Beel area in respect of higher mean grain yield (4.93 t/ha) and economics (Gross margin of Tk.100400/ha and BCR of 1.78). There was no blast infestation in the experimental field in both the years. Farmers showed moderate interest to grow wheat in Chalan Beel area specially in upland (medium low land of Beel) condition. Among the wheat variety 'BARI Gom-30' could be suitable for cultivation in Chalan Beel area.

Introduction

Beel (Low land and remains under water about 4-5 months from July to November) covering an area of 2.43 million hectares in Bangladesh (Aziz *et al.,* 2016). *Boro*-fallow is the major cropping pattern in beel area. Previous survey and experience indicate that farmers also grow maize, wheat, mustard, garlic, lentil, onion, pea, lathyrus and potato in beel area especially upper side land (*Kandha*) of beel (BARI, 2016). Although the farmers of this area grow some crops but they do not use improved crop varieties and production technologies (Islam *et al*., 2012). Previous research indicates that there is a possibility of improving productivity of different crops and cropping pattern through adaptation of HYV of crops along with their production technologies. *Boro* rice is the main crop in beel area which require huge amount of water *i.e*. one kg *boro* rice production requires 2500 liter water (Bouman, 2009). On the other hand, wheat and maize require 1300 litre and 900 liter water, respectively (Bouman, 2009). Consequently, *boro* rice cultivation depleted huge amount of underground water resulting depletion of underground water level. Chalan Beel is the largest wetland in northern Bangladesh, uniqueness for largely drastic falls in water level (Anon. 2017). Lifting of underground water is becoming a problem for farmers. Hence, alternate cropping rather than *boro* rice can save underground water

[1&2]Agronomy Division, Bangladesh Agricultural Research Institute (BARI), Gazipur-1701, Bangladesh.

resource as well as environment. Early flooding may cause damage the *boro* rice. In this context, *boro* rice can be replaced by wheat, potato, maize, mustard, garlic, lentil, onion and winter vegetables. These crops require low water as compared to *boro* rice. Wheat is the most important staple food crop in temperate zones and its demand is also increasing there. Being a major source of starch and energy, wheat also provides substantial amounts of protein, minerals, fat, calcium, iron, carotene, vitamin B-1, vitamin B-2 and other phytochemicals which are essential or beneficial for human and animal health (AIS, 2018). Wheat cultivation requires less cost as compared to *boro* rice. Moreover, use of HYV wheat and improved management practice can improve the yield of wheat and could save underground water use as compared to *boro* rice cultivation in beel area. Therefore, the experiment was undertaken to find out the performance wheat varieties in Chalan Beel area.

Materials and Methods

The experiment was conducted at Dobila, Tarash of Shirajgonj in Chalan Beel area during *rabi* seasons of 2016-17 and 2017-18. Soil of the experimental location was silty clay with pH value 7.24 and organic matter content 2.11% while nutrient like N, P, K, S, Zn and B were 0.088(%), 33.05 (ppm), 0.274 (meg/100 g), 17.08(ppm), 0.673 (ppm) and 0.23 (ppm) respectively (Appendix-1). The treatments were four wheat varieties *viz.* 'BARI Gom-25', 'BARI Gom-26', 'BARI Gom-28' and 'BARI Gom-30'. The experiment was laid out in a RCB design with four replications. The unit plot size was 8 m× 5 m. The crop was fertilized with 100-36-25-20-1.8-1.0 kg/ha of N-P-K-S-Zn-B (BARI, 2011). All the nutrients including 2/3 of N were applied as basal. Rest 1/3 of N was top dressed at CRI stage (17-21 days after sowing: DAS). Two irrigations were applied at 20 DAS and 50 DAS. Crop field was weeded once at 25 DAS. The crop was sown on 5 December 2016 and on 3 December 2017 but harvested on 27 March in both the years. Data on yield and yield components of wheat were recorded. The year wise and pooled data was subjected to statistical analysis with $LSD_{(0.05)}$ test following Statistix 10 Trial (Anon. 2018). Economic analysis of the study was also done. There was no blast infestation in the experimental field in both the years. Farmer's opinion about wheat cultivation was recorded. Cost and return analysis of *boro* rice cultivation was also done on the basis of five farmers' field of *boro* rice adjacent to wheat experimental field for comparison of economic returns. Agro-ecological information of the experimental site (Appendix-1) and weather data (Appendix-2) have been presented in appendices.

