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Screening of wheat genotypes for drought tolerance at High Barind Tract

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ABSTRACT

The study was carried out at FSRD site, Kadamshahar, Godagari, Rajshahi under OFRD, BARI, Barind station, Rajshahi during Rabi season 2017-18 to identify drought tolerance and susceptible wheat genotypes. In this trial forty-seven (47) wheat genotypes were evaluated against drought at vegetative stage (stress was imposed from CRI stage to before an thesis by withholding irrigation) with control (no drought). The experiment was sown at farmer's field on 07 December, 2017. The genotypes were evaluated for yield and yield components, heading, maturity, visual grain quality, etc. Significant variations were observed among the genotypes for all traits. On the basis of overall field performance and preferences of yield and on the basis of relative yield (RY), stress susceptibility index (SSI) and stress tolerance index (STI), sixteen (16) genotypes BARI GOM 23, BARI GOM 27, BARI GOM 31, BARI GOM 32, BARI GOM 33, BAW 1147, BAW 1202, BWSN 14, BWSN 16, BWSN 22, PYT 9, PYT 11, PYT 12, PYT 20, PYT 33 and Borlaug were selected as drought tolerant at vegetative stage for further evaluation in farmers field in the next year.

INTRODUCTION

Heat and drought are the major constraint of wheat production in Bangladesh. Recently climate change will further increase the losses due to high temperature. Moreover, about 50% wheat area in Bangladesh is sown late mostly due to delayed harvest of transplanted aman rice. As such this late-sown wheat faces high temperature stress during the grain filling stage. This affects wheat grain formation as well as grain development causing significant yield loss. Therefore, high temperature is an important production constrain in many tropical and subtropical environments including Bangladesh. It is absolutely clear that high temperature reduces grain yield by directly affecting various yield components like number of spike and potential spike lets per spike, potential grain number and individual grain weight etc. Wheat (*Triticum aestivum*) is the second most important cereal crop in Bangladesh in respect of area and production cultivated in winter season. But scanty rainfall and scarcity of available irrigation facilities in the winter season, it suffers from soil moisture stress during the growing period. Villarreal *et al.* (1999) showed that crown root initiation (CRI) and anthesis are the two stages at which yield losses from drought stress can be most critical to wheat. In Bangladesh, up to 60% of the land surface is subject to continuous or frequent stress and drought occurs of about 3.5 million ha of land area causing a great damage to crop production. So, it is important to find out suitable drought tolerant wheat genotype(s) for variety development in rainfed cultivation.

Major wheat growing region of the developing world has identified heat and drought stress as the top research priorities to increase the productivity of wheat. Breeding efforts for the introduction and

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development of germplasm adapted to warm growing environments for many countries have been under taken. However, introduction of heat and drought tolerance to the adapted varieties is not satisfactory due to insufficient knowledge about the physiological and genetic basis of heat and drought tolerance, which is rather a complex phenomenon. Significant yield loss is found due to late planting and lack of irrigation. By disseminating newly developed heat and drought tolerant varieties throughout the country, the yield loss due to late planting and drought will be minimized. Among prevailing abiotic stresses, it is the most significant and severe factor inhibiting plant growth and production (Naeem et al., 2015). Water deficiency in plant impairs the numerous physiological and metabolic functions (Wang *et al.* 2001). Selection of wheat genotypes that can tolerate water scarcity would be helpful tools for breeding program aiming to development of drought tolerant variety under water limited regions (Naeem et al., 2015). Emphasis is given on the problem drought in the recent years.

Drought resistance is defined by Hall (1993) as the relative yield of a genotype compared to other genotypes subjected to the same drought stress. Drought susceptibility of a genotype is often measured as a function of the reduction in yield under drought stress (Blum, 1988) while the values are confounded with differential yield potential of genotypes (Ramirez and Kelly, 1998). Drought indices which provide a measure of drought based on yield loss under drought conditions in comparison to normal conditions have been used for screening drought-tolerant genotypes (Mitra, 2001). So, here we use some indices like Stress tolerance index (STI), stress susceptibility index (SSI) and relative yield (RY) for selecting drought tolerant genotypes.

