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RESPONSE OF WHEAT GENOTYPES TO SALINITY UNDER FIELD ENVIRONMENT

MOHAMMAD SHAFI[1*], MOHAMMAD JAVED KHAN[2], JEHAN BAKHT[3] AND MOHAMMAD AMAN KHAN[4]

[1]*Department of Agronomy Agricultural University Peshawar, Pakistan*
[2]*Agricultural Research Institute Tarnab Peshawar, Pakistan*
[3] *Institute of Biotechnology and Genetic Engineering Agricultural University Peshawar, Pakistan*
[4] *Department of Biotechnology Quaid-i-Azam University Islamabad Pakistan*
[*]*Corresponding author e-mail: mshafi.aup@gmail.com*

Abstract

The study entitled "Response of wheat genotypes to salinity under field environment" was conducted to investigate the response of different wheat genotypes to salinity stresses. The experiment was laid out at three different locations of Khyber Pakhtunkhwa, Pakistan i.e., Yar Hussain, Baboo Dehari (District Mardan) and Khitab Koroona (District Charsadda) to study the performance of 11 wheat genotypes (Local, SR-24, SR-25, SR-7, SR-22, SR-4, SR-20, SR-19, SR-2, SR-23 and SR-40) for their salinity tolerance. These locations had different salinity profile i.e., Yar Hussain (EC. 3-3.5 dSm^{-1}), Baboo Dehari (EC. 4-4.5 dSm^{-1}) and Khitab Koroona (EC. 5-5.30 dSm^{-1}). Different locations and wheat genotypes had significantly ($p<0.05$) effected grain yield, shoot Na^+ and shoot K^+ concentration (3, 6 and 9 weeks after emergence). Maximum grain yield , maximum shoot K^+ and minimum Na^+ concentration (3, 6 and 9 weeks after emergence) were recorded from genotype SR-40 followed by genotype SR-23. Our results further indicated highest grain yield compared with lowest shoot K^+, Na^+ concentrations (3, 6 and 9 weeks after emergence) at Yar Hussain. Maximum, K^+ and Na^+ concentration (3, 6 and 9 weeks after emergence) and minimum grain yield were recorded at Khitab Koroona.

Introduction

Salinity is one of the major abiotic stresses, which affect productivity of agricultural lands. Plant species differ in their salt tolerance. Salt stress in addition to the known components of osmotic stress and ion toxicity also result in an oxidative stress (Ashraf, 2004; Shafi *et al*., 2009; Bakht *et al*., 2011). It has been well documented that NaCl causes higher plasma membrane permeability and enhance the production of oxygen radicals and H_2O_2 in wheat. Soil salinity is one of the major abiotic stresses which substantially hamper crop productivity. Excessive soil salinity occurs in many arid and semi arid regions of the world where it inhibits the growth and yield of crop plants (Hasegawa *et al*., 2001). When wheat is grown in saline soils, roots have to cope with osmotic stress that leads to lowered water potential and consequent loss of cell turgor in roots. Salinity stress is known to affect various growth processes including photosynthesis, ion regulation, and water relations (Ashraf, 2004; Shafi *et al*., 2010). Salt stress affects plant physiology at both whole plant and cellular levels through osmotic and ionic stress (Joset *et al.,* 1996; Ranjbarfordoei *et al*., 2002; Shafi *et al*., 2011). Physiological processes which are severely affected by salinity include changes in plant growth, mineral distribution, membrane instability resulting from calcium displacement by sodium, membrane permeability and decreased efficiency of photosynthesis (Hasegawa *et al*., 2001; Shazma *et al*., 2011). Under salinity, net photosynthetic CO_2 uptake decreases mainly because NaCl treatment decreases stomatal conductance, and consequently less CO_2 is available for carboxylation reaction in photosynthetic apparatus. Also, the rate of ribulose-1, 5-bisphosphate carboxylase/ oxygenase activity decreases under NaCl salinity and photochemical reactions are inhibited (Seeman & Critchley, 1985).

In Pakistan, wheat production has been deficit in recent years. Yield losses of wheat in moderately saline areas of Pakistan average 65% (Quayyum & Malik, 1988). If varieties of wheat capable of giving high yields on slight to moderately salt-affected soils could be developed, the productivity of such lands would be increased manifold and it might also permit expansion of agriculture on marginal lands. There is pressing need to develop an appropriate technique for screening of wheat cultivars/lines for slat tolerance. The study of ion transport and regulation within intact plant tissues of wheat will also improve the understanding of mechanisms of salt tolerance in species and will allow development of selection markers of direct value for plant breeders. The recognition of selection criteria will be a step towards the urgent goal of developing wheat varieties with better ability to grow and produce grain at locations where wheat is grown inefficiently or not at all. The present study was conducted to screen different genotypes of wheat for their grain yield performance and salinity tolerance under different saline environments.