Results and Discussion

There was no significant variation in yield and yield attributes, so pooled analysis was done. Spikes/m^2, grains/spike, 1000-grain weight, grain yield, straw yield, harvest index and field duration were significant as influenced by different

varieties but plant height was not significant as well as spikes/m^2 in 2016-17 (Tables 1 & 4). Plant height ranged 89-93 cm in 2016-17 and 90-91cm in 2017-18 while the pooled value ranged 90-92 cm. Number of spikes/m^2 was not varied significantly in 2016-17 but it was found significant in 2017-18 while the highest (444/m^2) was counted in 'BARI Gom-30' (Table 1). Pooled value of spikes/m^2 noticed higher in (408/m^2) in ' BARI Gom-30' followed by 'BARI Gom-28' (369/m^2) but other three varieties ranged 336-357/m^2 (Table 1). Variation of spikes/m^2 among the varieties was also reported by BARI, 2018. Number of grains/spike was found the highest (pooled value of 45/spike) in 'BARI Gom-30' in both the years while other varieties gave lower values (pooled value of 33-37/spike) (Table 2). Number of grains/spike of individual variety showed similar trend in both the years. This might be happened due to similar average temperature (28.5 ^{0}C in March both of 2017 and 2019) and total sun shine hours (313 in March 2017 and 314 in March in 2019) in grain filling stage (March) of wheat in both the years (Appendix-2). The Pooled 1000-grain weight was noticed the highest in 'BARI Gom-26' (49.28 g) followed by 'BARI Gom-28' (46.05 g) while lower value (40.55-41.00 g) was observed in 'BARI Gom-25' and 'BARI Gom-30' (Table 2). 'BARI Gom-26' produced higher 1000-grain weight due to bolder grain size as compared to other varieties (BARI, 2017). Variation of spikes/m^2, grains/spike and 1000-grain weight of varieties mainly controlled by genetical inheritance. Pooled grain yield was recorded higher (4.93 t/ha) in 'BARI Gom-30' (ranged 4.83-5.02 t/ha) followed by 'BARI Gom-28' (pooled value of 4.62 t/ha) (Table 3). The highest grain yield in 'BARI Gom-30' might be contributed by the cumulative effect of spikes/m^2 and grains/spike. Higher harvest index (44.22%) and biological yield could possibly enhanced to produce higher grain yield in 'BARI Gom-30' as compared to other varieties (Table 3). Similar results also have been reported by Mian and Begum (2018). On the contrary, 'BARI Gom-25' produced lower grain yield (4.21 t/ha), might be due to lower number of spike/m^2, grains/spike and lower 1000-grain weight. However, grain yield produced higher in 2016-17 as compared to 2017-18 irrespective of varieties (Table 3). This might be happened due to bit low temperature (32 ^{0}C) in March 2017 as compared to March (34 ^{0}C) of 2018 at grain filling stage and also of receiving higher total SSH (1001) in the growing season in 2016-17 as compared to 2017-18 (Appendix-2). Pooled straw yield was observed the highest (6.22 t/ha) in 'BARI Gom-30' followed by 'BARI Gom-25' (6.09 t/ha) and the lowest (5.91) in 'BARI Gom-26' followed by 'BARI Gom-28' (Table 3). Higher straw yield indicated better crop growth resulted higher grain yield in 'BARI Gom-30' (Table 3). Harvest index and field duration varied significantly among the varieties in both the years while mean value of field duration was not significant (Table 4). Pooled harvest index was higher (ranged in 43.20-44.22%) in all varieties except 'BARI Gom-25' (40.82%). Higher harvest index occurred possibly to better dry matter partitioning in grain or better sink in the grain. The results are in agreement with the observation of Mian (2008). 'BARI Gom-30'

required field duration of 113 days while other showed values of 110-111 days (Table 4). This difference might he due to interaction of varietal characters and environment (mainly temperature). Cost and return analysis of wheat as influenced by varieties have been presented in Table 5. The cost of cultivation was same in all varieties (Tk.56430/ha). The highest BCR (1.78) was found in 'BARI Gom-30' due to highest gross return (Tk.100400/ha). Gross return (Tk. 100400/ha) and gross margin (Tk.43970/ha) was also found higher in 'BARI Gom-30'. 'BARI Gom-30' was found superior in Chalan Beel area in respect of higher grain yield, monetary return and BCR (1.78). Results are in agreement with the findings of Mian and Begum (2018). There was no blast infestation in the experimental field. *Boro* rice cultivation gave lower values of monetary returns (Gross return of Tk. 90300/ha and gross margin of Tk.25410 /ha) and BCR (1.39) due to higher production cost and lower price of rice. Thus less economic returns and lower BCR were calculated in *boro* rice cultivation in Chalan Beel area.