Moreover, it is a constraint for dryland farming or rainfed crop production which retards crop growth and ultimately reduced yield of crops. Physiological means of minimizing drought stress may influence the yield in rainfed environment. Therefore, an improvement in drought tolerance in crops is a pre-requisite for achieving greater economic gains. The best and most effective approach in this regard is to develop drought tolerant crop varieties. It is therefore important to identify the genetic resources that have high tolerances and to understand the mechanisms of drought tolerance in plants. Ultimately, the wheat productivity and hence the production in the country will be increased and the production will be economic. The objective of this trial was to identify drought tolerance and susceptible wheat genotypes in drought stressed environment. This study also highlights and helps to select wheat genotypes tolerant to drought via farmers' field experiments under normal and drought conditions.

MATERIALS AND METHODS

A total of 47 genotypes was included in this trial which were collected from Wheat Research Centre, Plant Genetic Resource Centre of Bangladesh Agricultural Research Institute (BARI), Bangobondhu Sheikh Mujibur Rahman University (BSMRU), Bangladesh Institute of Nuclear Agriculture (BINA) and Bangladesh Agricultural University(BAU).The genotype 'Borlaug' have Blast tolerance also . Seeds were sown at proper soil moisture condition on 07 December, 2017. The crop was raised under rain-fed condition with single irrigation at CRI stage in order to have a good plant establishment at Farmers field in Kadamshahar, Godagai, Rajshahi. The experiment was laid out in randomized complete block design with three replications. There were two treatments combination viz., T_1= control (no drought), T_2= drought at vegetative stage (stress will impose from CRI to before anthesis withholding irrigation). The unit plot size was 2.5m long 1 rows with 20cm space between entries, respectively. Recommended fertilizers (N_{100}, P_{26}, K_{50}, S_{20}) dose and production package were followed to ensure the optimum the crop production. Data were recorded on different agronomic characters, yield, and yield contributing characteristics. At maturity stage, (30 March, 2018) crops were harvested to estimate yield and yield contributing attributes. The collected data were statistically analyzed and the means were compared by LSD with open source software R (R Core Team, 2017).

Calculation Relative Yield, Stress tolerance Index and Stress Susceptibility Index

At harvest, data on yield and yield contributing characters were recorded. Three selection indices including Relative Yield (RY, %) (Ashraf and Wahed, 1990), Stress tolerance Index (STI, Fernandez, 1992) and Stress Susceptibility Index (SSI, Fischer and Maurer, 1978) were calculated by the following formula:

1) Relative Yield (RY) = $\frac{\text{Yield of drought stressed plant}}{\text{Yield of control plant}} \times 100$

2) STI = Yp* Ys/ YP²

3) SSI = (1-(Ys/Yp))/SI, Stress intensity (SI, %) = 1-(YS/YP) x 100

Here, Yp = Yield of cultivar in normal condition, Ys = Yield of cultivar in Stress condition, YP= Total yield mean in normal condition and YS= Total yield mean in stress condition.

RESULTS AND DISCUSSION

Forty seven (47) wheat genotypes of different sources were included into this trial in the name of Screening of wheat genotypes for drought tolerance. Significant variation was observed among the genotypes in all yield and yield contributing traits (Table. 1 & 2). The days to heading range was 63 days to 73 days and days to maturity range was 99 to 112 days. The plant height range was 81.60 cm to 119.90 cm. The hundred grain weight range was 2.79g to 5.67 g. The maximum hundred grain weight found from BWSN 33 (5.5.67g and 5.44g) in control and drought at vegetative stage respectively with medium grain yield (3.53 and 3.41 t ha^{-1}). The maximum yield was recorded in case of control condition, BARI GOM 33 (5.06 t ha^{-1}) with medium grain size (4.82 g hundred grain weight) followed by BARI GOM 30 (4.78 t ha^{-1}), BAW 1147 (4.63 t ha^{-1}) and BARI GOM 22 (4.30 t ha^{-1}) with 3.74g, 4.57g and 3.92g hundred grain weight respectively. The maximum yield was recorded in case of drought at vegetative stage (stress) condition, BAW 1147 (4.49 t ha^{-1}) with medium grain size (4.62 g hundred grain weight) followed by BARI GOM 33 (4.36 t ha^{-1}), BWSN 30 (3.70 t ha^{-1}) and Borlaug (3.65 t ha^{-1}) with 4.62g, 4.79g and 4.10g hundred grain weight respectively. Considering the yield and yield contributing traits with visual grain quality six entries (BARI GOM 22, BARI GOM 30, BARI GOM 33 , BAW 1147, BWSN 33 and Borlaug) were selected from this trial for further evaluation in the next growing season.

