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Performance of Wheat Genotypes for Grain Yield and its Attributes under Irrigation with Saline Water

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ABSTRACT

A field experiment was conducted in randomized block design in 3 replications at agriculture research farm, Jagan Nath University Bahadurgarh, Haryana, India with 7 wheat varieties currently grown in northern India to evaluate the impact of saline irrigation water on the grain yield and its attributes. The soil is clay loam with EC 118 µS/cm and water from nearby *Bidhro* canal having pH 7.6 to 8.4 depending upon rainfall. The observations were recorded on five randomly selected plants in each replication for each genotype and the mean data for grain yield and its attributes: plant height, number of tillers per plant, number of ears per plant, number of spikelet's per plant, dry weight of 100 grains, dry weight of grains per ear, test weight and grain yield per plant were subjected to analysis of variance. The result revealed significant difference among wheat genotypes for grain yield and its attributes. Wheat variety HD-2967 was found superior for grain yield (8.46), number of tillers per plant (6.10), number of ears per plant (5.55), dry weight of grains per ears (7.00) whereas WH-1080 scored highest for plant height (78.0) and dry weight of 100 seeds(4.35) and WH-1105 scored highest for test weight(1.31). These genotypes may possess genes for salinity tolerance as evidenced by their performance in predominantly saline soil and water used. They should be included in direct cultivation in such environment as well as hybridization programme to develop recombinants possessing high grain yield and tolerance to salinity.

Keywords: *Triticum aestivum*, grain yield, salinity.

Introduction

Wheat is one of the most important food crops of the world which contribute substantially in food and nutritional security. The maximum level of production and stability of yield are the two desired features in a commercial cultivar. Indeed, development of varieties showing wide adaptability has received increased attention in recent past (Preeti et al., 2016). However, production and productivity of wheat is affected by several abiotic constraints including high temperature, low temperature, drought and salinity. Salinity stress is among them the major abiotic stress affecting 7% of world land area (Flower et al., 1997). In India, an area of about 7 m.ha is already under salinity and 3.6 m.ha under sodicity problem and still larger area is coming under potential salinity problem due to injudicious use of water under canal irrigation system (Hollington, 1998). Salinity of growing media may harm the crop in different ways. It reduces uptake of water due to increased osmotic pressure of the soil water resulting from the increased concentration of salts. Salinity creates imbalance in uptake of essential mineral elements. Accumulation of salts especially sodium ions in root zone may be toxic (Machado and Serrelheiro, 2017). Excessive salts act as an environmental stress and decrease plant growth potential. Salinity decreases the rate of seed germination, growth and development of plant, photosynthesis per unit leaf area and the utilization of photosynthates in growth of plant (Jose Ramon Acosta-Motos, et al., 2016).

Soils can be saline due to geo-historical processes or they can be manmade. The incoming water from the land brings salts that remain in soil because there is no outlet and the evaporation water does not contain salts. This is not only disturbs the plant water retention of the soil but also disturbs the cationic balance in root zone in most of the field crops (Machado and Serrelheiro, 2017).

A major proportion of ground water in the states of Gujarat (30%), Madhya Pradesh (25%), Punjab (41%), Uttar Pradesh (63%), Haryana (67%) and Rajasthan (84%) is brackish and good quality of water is occasional for assured irrigation (Kumar et al., 2017). Various scientific reports suggested that such water is unfit for irrigation as it contain badly salinity, sodicity or associated toxicity problems. When used for irrigation, brackish water would affect adversely the crop production. In absence of canal water or good quality water, most of the farmers use brackish water for irrigating their crops particularly in *Rabi* season. Wheat crop is semi-tolerant crop to salinity thus it is found that it might be grown with brakish water irrigation on the cost of some losses in yield. Different genotypes of wheat had varied limit to salt tolerance (Kumar et al., 2017). Therefore, it was considered necessary to test the newly evolved various wheat varieties against saline irrigation water for evaluating the effects on crop productivity and its physiological parameters. Jagan Nath University Bahadurgarh, Haryana is located by the side of *bidhro* drainage canal having drainage water from rainfall splash as well as excessive irrigation water which is having pH 7.69. As there is no other water available for irrigation therefore, we have compulsion to use such water for irrigation for wheat production at university campus. Under such situation it would be imperative to evaluate existing wheat variety grown in this region for tolerance to salinity and their relative yield potential.