Farmers showed moderate interest to grow wheat var. 'BARI Gom-30' in Chalon Beel area than that of *boro* rice cultivation.

Table 1. Plant height and spikes/m^2 of wheat varieties at Chalan Beel (2016-2018 and Pooled)

Variety	Plant height (cm)			Spikes/m^2 (no.)		
	2016-2017	2017-2018	Pooled	2016-2017	2017-2018	Pooled
'BARI Gom-25'	90	91	91	362	309	336
'BARI Gom-26'	93	90	92	348	366	357
'BARI Gom-28'	89	91	90	369	369	369
'BARI Gom-30'	91	91	91	372	444	408
LSD $_{(0.05)}$	NS	NS	NS	NS	53	48
CV (%)	6.88	4.37	6.12	5.69	9.93	8.25

Table 2. Grains/spike and 1000-grain weight of wheat varieties at Chalan Beel (2016-2018 and Pooled)

Variety	Grains/spike (no.)			1000-grain weight (g)		
	2016-2017	2017-2018	Pooled	2016-2017	2017-2018	Pooled
'BARI Gom-25'	35	34	34	40.60	40.50	40.55
'BARI Gom-26'	33	33	33	49.30	49.25	49.28
'BARI Gom-28'	37	37	37	46.10	46.00	46.05
'BARI Gom-30'	45	45	45	41.50	40.50	41.00
LSD $_{(0.05)}$	2.07	2.94	2.37	4.41	4.06	4.62
CV (%)	3.45	3.60	3.98	6.22	6.14	6.67

Table 3. Grain yield and straw yield of wheat varieties at Chalan Beel (2016-2018 and Pooled)

Variety	Grain yield (t/ha)			Straw yield (t/ha)		
	2016-2017	2017-2018	Pooled	2016-2017	2017-2018	Pooled
'BARI Gom-25'	4.59	3.83	4.21	6.35	5.83	6.09
'BARI Gom-26'	4.52	4.46	4.49	6.06	5.75	5.91
'BARI Gom-28'	4.63	4.60	4.62	6.09	5.79	5.94
'BARI Gom-30'	5.02	4.83	4.93	6.45	5.97	6.22
LSD $_{(0.05)}$	0.45	0.39	0.44	0.33	0.25	0.24
CV (%)	6.42	5.53	6.13	4.25	5.38	4.86

Table 4. Harvest index and field duration of wheat varieties at Chalan Beel (2016-2018 and Pooled)

Variety	Harvest index (%)			Field duration (day)		
	2016-2017	2017-2018	Pooled	2016-2017	2017-2018	Pooled
'BARI Gom-25'	41.96	39.69	40.82	111	110	111
'BARI Gom-26'	42.72	43.68	43.20	110	109	110
'BARI Gom-28'	43.19	44.27	43.73	112	108	110
'BARI Gom-30'	43.77	44.68	44.22	112	113	113
LSD $_{(0.05)}$	0.97	1.11	1.79	1.91	3.71	NS
CV (%)	2.19	2.45	2.61	2.18	3.11	2.89

Table 5. Cost and returns of analysis of four wheat varieties at Chalan Beel (Average of 2016-2017 and 2017-2018)

Variety	Cost of cultivation (Tk./ha)	Gross return (Tk./ha)	Gross margin (Tk./ha)	BCR
'BARI Gom-25'	56430	91800	35370	1.63
'BARI Gom-26'	56430	90400	33970	1.60
'BARI Gom-28'	56430	92600	36170	1.64
'BARI Gom-30'	56430	100400	43970	1.78
Boro rice	64890	90300	25410	1.39

Wheat grain: Tk.20/kg, *Boro* rice grain: Tk. 15/kg, Wheat straw: Tk.0.50/kg Rice straw: Tk. 4/kg

Conclusion

Two years' results revealed that wheat var. 'BARI Gom-30' performed better in Chalan Beel area in respect of higher grain yield (4.93 t/ha) and economic return (BCR of 1.78). Wheat cultivation was more profitable as compared to *boro* rice

cultivation in upland (medium low land of beel) of Chalan Beel area. So wheat var. 'BARI Gom-30' could be recommended for Chalan Beel area.

Acknowledgement

Acknowledged to Agronomy Division, BARI and NATP-2, BARC subproject (ID-688), BARC for research funding and logistic support.