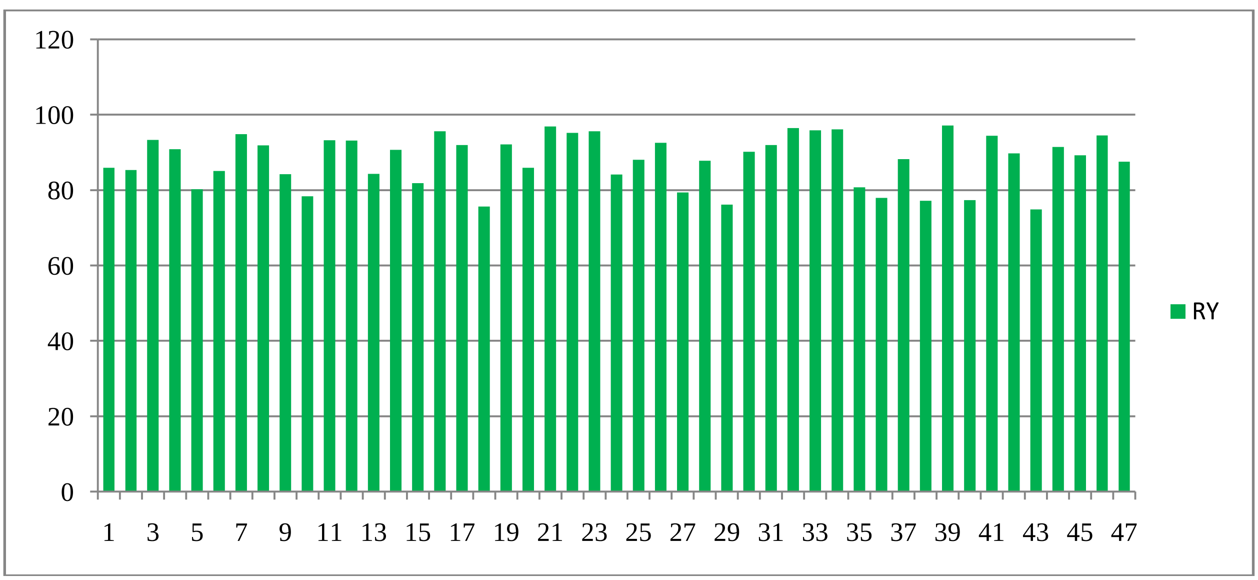

Fig. 1 Effect of drought stress on relative yield at vegetative stage of wheat genotypes

Relative yield based selection

The relative seed yield per plant ranged from 75.62-97.14 % at vegetative stage (**Table. 3**). . The minimum reduction was observed in PYT 20 (97.14%) at vegetative stage but genotypes BARI GOM 23, BARI GOM 27, BARI GOM 31, BARI GOM 32, BARI GOM 33, BAW 1147, BAW 1202, BWSN 14, BWSN 16, BWSN 22, PYT 9, PYT 11, PYT 12, PYT 20, PYT 33 and Borlaug also performed better which were produced above 90% relative seed yield per plant.

Based on Stress Tolerance Index (STI) and Stress Susceptibility Index (SSI)

Under drought stress condition, the stress tolerance view, BARI GOM 23, BARI GOM 27, BARI GOM 31, BARI GOM 32, BAW 1147, BAW 1202, BWSN 14, BWSN 16, BWSN 22, PYT 9, PYT 11, PYT 12, PYT 20, PYT 33 and Borlaug showed higher values in stress tolerance index (STI >0.9) though GOM 31, , BAW 1202, BWSN 14, BWSN 16 and PYT 9 were discarded from the selection because they produced very lower yield in stress condition and STI was able to identify only that genotypes which producing higher yield in both conditions (Talebi et al., 2009) (Figure 2). In stress susceptibility index (SSI), lower value is the selection criteria for drought tolerant genotypes. In this point of view, BARI GOM 23, BARI GOM 27, BARI GOM 31, BARI GOM 32, BARI GOM33, BAW 1147, BAW 1202, BWSN 14, BWSN16, BWSN 22, PYT 9, PYT 11, PYT 12, PYT 20, PYT 33 and Borlaug showed lower values in SSI and were similar with relative yield values of those genotypes at vegetative stage (Figure 3).