Materials and Methods

Field experiment was conducted at three different locations in Khyber Pakthunkhwa (Mardan and Charssada Districts) Pakistan to study the performance of 11 wheat genotypes (Local, SR-24, SR-25, SR-7, SR-22, SR-4, SR-20, SR-19, SR-2, SR-23 and SR-40) for their salinity tolerance. These locations included Yar Hussain (EC. 3-3.5 dSm^{-1}) and Baboo Dehari (EC. 4-4.5 dSm^{-1}) at district Mardan and Khitab Koroona (EC. 5-5.30 dSm^{-1}) at district Charssada. These experiments were laid out in randomized complete block design with three replications. Fertilizer dose of 135 kg N, 120 kg P_2O_5 and 60 kg K_2O ha^{-1} was applied to all locations. Half dose of N and full does of P and K was applied at the time of sowing and remaining half dose of N was given to wheat plots at 2nd irrigation. Recommend agronomic practice, i.e., weeding hoeing, thinning, irrigation and plant protection measures were carried out at appropriate times.

Table 1 reveals physiochemical characteristics of soils from three different experimental sites. Before plantation of wheat genotypes in the field composite soil samples were taken from all experimental sites i.e., Yar Hussain (Mardan district), Baboo Dehari (Mardan district) and Khitab Koroona (Charsadda district). Physiochemical characteristics of soil samples were determined using the following methods.

Table 1. Physio-chemical properties of the soil from three different experimental locations.

Characteristics	Yar Hussain	Baboo Dehari	Khitab Koroona
Electric conductivity (EC)	3-3.5	4-4.5	5-5.30
K(mg kg^{-1})	108	122	124
N(%)	0.057	0.064	0.087
P (mg kg^{-1})	9.3	8.2	9.3
Clay (%)	23.15	25.15	24.50
Silt (%)	32.10	30.90	31.20
Sand (%)	44.78	42.45	45.15
Textural Class	Loamy	Loamy	Loamy

Determination of pH: Soil pH was measured in soil water suspension (1:2:5) with the help of pH meter by the method outlined by McLean (1982).

Electrical conductivity (EC): Soil electrical conductivity (EC) was determined in soil-water suspension (1:2:5) using electrical conductivity meter (Rhoades, 1982)

Soil texture: Soil texture was determined by Bouyocous hydrometer method as described by Moodi *et al*., (1954).

Total nitrogen: Total nitrogen of soil was determined according to the method of Anon., (2004).

Phosphorus (soil): Soil phosphorus was determined by Olsen method (1954).

Statistical analysis: All data are presented as mean values of three replicates. Data were analyzed statistically for analysis of variance (ANOVA) following the method described by Gomez & Gomez (1984). MSTATC computer software was used to carry out statistical analysis (Russel & Eisensmith, 1983). The significance of differences among means was compared by using Duncun's Multiple Range test (DMRT).

Results

Maximum shoot Na^+ content (0.671 mg g^{-1} dry weight) three weeks after emergence was observed in genotype local followed by SR-24 (Table 2). Minimum shoot Na^+ content of 0.446 mg g^{-1} dry weight was produced from genotype (SR-40). The data further revealed highest shoot Na^+ (0.618 mg g^{-1} dry weight) from treatments sown at Khitab Koroona. Lowest Na^+ content (0.553 mg g^{-1} dry weight) was observed at Yar Hussain. Interaction between genotypes and locations showed minimum shoot Na^+ contents (0.400 mg g^{-1} dry weight) was produced at Yar Hussain from genotypes (SR-400). Maximum (0.721 mg g^{-1} dry weight) was observed at Khitab Koroona from genotype (Local). Data concerning shoot Na^+ contents six weeks after emergence is presented in Table 3. Maximum shoot Na^+ content (0.755 mg g^{-1} dry weight) six weeks after emergence was recorded from genotype (Local) compared with minimum shoot Na^+ contents of 0.663 mg g^{-1} dry weight from genotype (SR-40). Highest shoot Na^+ of 0.770 mg g^{-1} dry weight was obtained at Khitab Koroona. Similarly shoot Na^+ content was minimum (0.592 mg g^{-1} dry weight) when various genotypes of wheat were planted at Yar Hussain. Lowest shoot Na^+ (0.580 mg g^{-1} dry weight) was recorded at Yar Hussain from genotype (SR-400) compared with highest (0.813 mg g^{-1} dry weight) at Khitab Koroona from genotype (Local). Maximum shoot Na^+ contents (1.208 µg g^{-1} dry weight) nine weeks after emergence was recorded from genotype (Local) compared with minimum shoot Na^+ contents of 1.061 µg^{-1} dry weight from SR-40 (Table 4). Highest shoot Na^+ of 1.231 µg g^{-1} dry weight was produced at Khitab Koroona compared with lowest shoot Na^+ contents (1.001 µg g^{-1} dry weight) at Yar Hussain. Genotypes x locations interaction revealed minimum shoot Na^+ content of 0.928 µg g^{-1} dry weight at Yar Huassain from genotype (SR-40) whereas maximum (1.300 µg g^{-1} dry weight) was observed at Khitab Koroona from genotype (Local).