Appendix 1. Agro-ecological information of the experimental site

Name of information	Description
Agro-ecological Zone (AEZ)	Site belongs to AEZ-5 (Sirajganj)
Rainfall (Average)	1784 mm
Temperature (Average)	25.5 ^{0}C
Land Type	Medium low land (generally water depth 1.4-2.30 m) Water logged 4-5 month from July to end of October
Soil texture	Silty clay
Major cropping pattern	*Boro*-Fallow
Soil pH	7.24
Organic matter (%)	2.11
N (%)	0.088
P(ppm)	33.05
K (meq/100g)	0.274
S (ppm)	17.08
Zn (ppm)	0.673
B (ppm)	0.235

Source: Adapted from Mian, M.A.K and A.A. Begum 2018. and https://www.worldweatheronline.com/sirajganj-weather-averages/bd.aspx(Sirajganj Monthly Climate Averages: visited on 19 .7.2019).

Appendix 2. Weather data (2016-17 and 2017-2018) of the experimental location at Chalan Beel (Sirajganj)

Month	Monthly average temperature ^{0}C		Total Sun shine hour (TSSH)	Total rainfall (mm)	Relative humidity (%)
	Maximum	Minimum			
1st year (2016-2017)					
December 2016	28	18	233	0.01	56
January 2017	27	20	231	0.19	43
February 2017	30	23	224	0.11	39
March 20107	32	25	313	31.15	52
Total	*Av. 29.25	Av.21.50	1001	31.46	Av. 47.50

Month	Monthly average temperature ^{0}C		Total Sun shine hour (TSSH)	Total rainfall (mm)	Relative humidity (%)
	Maximum	Minimum			
2nd year (2017-2018)					
December 2017	27	19	127	8.65	60
January 2018	24	15	230	0.00	46
February 2018	30	19	220	0.55	41
March 20108	34	23	314	8.63	40
Total	Av. 28.75	Av.19.00	891	17.83	Av. 46.75

Source: Adapted from https://www.worldweatheronline.com/sirajganj-weather-averages/bd.aspx(Sirajganj Monthly Climate Averages: visited on 19 .7.2019), * Av.=Average value

Reference

AIS (Argil. Information Service). 2018. *Krishi Diary* (In Bangla). Department of Argil. Extension. Khamarbari, Dhaka1215. Pp.14-119. (www. Bangladesh deltaplan 2100 (visited on 19.01.2017)

Anonymous. 2018. (https://en.freedownloadmanager.org/users-choice/Statistix_10.html, visited on 3 March 2018).

Anonymous.2017. Chalan Beel Under threat. *In:* Project of the General Economic Division, Planning commission, Govt. Peoples Repub. Bangladesh.

Aziz, M.A., M. S. Alom, M.A.K. Mian, J.A. Chowdhury, and A.A. Begum *et. al.* 2016. Unfavourable ecosystem: Crop production under Hill and Haor ecosystem (Book). Agronomy Division. Bangladesh Agricultural Research Institute, Joydebpur, Gazipur 1701. 114P.

BARI (Bangladesh Agricultural Research Institute) 2016. Survey on crops and cropping at Chalanbeel areas of Bangladesh. In: Annual research Report. Agronomy Division. BARI. Gazipur 1701.Pp.171-180.

BARI (Bangladesh Agricultural Research Institute) 2017. *Krishi Projukti Hatboi* (Hand book of Agro-technology). BARI. Gazipur1701. Pp. 1-4.

BARI (Bangladesh Agricultural Research Institute) 2018. Varietal development (wheat). *In*: BARI Annual Report. 2018. BARI. Gazipur 1701. Pp.3-4.

Bouman, B. 2009. How much water does rice need? *In* Rice Today. International Rice Research Institute. Philippine. P. 29. (www.irri.org visited on 29.01.2017).

Completion Report. NATP-2, BARC. Farmgate, Dhaka-1215. Pp.12-22.

Islam, M.N., M.A, Hossain, M. Mohiuddin and M.A.K. Mian *et.al.* 2012. Crops and cropping of Charland areas in Bangladesh. *Bangladesh Agron. J.* **15** (2):1-10.

Mian, M.A.K and A.A. Begum. 2018. Crop Productivity in Beel Area of Bangladesh. Project

Mian, M.A.K. 2008. Performance of maize oriented cropping under different nutrient management. Ph.D. Dissertation. Department of Agronomy. Bangladesh Agril. Univ. Mymensingh. Pp. 54-57.