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Comparative Evaluation of Hexaploid Triticale Genotypes 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, to evaluate the production potential of 7 triticale genotypes namely TL2942, TL2969, TL3004, TL3001, TL3003, TL3002 and TL3005 under irrigation with saline water. 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 spike, dry weight of 100 grains, grain yield per plant and test weight were subjected to analysis of variance. The results revealed significant differences among 7 triticale genotypes for grain yield and its attributes. Among seven triticale varieties TL3002 was found superior for grain yield (7.5g/plant), number of spikelets per spike (16.88) whereas TL3001 scored highest number of tillers per plant (6.2), number of ears per plant (6.21), test weight (15.79) and TL2969 scored highest plant height (88.2 cm) and number of spikelets per spike (16.88). 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: *6x triticosecale*, grain yield, salinity

Introduction

Triticale (6x *triticosecale, AABBRR*) is a first man made cereal obtain from cross between tetraiploid wheat (AABB) and diploid rye (RR) (Conrado *et al.* 1993). It posses attributes of both parents that is grain quality from wheat and stress tolerance from rye (Blum, 2014). Triticale can be grown in marginal soils with low to medium fertility and soils possessing salinity/ acidity problems (Bona, 2004). Initially triticales wear suffering from grain shrivelling and low grain yield. However broadening of genetic base in secondary 6x triticale lines through recombination breeding have paid dividends (Blum, 2014). Triticale lines now available have well filled long grains possessing comparative yield to wheat (Arya *et al.* 2016) with better grain quality particularly for protein, lysine and mineral matters (Mergoum *et al.* 2009). A set of seven such lines has been evaluated under field condition using saline water from drain canal (Bidro) at the research farm, Jagan Nath University Bahadurgarh, Haryana, India. This paper deals with comparative evaluation of seven Triticale genotypes for grain yield and its components and other morphological characters.

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 and longitude 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 physico-chemical parameters (Table 1).

Plant material and experimental design: Seven triticale genotypes (TL2942, TL2969, TL3004, TL3001, TL3003, TL3002 and TL3005) obtained from CCS HAU Hisar (Table 2) 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. Yield and yield components plant height, number of tillers per plant, number of ears per plant, number of spikelet’s per spike, dry weight of 100 grains, grain yield per plant and test weight *etc.*) were recorded after harvesting the plants at maturity.

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

Results and Discussion

Analysis of Variance revealed that significant differences among triticale 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 (Table 3) revealed that genotype TL2942 recorded highest plant height (88.2 cm) while the lowest being in TL3005 (84.1 cm). Highest number of tillers per plant was observed in TL3001 (6.2) while lowest in TL2942 (4.7). Maximum number of ears per plant was recorded for TL3001 (6.2) while minimum in TL2942 (4.44). TL2969 and TL3002 recorded highest number of spikelet’s per spike (16.88) while TL2942 recorded the lowest (14.88). Dry weight of 100 grains was observed maximum in TL3004 (3.72 g) while minimum in TL2942 (3.27 g). TL3002 scored maximum grains yield per plant (7.50 g) while TL3005 recorded minimum grain yield (5.68 g). Highest test weight was observed in TL3001 (15.79 g/cm^3) while lowest in TL3003 (9.75 g/cm^3). The standard error or difference of mean for various traits was almost within 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 TL3002 figured important for its superior performance for number of spikelets per spike and grain yield per plant coupled with second highest performance for number of tillers per plant and number of ears per plant. Coincidentally these are principle components of grain yield. It’s seems that the genetic makeup of this genotype offers tolerance to salinity of irrigation water as well as soil. Also, TL3001 exhibited superior performance for grain yield at second ranked coupled with relatively high number of tillers per plant, number of ears per plant and test weight. Likewise, genotype TL2969 revealed considerably high yield coupled with superior performance for plant height, number of spikelet’s per spike and test weight. Thus it is evident that the genotypes found superior for grain yield also had superior performance for at least one or more yield components contributing towards grain yield (Dumbrava *et al.* 2016). Salt tolerance in plant is 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). The performance of agronomic traits have been used to identify relative tolerance of triticale genotypes for salt stress. A genotype performing better under salinity stress as well as no stress condition is expected to possess mechanism of homeostasis (Bartels and Sunkar, 2005). Such genotypes are worthwhile to insure survival under salt stress and yield potential under optimal condition. Involvement of such genotype in hybridization program may yield recombinants exhibiting higher performance for grain yield as well as its components especially in the environment where soil salinity is predominant.

Triticale is a relatively new crop for Indian farmers. Its lower grain quality for leavened bread (*Chapatti)* compare to wheat and its high nutritional value and production potential in marginal soils make it as an attractive crop for animal husbandry particularly for monogastic animals like swine and poultry (Farrell *et al.* 1983). We shall take up the feeding trials for poultry industry prevalent in Jhajjar district around the university.

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Table 1. Various physico-chemical parameters of water used for irrigation

pH	7.26
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
Ca Hardness (ppm)	200.21
Mg Hardness (ppm)	832.79
Total Alkalinity (ppm)	147.49

Table 2. Pedigree of seven triticale genotypes utilized in experimentation

Sr. No.	Variety	Pedigree
1.	TL2942	TL 2732/DT 54
2.	TL2969	JNIT 141/TL1210//JNIT141
3.	TL3004	TL2969/2987
4.	TL3001	UPT79362/DT962//JNIT128
5.	TL3003	T2396/DT78/JNIT128//TL1241
6.	TL3002	T2938/T2969
7.	TL3005	TL2969/2987

Table 3. Performance of various agronomical parameters in seven triticale genotypes

Variety	Plant Height	No. of Tillers Per Plant	No. of Ears Per Plant	No. of Spikelets Per Spike	Dry Wt. of 100 Grains (g)	Grains Yield Per Plant (g)	Test Wt. (g/cm³)
TL2942	85.6 ±5.33	4.7 ±1.38	4.44 ±1.07	14.88 ±2.0	3.27 ±0.21	5.82 ±0.59	12.63 ±2.34
TL2969	88.2 ±3.29	5.1 ±0.84	4.88 ±1.01	16.88 ±1.6	3.25 ±0.21	6.38 ±1.22	14.57 ±3.67
TL3004	85.2 ±7.39	5.6 ±0.87	5.44 ±1.07	16.22 ±1.5	3.72 ±0.38	5.96 ±0.19	14.54 ±4.18
TL3001	87.3 ±4.72	6.2 ±1.26	6.21 ±1.26	15.99 ±1.1	3.52 ±0.21	7.04 ±1.16	15.79 ±4.21
TL3003	85.59 ±6.83	4.8 ±0.19	5.88 ±1.83	15.10 ±2.1	3.49 ±0.13	6.63 ±1.99	9.75 ±2.05
TL3002	84.69 ±9.63	5.8 ±0.76	5.88 ±0.76	16.88 ±0.7	3.64 ±0.10	7.50 ±1.80	14.14 ±3.16
TL3005	84.1 ±8.72	5.4 ±1.89	5.11 ±2.01	15.77 ±3.2	3.65 ±0.76	5.68 ±2.85	10.78 ±2.85

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