Forage Res., **46** (2) : pp. 208-211 (2020) **http://forageresearch.in**
SHORT COMMUNCATION

COMPARATIVE PERFORMANCE OF ADVANCE BARLEY GENOTYPES UNDER SALINE SOIL CONDITION

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(Received : 21 August 2020; Accepted : 16 September 2020)

SUMMARY

An experiment was conducted to test the performance of different advance barley genotypes for grain yield and its components under saline soil condition at Barley Research Area, Department of Genetics and Plant Breeding, CCS Haryana Agricultural University, Hisar during *rabi* 2018-19. The experiment was laid in randomized block design with three replications with a plot size of 6.9 m^2. Sixteen advance barley genotypes along with two national checks *viz*., RD 2794 and BH 946 were evaluated on a natural soil salinity patch having pH of 8.3 and Ece 6 dsm^{-1}. The variation due to treatment were found to be highly significant for days to heading, plant height, spike length, number of tillers per meter, number of grains per spike, 1000 grain weight (g), biological yield and grain yield, and significant for days to maturity and harvest index. The coefficient of variation was recorded highest for grain yield (17.40) followed by harvest index (11.88) and biological yield (8.36); however, days to maturity (1.52) exhibited lowest variation. Six genotypes namely BH 17-26, BH 17-32, BH 16-44, BH 17-34, BH 17-35 and BH 16-35 produced higher grain yield and also showed better performance for several other yield components. These best performing genotypes may be considered in future breeding programmes intended to develop salt tolerant varieties.

Key words : Barley genotype, performance, saline condition

Barley (*Hordeum vulgare* L.) is an annual cereal crop, which belongs to the tribe *Triticeae* of family *Poaceae*. It has persisted as a major cereal crop through many centuries and is the world's fourth important cereal crop after wheat, rice and maize (Kumar *et al.*, 2013). In India, barley occupied an area of 0.66 million hectare with production of 1.73 million tonnes during the crop season 2018-19 (ICAR-IIWBR 2019). Barley was cultivated on 18,100 hectares with a production level of 57,990 tons in Haryana which ranks second in average productivity (3204 kg/ha) after Punjab (3800 kg/ha). Salinity and drought stresses are the most common abiotic stresses, and are major constraints for barley production (Sabagh *et al.*, 2019). Barley is rather a salt tolerant crop and reasonably good yield can be obtained by some management practices and/or selection of relatively more salt tolerant genotypes. The performance of genotypes for yield components ultimately determines the final yield of the crop. Management, reclamation and selection of salt tolerant cultivars within crop species can increase the share of the area of salt affected soils to the total productivity of crops. The selection of relatively salt tolerant cultivars within crop species is the rapid and economical method to increase the productivity of crops in salt affected areas. Breeding crops for salt tolerance would likely be provide an economic and efficient method of overcoming saline soil problems. However, such breeding programmes must be based on adequate variability for salinity tolerance. Wild barley has developed unique mechanisms for surviving harsh environments, with a wider genetic variation and much greater stress tolerance as compared to cultivated barley (Ahmed *et al*., 2013). Therefore, it is of vital importance to know the mechanisms of salinity tolerance in order to obtain plants with a better response to this abiotic stress (Hernandez, 2019). The present study was aimed at the evaluation of barley genotypes for salt tolerance under saline condition.

Present investigation was carried out at Barley Research Area of the Department of Genetics and Plant Breeding, CCS Haryana Agricultural University, Hisar situated between 29°10′N latitude, 75°46′E longitude and at an altitude of 215.2 m above mean sea level in subtropical region of North Western Plain Zone of India. The experimental was conducted during *rabi* 2018-19 under saline soil condition. The pH and EC of the experimental plot was 8.3 and 6 dsm^{-1},

respectively. A set of 16 advanced barley genotypes representing both 2-row (7) and 6-row (9) types were used in the present study along with two national checks namely, RD 2794 and BH 946. The material was planted on 11th November, 2018 in randomized block design with three replications in 6 rows of 5 m length for each genotype, with spacing of 23 cm between rows. The standard agronomic practices were applied to raise the good crop. The data was recorded on 10 metric traits *viz*., days to heading, days to maturity, plant height (cm), spike length (cm), number of tillers per meter, number of grains per spike, 1000-grain weight (g), harvest index (%), biological yield (kg/plot) and grain yield (kg/plot). Five randomly selected competitive plants in each replication were recorded for all the traits under study except of days to heading and maturity, biological yield and grain yield which were recorded on plot basis. Further, the value of harvest index was calculated as per the formula given by Donald and Humblin (1976). Mean, standard deviation (SD) and coefficient of variation (CV) were calculated following standard statistical procedures.

The weather parameters during the crop season *i.e.* 1st October 2018 to 30th April 2019 are presented in Fig. 1. Monthly mean maximum temperature varied between 19.2 to 36.7°C whereas, the monthly mean minimum temperature was between 4.9 to 18.4°C. Morning RH varied from 69 to 94% while evening RH was highly variable with a range from 27 to 60%. Total amount of rainfall received during the season at Hisar was 44.1 mm which was less than normal of 60 mm.