Materials and Methods

Experiment location:

All the experiments were conducted in research farm of the Department of Agriculture, Jagan Nath University during *Rabi* season 2018-19. This location has latitude 28⁰62’80’’N 76⁰75’34’’E

Soil: The district Jhajjar, is a part of Eastern Haryana plain which forms a part of the Indo-Gangetic Plain. The soil at the location is clayey loam with Organic Carbon 0.69%, Total Nitrogen 0.16% and Available P_2O_5 (5.0 kg/ha).

Irrigation Water: This experimental field was irrigated with bidhro water. Water samples were collected from bidhro before sowing and were analyzed for various physiological parameters.

Plant material and experimental design: Seven wheat genotypes (WH-1105, WH-1124, HD-2967, DBW-88, WH-1142 WH-1080 WH-1025) obtained from CCS HAU Hisar were sown in a randomized block design with three replicates. Recommended doses of 120 kg N, 60 kg P, and 60 kg K/ha through Urea, Di-ammonium phosphate and Muriate of Potash, respectively were applied. Half of the N and full of P and K were applied at sowing while remaining half N was top dressed in two equal parts each at tillering and heading stages of crop. Fertilizer application preceed with irrigation with saline water from bidhro as flood irrigation. Plants were allowed to grow up to maturity. At physiological maturity flag leaves of the plants were collected for chemical analysis. Yield and yield components (plant height, number of tillers per plant, number of ears per plant, number of spikelet's per plant, dry weight of 100 grains, dry weight of grains per ear, test weight and grain yield per plant etc) were recorded after harvesting the plant at maturity.

Statistical analysis: The mean data for each trait was subjected to analysis of variance to ascertain significant difference among genotypes. Also the standard errors for mean difference for each trait were calculated. Based on statistical analysis superior genotypes were identified.

Results

Analysis of variance revealed that significant difference among wheat genotypes for all the traits (data not given for brevity). It indicated that each genotype reacted differently to saline irrigation water. The comparison of means for each trait revealed that genotype WH-1080 recorded highest plant height (78.00) whiles the lowest being in DBW-88 (73.22). Highest number of tillers per plant was observed in HD-2967 (6.10) while lowest in DBW-88 (4.55). Maximum number of ears per plant was recorded for HD-2967 (5.55) while minimum in DBW-88 (4.33). DBW-88(16.66) recorded highest number of spikelet's per plant while WH-1025(10.66) recorded the lowest. Dry weight of 100 grains (g) was observed maximum in WH-1080(4.35) while minimum in WH-1142 (3.78). HD-2967(7.00) observed maximum for dry weight of grains per ears (g) while WH-1025 for minimum (4.78). Highest test weight (g/cm^3) was observed in WH-1105(1.31) while lowest WH-1124(1.10).

The standard error or difference of mean for various trait was all most with acceptable range which revealed that the experiment was properly conducted and the sampling was effectively done.

Some genotypes figured superior for two or more characters. In this context genotype HD-2967 figured important for its superior performance number of tillers per plant, number of ears per plant and dry weight of grains pre ears (g) and grain yield. Coincidentally these are principle components of grain yield. It's seen that the genetic makeup of this genotype offers tolerance to salinity of irrigation water as well as soil. Also, WH-1080 exhibited superior performance for plant height and dry weight of 100 grains (g).

Salt tolerance in plant mainly determine by mechanisms including salt exclusion by root (Munns and Tester, 2008), deposition of salts in vacuoles, exclusion of salts from leaf margins and maintenance of turgor and osmotic potential under saline condition. On the other hand, the salt injuries are caused either by osmotic stress or ionic injury (Tang et al., 2015). In variably the performance of agronomic traits have been used to identify relative tolerance of wheat genotype to salt stress. A genotype performing better under salinity stress as well no stress condition is expected to posse's mechanism of homeostasis (Bartels and Sunkar 2005). Such genotypes are worthwhile it insures survival under salt stress and yield potential under optimal condition.

Involvement of this genotype in hybridization program may yield recombinants existing higher performance for grain yield as well as its component especially in the environment where soil salinity is predominant.

