Research Article

To Evaluate Five Wheat (*Triticum aestivum* L.) Varieties at Early Growth Stage with Various Salinity Levels

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Abstract | Studies on salinity tolerance at early seedling stage of wheat against various salinity levels were carried out under controlled conditions. Five wheat varieties (TD1, TJ-83, Moomal, Sarsabz, Kiran-95) were obtained from different Agricultural Research Institutes of Sindh. The research was conducted in the Department of Crop Physiology, Faculty of Crop Production, Sindh Agriculture University, Tandojam, Sindh, Pakistan. In this research, seed germination and seedling growth were analyzed under a control environment. Each replication was treated with different NaCl solutions of 0 (control), 50, 100, 150 and 200 mol m^{-3}. Wheat varieties viz; T.J-83, Sarsabz, and Moomal showed significantly superior germination and seedling growth, while T.D-1 and Kiran-95 exhibited reduced germination and seedling growth under 0 (control), 50, 100, 150 and 200 mol m^{-3} salinity levels. It was observed that increased salinity from 50 to 200 mol m^{-3} significantly affected all the initial growth traits. However, seeds germination percentage root and shoot length were remained satisfactory as compared to control at 50 mol m^{-3} of NaCl salinity level.

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Introduction

Agriculture is a backbone of Pakistan and consists of about 80 million hectares (m ha) land, among them 20 million hectares considered for cropping including 16.08 million hectares are irrigated while 3.92 are rain fed (Anonymous, 2004). Due to the alarming situation of population, the food demand is increasing day by day and creating challenges for agriculture. Next two decades, the food requirement will be increased up to 40 to 50%. To overcome such problems, farming can be started on uncultivated areas to fulfil food problems. These conditions need more human labor to maximize the production per unit area. Tropical areas are uncultivated, containing high salt or high underground water tables. Abiotic stresses are the chief problems for agriculture causing low crop yield (Kausar and Gull, 2014; Reguera *et al*., 2012). Around 20% land of the world is highly affected by salts (Munns, 2005). The climatic conditions are creating variation in the environment due to deterioration of agriculture zones worldwide (Soussana *et al*., 2012). The germination of seeds is introverted by abiotic stresses (He *et al*., 2011). Salinity directly affects wheat germination (Rahman *et al*., 2000; Masoomeh *et al*., 2014). *Triticum aestivum* is Asia's most famous crop utilized for food on a large scale (Shirazi *et al*., 2001). Wheat crop is classified as a glycophyte and can tolerate salinity on a small scale (Abou-Hadid, 2003). Soil salinization process occurs by changing the physical and chemical properties of the soil (Wild, 2003). Salt tolerant crop species take up salts to reduce the salinity problem and provide food, fuel, fodder, fiber, and oil (Bruno, 2012). It is important to develop salt tolerant crop species. The research consists of the following objectives:

- To scrutinize the germinating of various wheat varieties at different salinity levels under laboratory conditions.
- To examine the salt tolerant wheat varieties at early seedling growth under laboratory conditions.

Materials and Methods

Experiment was arranged by Randomized Complete Design (CRD) with three replications. The salt was used as sodium chloride (NaCl) for five treatments as 0 (control), 50, 100, 150 and 200 mol m^{-3} that was represented by T_1, T_2, T_3, T_4, T_5, respectively and for five wheat varieties as T.D-1, T.J-83, Moomal, Sarsabz, Kiran-95 and represented by V_1, V_2, V_3, V_4, V_5.

Seed preparations

The 20 healthy seeds of each variety were sterilized with 2.0% sodium hypochlorite solution for five minutes, and finally the seeds were washed thoroughly with distilled water to avoid any contamination (Khan *et al*., 1990).