Table 5 revealed maximum shoot K^+ content (0.905 mg g^{-1} dry weight) three weeks after emergence from genotypes (SR-40) followed by SR-23 compared with minimum shoot K^+ content of 0.738 mg g^{-1} dry weight in genotype (Local). The data further indicated maximum shoot K^+ (0.910 mg g^{-1} dry weight) at Khitab Koroona followed by 0.750 mg g^{-1} dry weight at Babu Dehari compared with minimum 0.750 mg g^{-1} dry weight from location of Yar Hussain. Interaction between genotypes x locations showed minimum shoot K^+ contents (0.676 mg g^{-1} dry weight) at Yar Hussain from genotype local while maximum (0.984 mg g^{-1} dry weight) was observed at Khitab Koroona when planted with SR-40. Table 6 showed highest shoot K^+ content (1.013 mg g^{-1} dry weight) six weeks after emergence in genotype (SR-40) compared with lowest lowest shoot K^+ content of 0.543 mg g^{-1} dry weight from genotype (Local). Highest shoot K^+ of 0.942 mg g^{-1} dry weight was obtained at Khitab Koroona compared with lowest (0.797 mg g^{-1} dry weight) when various genotypes of wheat were sown at Yar Hussain. Interaction of genotypes and locations revealed highest shoot K^+ content (1.150 mg g^{-1} dry weight) at Khitab Koroona from genotype (SR-400) compared with lowest (0.706 mg g^{-1} dry weight) at Yar Hussain from genotype (Local). Maximum shoot K^+ content (1.040 mg

g^{-1} dry weight) six weeks after emergence was produced from SR-40 (Table 7). Minimum shoot K^+ content of 0.0.839 mg g^{-1} dry weight was recorded in genotype (Local). Highest shoot K^+ content of 1.014 mg g^{-1} dry weight was obtained from treatments sown at Khitab Koroona, while minimum shoot K^+ content (0.878 mg g^{-1} dry weight) was recorded when various genotypes were sown at Yar Hussain. Genotypes x locations interaction indicated maximum shoot K^+ content of 1.109 mg g^{-1} dry weight at Khitab Koroona from genotype (SR-40) compared with 0.763 mg g^{-1} dry weight at Yar Hussain when sown with genotype (Local).

Table 2. Shoot Na^+ contents (µg g^{-1} fresh weight), 3 weeks after emergence of wheat as affected by locations of different salinity levels.

Genotypes	Yar Hussian	Baboo Dehari	Khitab Koroona	Mean
Local	0.601	0.691	0.721	0.671a
SR-24	0.582	0.667	0.696	0.647b
SR-25	0.570	0.655	0.684	0.636b
SR-7	0.550	0.632	0.660	0.614c
SR-22	0.530	0.609	0.636	0.591c
SR-4	0.540	0.681	0.648	0.603c
SR-20	0.520	0.598	0.624	0.580c
SR-19	0.460	0.529	0.552	0.513d
SR-2	0.490	0.563	0.588	0.537d
SR-23	0.430	0.494	0.516	0.480e
SR-40	0.400	0.460	0.480	0.446f
Mean	0.553 c	0.592 b	0.618 a	

DMRT value for interactions at $p \leq 0.05 = 0.08$

Means of the same category followed by different letters are significantly different using DMRT test ($p \leq 0.05$)

Table 3.Shoot Na^+ contents (µg g^{-1} fresh weight), 6 weeks after emergence of wheat as affected by locations of different salinity levels.