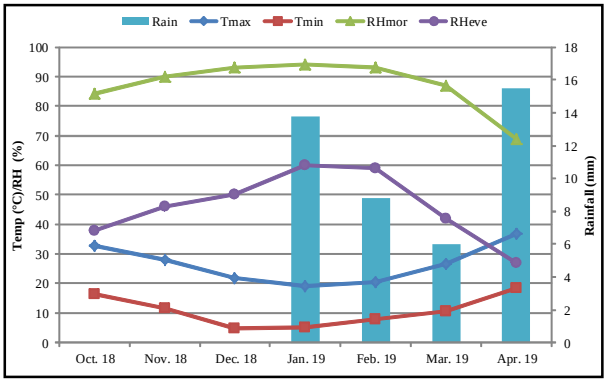

Fig. 1. Weather parameters during the crop season.

The variation due to treatment were found to be highly significant for days to heading, plant height, spike length, number of tillers per meter, number of grains per spike, 1000 grain weight (g), biological yield and grain yield, and significant for days to maturity and harvest index. Similar findings were also

TABLE 1
Mean performance of barley genotypes for different characters under saline soil condition

Genotypes	Row Type	DH	DM	PH	SL	T/M	G/S	GW	HI
BH 17-28	6	97	139	47	5.8	52	51	43.2	28.48
BH 16-20	6	89	135	91	8.2	68	61	40.3	28.65
BH 16-06	6	80	132	100	9.0	55	64	42.0	25.86
BH 16-27	2	81	134	86	9.1	88	25	42.0	29.18
BH 16-25	2	81	133	78	7.8	112	23	48.5	26.41
BH 16-18	6	86	136	105	7.1	97	59	38.8	25.08
BH 17-14	2	88	135	108	8.2	91	29	52.3	29.18
BH 17-34	2	90	134	104	7.1	107	29	47.1	29.72
BH 17-26	6	82	133	85	7.0	113	54	35.8	36.64
BH 16-35	2	83	135	84	9.2	88	25	55.4	29.11
BH 16-44	6	91	134	91	7.1	114	58	38.8	30.76
BH 17-35	6	80	136	91	12.6	83	71	39.6	32.43
BH 16-37	2	93	133	88	9.8	79	31	36.3	29.19
BH 15-46	6	91	133	95	7.0	72	48	43.1	27.19
BH 17-19	2	95	135	93	8.4	97	25	50.0	31.68
BH 17-32	6	93	136	88	6.8	67	69	41.8	35.14
BH 946 (c)	6	89	136	64	7.6	56	55	38.2	31.29
RD 2794 (c)	6	97	134	101	9.2	89	72	39.1	30.59
Mean		88.1	134.6	88.9	8.17	84.8	47.2	42.9	29.81
CD (0.05)		3.40	3.41	8.90	0.46	9.74	3.59	5.29	5.90
SD		5.82	1.65	14.82	1.54	20.07	17.98	5.58	2.97
CV (%)		2.31	1.52	6.00	3.39	6.89	4.57	7.39	11.88

DH: Days to heading, DM: Days to maturity, PH: Plant height (cm), SL: Spike length (cm), T/M: Number of tillers per meter, G/S: Number of grains per spike, GW: 1000 grain weight (g), HI: Harvest index (%), SD: Standard deviation, CV: Coefficient of variation

corroborated by Sally *et al*. (2019) in barley genotypes under salt stress for nine traits. Some other studies have also been conducted in barley to test the performance of different genotypes under salinity conditions (El-Shawy *et al.*, 2018). The estimates of variability parameters and mean performance of all the genotypes for 10 characters are depicted in Table 1, indicates a wide range for all the traits under study. The coefficient of variation was recorded highest for grain yield (17.40) followed by harvest index (11.88) and biological yield (8.36). However, days to maturity (1.52) exhibited lowest variation. Similar results were also substantiated by Devi *et al*. (2020). Gangwar *et al*. (2016) also showed wide spectrum of variation for various characters in sixty four released varieties of barley grown under partially reclaimed saline-sodic soil. The coefficients of variation were also used as the indicators of barley tolerance under salinity stress by Jamshidi and Javanmard (2018).