Growth conditions

This research was determined to evaluate the germination percentage status and seedling growth of five wheat varieties. Twenty seeds of each variety were placed in a petri dish which contains blotting paper. Different treatments of 0 (control), 50, 100, 150 and 200 mol m^{-3} were prepared by dissolved NaCl salt. Each replication was treated with six ml of each 0 (control), 50, 100, 150 and 200 mol m^{-3} solutions. The plates were placed at 25°C ± 10°C in an incubator (Luminine cube II, ANALIS Model, LM-500, Belgium) for 3 days to record seed germination percentage, root and shoot length (cm).

Statistical analysis

The data was analyzed by using software statistics 8.1.

Results and Discussion

Effect of salinity on seed germination percentage of wheat

Table 1 describes the results of seed germination and interaction of salinity x variety to with various salinity concentrations. Maximum germination 97.11% was found at 00 mol m^{-3} (control), followed by 50 mol m^{-3} at 96.77%, and 100 mol m^{-3} at 90%, according to the mean values of all treatments. The lowest germination rate, however, was 75.22% at a higher level of 200 mol m^{-3}. T.J.-83 and Sarsabz varieties had significantly (P 0.05) higher germination rates than did Moomal and Kiran-95 variations, which had significantly (P 0.05) lower germination rates than did TD-1 variety (79.74%). The interactive findings depicted that the higher germination 99.83% recorded in TJ-83 variety x control and lower germination 55.01% was observed in TD-1 variety × 200 mol m^{-3}. Similar outcomes like treatment with various salts for pre-sowing were satisfactory (Cantliffe, 2003). Toxicity of salts can be effected through different biochemical processes of seed. Osmotic stress and ionic stresses create a complication germination and early growth stage (Jahari *et al*., 2010). High concentration of NaCl salt reduces seed germination (Pujol *et al*., 2000).

Effect of salinity on root length (cm) of wheat

Table 2 shows the statistics of root length of five wheat varieties and analyzed for variance on diverse salinity levels. The mean values of all treatments have an increased root length of 12.72 cm noted in 00 mol m^{-3} (control), followed by 10.67 cm on 50 mol m^{-3} and the verse root length 2.46 cm was recorded when treated with 200 mol m^{-3}. The significantly $P< 0.05$, the highest 8.78 and 8.45 cm root length was observed in Sarsabz and TJ-83 varieties followed by 7.67 and 7.22 cm in Moomal and Kiran-95. While TD-1 variety showed the lowest root length 6.08 cm, the results further suggested that the combination of variety x control was maximum 16.01 cm in TJ-83 and the lowest 1.97 cm was recorded in

Table 1: *Influence of salinity on seed germination (%) of wheat.*

Salinity levels (mol m^{-3})	Varieties					Mean
	T.D-1	T.J-83	Moomal	Sarsabz	Kiran-95	
Control	92.47b-e	99.83 a	96.67 abc	99.00 ab	98.66 ab	97.11 a
50	98.33 ab	99.00 ab	94.77 abc	95.78 abc	96.10 abc	96.79 a
100	80.22 hi	96.11 abc	92.88 bcd	93.67 a-d	87.10 d-g	90.00 b
150	72.66 jk	90.22 c-f	86.11 e-h	85.00 fgh	85.00 fgh	83.80 c
200	55.00 l	96.10 abc	75.66 ij	81.78 ghi	67.55 k	75.22 d
Mean	79.74 d	96.25 a	89.00 bc	91.04 b	86.88 c	
	Salinity		Varieties		Salinity varieties	
SE	1.47		1.47		3.30	
LSD 5%	2.84		2.84		5.24	

Table 2: *Effect of salinity on root length (cm) of wheat seedlings.*

Salinity levels (mol m^{-3})	Varieties					Mean
	T.D-1	T.J-83	Moomal	Sarsabz	Kiran-95	
Control	11.03 bc	16.01 a	12.19 bc	13.07 b	11.31 bc	12.72 a
50	7.65 de	11.84 bc	11.31 bc	11.38 bc	11.16 bc	10.67 b
100	6.83 de	8.47 d	7.96 de	10.69 c	6.17 ef	8.02 c
150	2.90 gh	3.99 gh	4.35 fg	6.05 ef	4.41 fg	4.34 d
200	2.03 h	1.97 h	2.56 gh	2.70 gh	3.04 gh	2.46 e
Mean	6.08 d	8.45 ab	7.67 bc	8.78 a	7.22 c	
	Salinity		Varieties		Salinity Varieties	
SE	0.45		0.45		1.02	
LSD 5%	0.91		0.91		2.05	