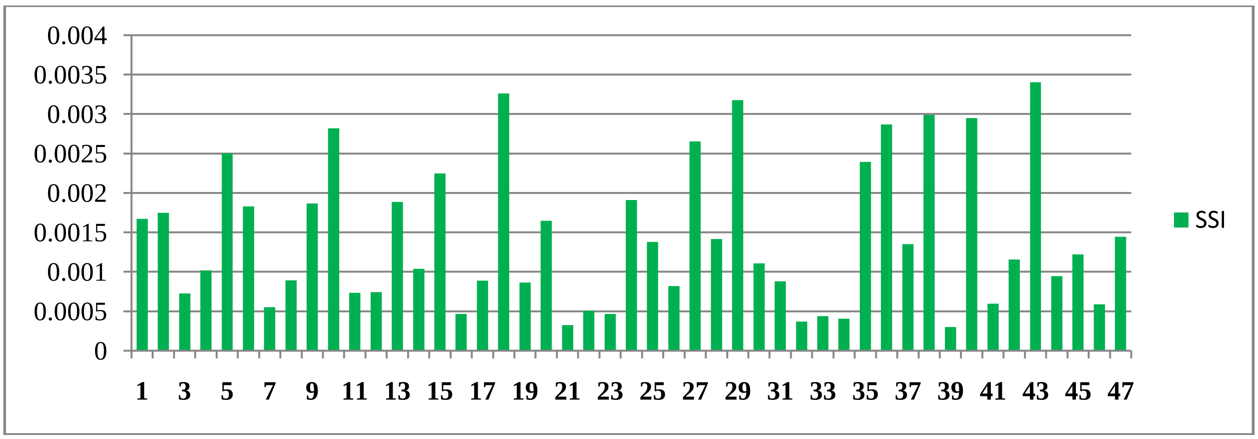

Figure 2: Drought stress on stress susceptibility index (SSI) at vegetative stage of wheat genotypes

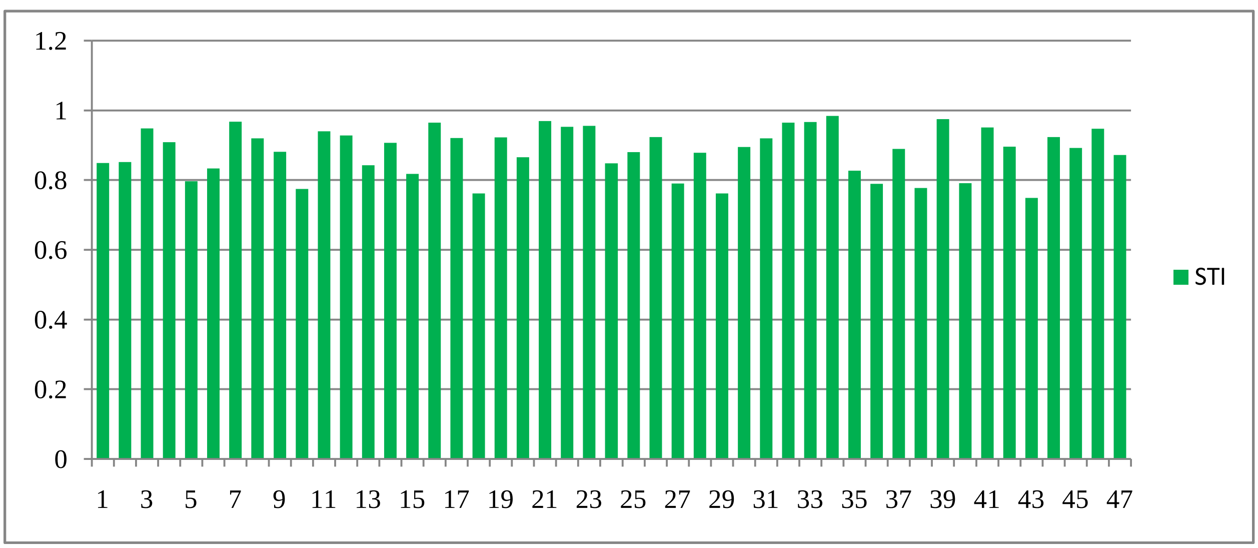

Figure 3: Drought stress on stress tolerance index (STI) at vegetative stage of wheat genotypes