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Table 1. Various physiological parameters of water used for irrigation

pH	7.69
TDS (ppm)	1737.47
EC (µS/cm)	3393.43
ORP (mV)	202.08
F^- (ppm)	1.25
Cl^- (ppm)	1472.42
NO_3^- (ppm)	22.98
SO_4^{2-} (ppm)	329.39
PO_4^{3-} (ppm)	0.16
Total Hardness (ppm)	1025.70
Total Alkalinity (ppm)	147.49

Table 2. Various agronomical parameters of wheat genotypes

Variety	Plant Height(cm)	No. of tillers per plant	No. of Ears per plant	No. of Spikelet per plant	Dry weight of 100 grains (g)	Dry weight of grains pre ears (g)	Test weight (g/cm^3)	Grain yield per plant
WH 1105	73.83±3.33	5.10±1.38	5.10±1.38	15.99±1.33	3.84±0.23	5.94±1.16	1.31±0.36	7.33±1.2
WH 1124	74.33±5.04	5.22±0.69	5.10±0.77	14.66±2.30	4.08±0.04	6.14±1.24	1.10±0.16	7.59±1.25
HD 2967	73.77±3.67	6.10±0.77	5.55±1.34	14.66±0.66	4.21±0.10	7.00±2.04	1.16±0.17	8.46±2.20
DBW88	73.22±5.82	4.55±0.69	4.33±1	16.66±1.15	4.07±0.17	5.98±0.66	1.23±0.17	7.48±0.75
WH 1142	73.35±4.03	5.33±0.67	4.99±0.88	15.22±1.57	3.78±0.47	5.44±0.94	1.16±0.29	6.11±1.06
WH 1080	78±3.52	5.21±1.89	5.10±1.95	11.99±0.66	4.35±0.18	5.05±1.42	1.20±0.24	7.39±0.86
WH 1025	77.77±6.84	5.77±0.83	5.33±0.57	10.66±0.66	4.27±0.09	4.78±0.56	1.18±0.20	6.29±0.57

References

Bartels D., and Sunkar R., (2005). Drought and Salt Tolerance in Plants. Crit Rev Plant Sci 24: 23–58.

Flowers T. J., Garcia A., Koyama M., and Yeo A. R., (1997). Breeding for salt tolerance in crop plants, the role of molecular biology. Acta Physiol. Plant, 19(4), 427-433. http://dx.doi.org/10.1007/s11738-997-0039-0

Flowers T.J., Garcia A., Koyama M., and Yeo A.R., (1997). Breeding for salt tolerance in crop plants, the role of molecular biology. Acta Physiol. Plant, 19(4), 427-433.

Hollington P.A., (1998). Technological breakthroughs in screening/breeding wheat varieties for salt tolerance. In S. K. Gupta, S. K. Sharma and N. K. Tyagi (Eds.), Proceedings of the National Conference 'Salinity management in agriculture' (pp. 273-289). Karnal India: Central Soil Salinity Research Institute.

Jose Ramon Acosta-Motos, Maria Fernanda Ortuño, Agustina Bernal-Vicente, Pedro Diaz-Vivancos, Maria Jesus Sanchez-Blancoand Jose Antonio Hernandez., (2017) Plant Responses to Salt Stress: Adaptive Mechanisms. Agronomy, 7, 18.

Kumar B., Gangwar V., and Parihar. S.K.S., (2017) Effect of Saline Water Irrigation on Germination and Yield of Wheat (*Triticum aestivum* L.) Genotypes. Agrotechnology, 6: 156.

Machado Rui, and Serralheiro Ricardo., (2017). Soil Salinity: Effect on Vegetable Crop Growth. Management Practices to Prevent and Mitigate Soil Salinization. Horticulturae. 3. 13.

Munns R., and Tester M., (2008) Mechanisms of Salinity Tolerance. Annual Review of Plant Biology. 59:651-681.

Preeti I.S., Panwar, and R. K. Arya, (2016). Effects of Changing Environment on Wheat Dry Matter Yield. Forage Res., 42 (1) : pp. 56-61 http://forageresearch.in

Tang X., Mu X., Shao H., Wang H., and Brestic M., (2015). Global plant-responding Mechanisms to Salt Stress: Physiological and Molecular Levels and Implications in Biotechnology. Crit. Rev. Biotechnol. 2015, 35, 425–437.