Table 3: *Effect of salinity on shoot length (cm) of wheat seedlings.*

Salinity levels (mol m^{-3})	Varieties					Mean
	T.D-1	T.J-83	Moomal	Sarsabz	Kiran-95	
Control	14.11 def	14.58 de	11.74 g	16.90 a	15.54 bc	14.57 a
50	13.64 f	13.78 ef	11.17 gh	15.68 b	15.56 b	13.97 b
100	11.97 g	13.58 f	10.20 i	14.85 bcd	14.67 cd	13.05 c
150	6.03 k	8.44 j	7.76 j	10.28 i	10.54 hi	8.61 d
200	2.89 m	1.55 n	2.80 m	2.62 m	5.15 a	3.00 e
Mean	9.73 c	10.38 b	8.73 d	12.06 a	12.29 a	
	Salinity		Varieties		Salinity X Varieties	
SE	0.19		0.19		0.43	
LSD 5%	0.39		0.39		0.87	

TJ-83 variety x 200 mol m^{-3}. There are several methods by which seedlings could be checked for tolerance of salinity stress (Ungar, 2005). Wheat seedling, are very sensitive than other crops the early growth stages are also affected when treated with salt stress (Bhutta and Hanif, 2010; Khayatnezhad and Gholamin, 2011).

Influence of salinity on shoot length (cm) of wheat

The results showed that shoot lengths were analyzed at different salinity levels, set P<0.05, Table 3. The maximum 14.57 cm shoot length was obtained when plants were watered with 00 mol m^{-3} (control), followed by 13.97 cm on 50 mol m^{-3} and the minimum 3.00 cm was recorded on 200 mol m^{-3}. The varietal response revealed the significant values of The Kiran-95 and Sarsabz varieties' shoot lengths were 12.29 and 12.06 cm, those of the TJ-83, 9.73, and T.D-1 variants were 10.38 and 9.73 cm, and

Links Researchers

the Moomal variety's shoot length was 8.73 cm, the shortest ever recorded. The higher shoot length of 16.9 cm in the Sarsabz variety and the lower shoot length of 1.55 cm in the TJ-83 variety with 200 mol m^{-3} were described by the interaction of variety x treatment. Azizpour *et al*. (2010) suggested that the accumulation of salts in soil can negatively affect the physiological and biochemical processes of crop finally to reduce the crop growth and production. At various salinity levels the different growth stages of wheat are severely affected (Noori and McNeilly, 2000; Ali *et al*., 2002).

Conclusions and Recommendations

This research work was evaluated for five wheat varieties at various salinity levels at the early stage of wheat growth. T.J-83, Sarsabz, Kiran-95 and Moomal performed better than T.D-1 variety. T.D-1 showed poor performance in germination and at early growth stage compared to rest of varieties under high 200 mol m^{-3} salt stress.

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Novelty Statement

By focusing on the early growth stage, this research sheds light on the crucial period when wheat plants are particularly sensitive to salinity stress. It uncovers how different varieties respond to salinity at this critical stage.

Author's Contribution

Javed Hussain Umrani: Conceived the idea, Research work.
Roseena: Help in paper Writing.
Ashfaq Ahmed: Over view the paper.
Saba Iqbal: Data collection.
Amtul Sami: Technical Input at every step.
Mumtaz Ali Salito: Data analysis.
Gulnaz Parveen: Write the paper and correspondence author.

Conflict of interest

The authors have declared no conflict of interest.

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