Table 1: Yield and yield attributes of Wheat Genotypes in HBT under Irrigated condition during Rabi season 2017-18

Sl	Genotypes	Days to Head	Days to mature	Plant height (cm)	Spikes m^{-2}	Spike length (cm)	Grains $Spike^{-1}$	HGW (g)	Grain yield (t ha^{-1})
1.	BARI GOM 21	72	109	93.0	408	9.06	41.33	4.09	3.84
2.	BARI GOM 22	70	107	93.4	423	9.58	43.33	3.92	4.30
3.	BARI GOM 23	71	106	91.9	321	11.26	43.12	3.77	2.96
4.	BARI GOM 24	67	104	89.9	315	7.66	38.33	4.12	3.10
5.	BARI GOM 25	65	106	90.6	361	11.28	46.65	3.87	3.59
6.	BARI GOM 26	66	104	92.4	422	11.01	38.16	4.97	3.64
7.	BARI GOM 27	65	103	89.6	455	8.96	30.33	4.67	3.79
8.	BARI GOM 28	64	100	85.4	350	9.26	37.50	4.02	3.06
9.	BARI GOM 29	66	105	90.3	346	11.17	39.63	4.30	3.17
10.	BARI GOM 30	68	110	90.6	467	10.51	34.33	3.74	4.78
11.	BARI GOM 31	70	108	84.7	221	9.89	36.46	4.02	1.98
12.	BARI GOM 32	66	108	90.6	367	8.91	43.99	3.47	3.39
13.	BARI GOM 33	67	109	89.7	510	10.67	35.00	4.82	5.06
14.	BAW 1147	68	108	92.5	475	11.07	39.16	4.57	4.63
15.	BAW 1194	70	108	92.8	296	11.37	47.66	4.66	2.20
16.	BAW 1202	65	106	82.1	217	9.47	50.77	4.54	1.92
17.	BAW 1208	65	102	95.5	468	10.86	45.33	4.05	3.81
18.	BAW 1243	66	104	94.6	326	11.71	44.80	3.81	2.92
19.	BWSN 7 5	64	106	113.4	411	11.45	36.31	4.58	3.62
20.	BWSN 13	67	111	93.4	401	11.32	37.33	4.68	3.83
21.	BWSN 14	71	105	93.9	337	11.26	42.00	4.54	2.70
22.	BWSN 16	68	107	93	299	11.62	45.83	4.55	2.53

23.	BWSN 22	67	103	92	329	10.52	33.66	3.64	2.95
24.	BWSN 30	68	109	96.3	427	11.27	38.16	4.76	4.12
25.	BWSN 31	67	109	84.5	225	8.08	31.66	4.56	1.99
26.	BWSN 33	66	105	92.9	409	10.50	36.83	**5.67**	3.53
27.	BWSN 38	65	103	85.4	389	9.81	38.60	4.64	3.45
28.	BWSN 40	64	105	88.3	366	9.66	37.16	4.62	3.40
29.	BWSN 42	65	100	79.1	351	9.90	27.83	4.40	3.30
30.	BWSN 48	65	104	88.0	396	9.02	36.66	3.40	3.56
31.	PYT 6	68	107	91.1	390	9.77	36.33	4.41	3.48
32.	PYT 9	66	106	88.3	269	10.93	45.00	4.60	2.87
33.	PYT 11	66	105	88.3	388	11.42	34.99	5.14	3.38
34.	PYT 12	69	103	94.2	398	10.76	38.33	4.08	3.60
35.	PYT 13	64	105	91.2	383	9.16	38.83	4.18	3.95
36.	PYT14	64	103	90.7	302	10.46	30.63	5.28	2.79
37.	PYT 15	67	104	93.1	358	9.28	49.33	4.47	3.29
38.	PYT 19	68	105	92.0	379	9.74	46.33	4.36	3.40
39.	PYT 20	66	101	90.1	363	8.73	33.80	3.18	3.11
40.	PYT 32	67	107	78.2	325	9.33	36.16	3.00	2.88
41.	PYT 33	72	107	88	275	10.14	43.16	3.38	2.17
42.	PYT 34	73	112	92.4	351	9.57	44.83	3.05	3.00
43.	AYT 7	69	107	94.1	387	10.51	42.83	3.81	3.08
44.	AYT 10	70	106	91.6	363	9.66	38.16	3.15	3.32
45.	KRL 14	70	104	91.3	301	9.81	45.81	3.07	2.14
46.	Borlaug	67	104	93.2	396	9.29	33.45	4.24	3.97
47.	BINA GOM 1	67	104	90.3	392	10.11	42.66	4.06	3.47
	LSD	**1.06**	**1.54**	**4.67**	**45.65**	**0.67**	**7.24**	**0.23**	**0.39**
	CV(%)	**0.97**	**0.90**	**3.17**	**7.73**	**4.11**	**11.29**	**3.36**	**7.32**
	Sig. level	**	**	**	**	**	**	**	**