The minimum number of days for heading was noted for BH 16-06 and BH 17-35; however, late heading was exhibited also by two genotypes *i.e.* BH 17-28 and RD 2794. The general mean for this character was 88.1 while, it was 134.6 for days to maturity. The earliest maturing genotype among all was BH 16-06 (132). This character varied from 132 to 139 days and results indicates that none of the genotype matured significantly earlier than the general mean. The general mean for plant height was 88.9 cm. The lowest value was recorded in BH 17-28 (47 cm) and highest value for BH 17-14 (108 cm). Three genotypes *viz*., BH 17-28, BH 946 and BH 16-25 were significantly shorter in plat stature than the general mean. For lodging resistance, these genotypes could be incorporated in breeding barley. Spike length ranged from 5.80 to 12.60 cm with a general mean of 8.17 cm. BH 17-35 recorded with longest spike while, BH 17-28 exhibited shortest spike length. Among eighteen genotypes, six genotypes showed significantly longer spike than general mean. Six genotypes for longer spike in order of merit were BH 17-35, BH 16-37, RD 2794, BH 16-35, BH 16-27 and BH 16-06. Ahmad *et al*. (2011) revealed different response of wheat genotypes under salinity stress in terms of yield and yield components. The number of tillers per meter was found maximum in BH 16-44 (114) followed by BH 17-26 (113) whereas; BH 17-28 had the minimum number of tillers (52). Six genotypes had significantly higher tillers than the general mean of 84.8 for this trait. Soil salinity affects the normal development and viability of tillers; it also decreases the number of primary and secondary tillers. Number of grains per spike ranged from 23 to 72 with general mean of 47.2. Ten genotypes out of eighteen showed superiority for number of grains per spike, recorded highest in RD 2794 (72) followed by BH 17-35 (71). The lowest and highest value for 1000 grain weight were recorded for BH 17-26 (35.8) and BH 16-35 (55.4), respectively. The toxicity to the plant caused by salinity stress is particularly evident after anthesis. It is characterized by early senescence and low kernel weight. The general mean for biological yield was 5.55 kg per plot and varied from 4.23 (BH 17-28) to 6.85 kg/plot (BH 16-44). Three genotypes *viz*., BH 16-44, BH 17-34 and BH 17-32 identified superior for biological yield (Fig. 2). Harvest index as expressed in percentage ranged from 25.08 to 36.64 % and only one genotype *i.e.* BH 17-26 was found significantly better for this character. Abu-El-lail *et al*. (2014) confirmed the importance of parameters *viz*., days to heading, plant

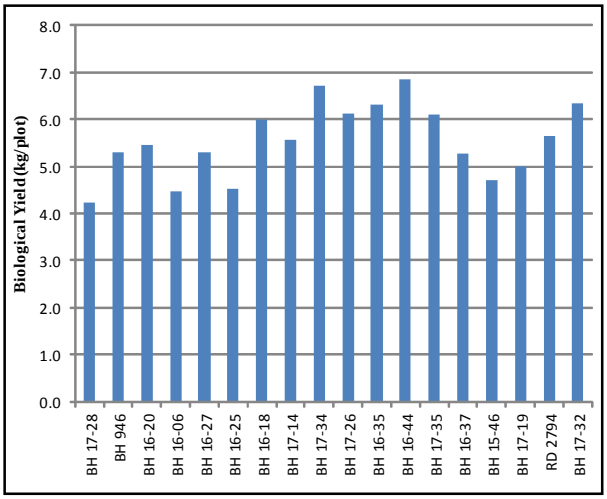

Fig. 2. Biological yield comparison of barley genotypes.

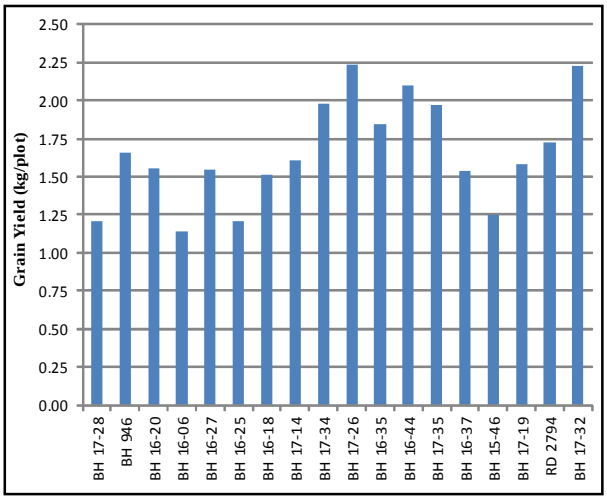

Fig. 3. Grain yield comparison of barley genotypes.

height, spike length, number of kernels/spike, 1000-kernel weight, grain yield and straw yield as useful selection criteria for screening the salt tolerance in terms of grain yield among barley genotypes at high salinity concentrations. The general mean calculated for grain yield per plot was 1.66 g. It ranged from 1.14 g (BH 16-06) to 2.24 g (BH 17-26). Among all, two genotypes namely BH 17-26 and BH 17-32 were found significantly promising for grain yield over the general mean as well as over best performing check variety RD 2794 (Fig. 3). Ebrahim *et al.* (2020) also evaluated 47 wild barley genotypes and six barley cultivars under salinity stress condition in order to find the most salinity-tolerant genotype for crosses with the cultivated barley. Sabagh *et al.* (2019) highlighted the adverse effect of salinity stress on barley and their mitigation strategies for sustainable barley production under changing climate.

Hence, it is concluded that six genotypes namely BH 17-26, BH 17-32, BH 16-44, BH 17-34, BH 17-35 and BH 16-35 produced higher grain yield and also showed better performance for several other yield components. These genotypes can be used in barley improvement programme and will be helpful in breaking the yield plateau under salinity.

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