** Highly significant and ^{NS} Non Significant

Table 2: Yield and yield attributes of Wheat Genotypes under Non-Irrigated condition in HBT during Rabi season 2017-18

SL. No.	Genotypes	Days to Head	Days to mature	Plant height (cm)	Spikes m^{-2}	Spike length (cm)	Grains $Spike^{-1}$	HGW (g)	Grain yield (t ha^{-1})
1.	BARI GOM 21	72	109	94.00	371	9.06	40.33	4.04	3.28
2.	BARI GOM 22	69	107	93.20	387	9.58	36.50	3.86	3.35
3.	BARI GOM 23	70	105	90.20	273	11.26	35.65	3.34	2.75
4.	BARI GOM 24	66	104	90.30	292	7.66	30.66	3.81	2.88
5.	BARI GOM 25	66	107	98.60	350	11.28	41.32	3.58	3.03
6.	BARI GOM 26	65	104	97.10	388	11.01	39.93	4.89	3.30
7.	BARI GOM 27	64	103	90.90	338	8.96	41.11	4.53	3.10
8.	BARI GOM 28	64	99	85.90	318	9.26	37.66	3.90	2.94
9.	BARI GOM 29	66	105	93.00	308	11.17	41.50	4.39	2.91
10.	BARI GOM 30	68	110	90.60	412	10.51	37.66	3.83	3.63
11.	BARI GOM 31	65	110	87.50	208	9.89	42.47	4.11	1.83
12.	BARI GOM 32	65	107	92.80	317	8.91	37.83	3.33	2.89
13.	BARI GOM 33	66	110	92.80	474	10.67	37.83	4.61	4.36
14.	BAW 1147	68	110	92.80	456	11.07	44.12	4.62	4.49
15.	BAW 1194	71	109	93.90	232	11.37	38.00	4.52	2.10
16.	BAW 1202	64	107	88.60	205	9.47	41.47	4.59	1.84
17.	BAW 1208	66	101	95.50	337	10.86	44.97	4.07	3.21
18.	BAW 1243	66	104	92.40	283	11.71	38.23	3.80	2.57
19.	BWSN 7 5	64	105	119.9	402	11.45	42.36	4.37	3.35
20.	BWSN 13	67	111	94.50	439	11.32	43.05	4.45	3.02
21.	BWSN 14	69	104	96.10	271	11.26	45.50	4.43	2.36
22.	BWSN 16	68	105	98.00	206	11.62	51.83	4.33	1.93
23.	BWSN 22	67	103	92.30	285	10.52	30.98	4.00	2.77
24.	BWSN 30	67	111	96.60	389	11.27	34.28	4.79	3.70

25.	BWSN 31	66	111	85.50	208	8.08	35.00	4.11	1.84
26.	BWSN 33	67	104	92.90	356	10.50	37.69	5.44	3.41
27.	BWSN 38	66	103	87.70	346	9.81	43.65	4.41	3.31
28.	BWSN 40	63	103	92.70	342	9.66	38.31	4.56	3.29
29.	BWSN 42	64	99	79.20	294	9.90	32.00	4.50	2.70
30.	BWSN 48	64	102	81.90	334	9.02	41.33	3.16	2.78
31.	PYT 6	68	106	96.30	333	9.77	39.01	4.22	3.08
32.	PYT 9	66	105	90.10	298	10.93	42.80	4.40	2.23
33.	PYT 11	66	105	91.10	362	11.42	40.75	5.03	3.28
34.	PYT 12	69	103	92.50	323	10.76	34.33	4.07	3.28
35.	PYT 13	64	105	90.90	364	9.16	35.17	4.01	3.08
36.	PYT14	63	102	89.00	299	10.46	34.58	5.12	2.64
37.	PYT 15	68	104	91.50	303	9.28	46.17	4.45	2.95
38.	PYT 19	68	104	82.80	305	9.74	30.51	4.16	2.55
39.	PYT 20	67	101	92.10	325	8.73	42.44	3.18	2.85
40.	PYT 32	67	106	81.60	279	9.33	42.33	2.79	2.57
41.	PYT 33	73	106	87.10	248	10.14	44.17	3.50	2.05
42.	PYT 34	70	111	93.20	276	9.57	43.17	2.97	2.63
43.	AYT 7	69	106	92.40	308	10.51	37.80	3.44	2.46
44.	AYT 10	69	105	89.40	308	9.66	42.82	3.11	3.25
45.	KRL 14	70	105	95.70	231	9.81	37.47	3.01	2.03
46.	Borlaug	66	104	91.90	377	9.29	44.17	4.10	3.65
47.	BINA GOM 1	66	103	90.40	314	10.11	30.80	4.06	2.97
	LSD (5%)	1.4	1.07	3.80	46.53	0.68	6.29	0.22	0.45
	CV (%)	1.37	0.63	2.55	8.95	4.11	9.85	3.29	9.65
	Sig. level	**	**	**	**	**	**	**	**

** Highly significant and ^{NS} Non Significant

Table 3: Yield and yield attributes of Wheat Genotypes in HBT during Rabi season2017-18

Treatment	Genotypes	RY (%)	STI	SI (%)	SSI (%)
1.	BARI GOM 21	85.91	0.85	-84.29	-0.0017
2.	BARI GOM 22	85.29	0.85	-84.10	-0.0017
3.	BARI GOM 23	93.29	0.95	-92.57	-0.0007
4.	BARI GOM 24	90.84	0.91	-89.85	-0.0010
5.	BARI GOM 25	80.25	0.80	-78.87	-0.0025
6.	BARI GOM 26	85.04	0.83	-81.83	-0.0018
7.	BARI GOM 27	94.84	0.97	-93.64	-0.0006
8.	BARI GOM 28	91.90	0.92	-90.94	-0.0009
9.	BARI GOM 29	84.24	0.88	-84.47	-0.0019
10.	BARI GOM 30	78.35	0.78	-76.82	-0.0028
11.	BARI GOM 31	93.24	0.94	-91.75	-0.0007
12.	BARI GOM 32	93.17	0.93	-91.75	-0.0007
13.	BARI GOM 33	84.28	0.84	-83.28	-0.0019
14.	BAW 1147	90.68	0.91	-89.66	-0.0010
15.	BAW 1194	81.88	0.82	-80.69	-0.0022
16.	BAW 1202	95.57	0.96	-94.76	-0.0005
17.	BAW 1208	91.96	0.92	-90.65	-0.0009
18.	BAW 1243	75.62	0.76	-74.76	-0.0033
19.	BWSN 7 5	92.14	0.92	-91.19	-0.0009
20.	BWSN 13	85.96	0.87	-85.17	-0.0016
21.	BWSN 14	96.90	0.97	-95.87	-0.0003
22.	BWSN 16	95.21	0.95	-94.23	-0.0005
23.	BWSN 22	95.60	0.96	-94.58	-0.0005
24.	BWSN 30	84.11	0.85	-83.25	-0.0019
25.	BWSN 31	88.01	0.88	-87.01	-0.0014

Treatment	Genotypes	RY (%)	STI	SI (%)	SSI (%)
26.	BWSN 33	92.52	0.92	-91.40	-0.0008
27.	BWSN 38	79.39	0.79	-77.75	-0.0027
28.	BWSN 40	87.78	0.88	-86.25	-0.0014
29.	BWSN 42	76.13	0.76	-75.13	-0.0032
30.	BWSN 48	90.18	0.89	-88.58	-0.0011
31.	PYT 6	91.97	0.92	-90.98	-0.0009
32.	PYT 9	96.47	0.96	-95.46	-0.0004
33.	PYT 11	95.86	0.97	-94.80	-0.0004
34.	PYT 12	96.14	0.98	-95.48	-0.0004
35.	PYT 13	80.72	0.83	-80.54	-0.0024
36.	PYT14	77.93	0.79	-76.98	-0.0029
37.	PYT 15	88.18	0.89	-87.51	-0.0014
38.	PYT 19	77.15	0.78	-76.39	-0.0030
39.	PYT 20	97.14	0.97	-96.04	-0.0003
40.	PYT 32	77.33	0.79	-76.85	-0.0029
41.	PYT 33	94.43	0.95	-93.62	-0.0006
42.	PYT 34	89.75	0.90	-88.67	-0.0012
43.	AYT 7	74.87	0.75	-73.85	-0.0034
44.	AYT 10	91.41	0.92	-90.64	-0.0009
45.	KRL 14	89.24	0.89	-88.24	-0.0012
46.	Borlaug	94.50	0.95	-93.47	-0.0006
47.	BINA GOM 1	87.55	0.87	-86.35	-0.0014

CONCLUSION

From the above results, it may be concluded that under drought stress condition, sixteen genotypes BARI GOM 23, BARI GOM 27, BARI GOM 31, BARI GOM 32, BARI GOM 33, BAW 1147, BAW 1202, BWSN 14, BWSN 16, BWSN 22, PYT 9, PYT 11, PYT 12, PYT 20, PYT 33 and Borlaug for vegetative stage were selected for drought tolerance on the basis of integrated score, relative yield (RY), stress susceptibility index (SSI) and stress tolerance index (STI). As such, studies on those wheat genotypes will contribute towards furthering our understanding of the mechanism of drought resistance as well as the identification of the specific genes involved in drought tolerance, thereby resulting in future improvement of cultivated wheat.

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Conflict of Interest

The authors declare that there is no conflict of interests regarding the publication of this paper.

REFERENCES

Ashraf M and Waheed A (1990). Screening of lentil (*Lens culinaris* Medic.) for salt tolerance at two growth stages. Plant and Soil, 128: 167- 176.

Blum A (1988). Plant Breeding for Stress environments. CRC Press, Florida. p 212 Fernandez, G.C.J., 1992. Effective selection criteria for assessing stress tolerance. In: Kuo

C.G. (Ed.), Proceedings of the International Symposium on Adaptation of Vegetables and Other Food Crops in Temperature and Water Stress, Publication, Tainan, Taiwan.

Fischer RA, Maurer R (1978). Drought resistance in spring wheat cultivars. I., Grain yield response. Aust. J .Agric. Res. 29, 897-907. Hall, A.E., 1993. Is dehydration tolerance relevant to genotypic differences in leaf senescence and crop adaptation to dry environments? In: T.J. Close and Bray, E.A., (Eds.), Plant Responses to cellular Dehydration during environmental stress. pp.1-10.

Naeem MK, Ahmad M, Kamran M, Shah KMN, Iqbal MS (2015). Physiological Responses of Wheat (*Triticum aestivum* L.) to Drought Stress. Int. J. Plant & Soil Science, 6(1): 1- 9.

Mitra J (2001). Genetics and genetic improvement of drought resistance in crop plants. Curr Sci, 80, 758-762.

R Core Team (2017). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria.URL https://www.R- project.org/.

Ramirez P and Kelly JD (1998). Traits related to drought resistance in common bean. Euphytica, 99, 127-136.

Villareal RL and Mujeeb-Kazi A (1999). Exploiting synthetic hexaploids for abiotic stress tolerance in wheat. pp. 542-552. In: Regional Wheat Workshop for Eastern, Central and Southern Africa, 10. CIMMYT, University of Stellenbosch, South Africa, Addis Ababa, Ethiopia.

Wang WX, Vinocur B, Shoseyov O and Altman A (2001). Biotechnology of plant osmotic stress tolerance: physiological and molecular considerations. Acta Horticulture 560:285–292.