Genotypes	Yar Hussian	Baboo Dehari	Khitab Koroona	Mean
Local	0.661	0.793	0.813	0.755a
SR-24	0.650	0.780	0.799	0.752a
SR-25	0.640	0.768	0.787	0.731b
SR-7	0.6 35	0.762	0.781	0.726b
SR-22	0.628	0.753	0.772	0.717bc
SR-4	0.632	0.758	0.777	0.722bc
SR-20	0.625	0.750	0.768	0.714bc
SR-19	0.618	0.741	0.760	0.706bc
SR-2	0.620	0.744	0.762	0.708bc
SR-23	0.60	0.720	0.738	0.686c
SR-40	0.580	0.696	0.713	0.663d
Mean	0.592c	0.751b	0.770a	

DMRT value for interactions at $p \leq 0.05 = 0.125$

Means of the same category followed by different letters are significantly different using DMRT test ($p \leq 0.05$)

Table 4. Shoot Na^+ contents (µg g^{-1} fresh weight), 9 weeks after emergence of wheat as affected by locations of different salinity levels.

Genotypes	Yar Hussian	Baboo Dehari	Khitab Koroona	Mean
Local	1.057	1.268	1.300	1.208a
SR-24	1.040	1.248	1.278	1.188a
SR-25	1.024	1.229	1.259	1.171a
SR-7	1.016	1.219	1.249	1.161a
SR-22	1.005	1.204	1.235	1.148a
SR-4	1.011	1.213	1.243	1.156a
SR-20	1.00	1.200	1.228	1.143a
SR-19	0.988	1.186	1.216	1.130b
SR-2	0.992	1.190	1.219	1.134b
SR-23	0.950	1.152	1.181	1.094b
SR-40	0.928	1.114	1.141	1.061b
Means	1.001c	1.202b	1.231a	

DMRT value for interactions at $p \leq 0.05 = 0.192$

Means of the same category followed by different letters are significantly different using DMRT test ($p \leq 0.05$)

Table 5. Shoot K^+ contents (µg g^{-1} fresh weight), 3 weeks after emergence of wheat as affected by locations of different salinity levels .

Genotypes	Yar Hussian	Baboo Dehari	Khitab Koroona	Mean
Local	0.676	0.750	0.789	0.738g
SR-24t	0.745	0.771	0.810	0.755f
SR-25	0.680	0.789	0.819	0.763f
SR-7	0.754	0.836	0.906	0.832e
SR-22	0.741	0.849	0.927	0.839e
SR-4	0.728	0.841	0.932	0.834e
SR-20	0.745	0.862	0.949	0.852d
SR-19	0.802	0.945	0.960	0.902c
SR-2	0.804	0.832	0.966	0.867c
SR-23	0.823	0.971	0.966	0.900b
SR-40	0.753	0.979	0.984	0.905a
Means	0.750c	0.857b	0.910a	

DMRT value for interactions at $p \leq 0.05 = 0.065$

Means of the same category followed by different letters are significantly different using DMRT test ($p \leq 0.05$)

Table 6. Shoot K^+ contents (µg g^{-1} fresh weight), 6 weeks after emergence of wheat as affected by locations of different salinity levels.

Genotypes	Yar Hussian	Baboo Dehari	Khitab Koroona	Mean
Local	0.706	0.780	0.815	0.767f
SR-24	0.810	0.793	0.845	0.816e
SR-25	0.732	0.823	0.858	0.804e
SR-7	0.793	0.901	0.978	0.890d
SR-22	0.771	0.884	0.962	0.872d
SR-4	0.776	0.888	0.953	0.872d
SR-20	0.806	0.892	0.960	0.886c
SR-19	0.803	0.890	0.950	0.881c
SR-2	0.820	0.888	0.950	0.886c
SR-23	0.875	0.980	1.040	0.965b
SR-40	0.880	1.010	1.150	1.013a
Means	0.797c	0.884b	0.942a	

DMRT value for interactions at $p \leq 0.05 = 0.068$

Means of the same category followed by different letters are significantly different using DMRT test ($p \leq 0.05$)

Table 7. Shoot K^+ contents (µg g^{-1} fresh weight), 9 weeks after emergence of wheat as affected by locations of different salinity levels.

Genotypes	Yar Hussian	Baboo Dehari	Khitab Koroona	Mean
Local	0.763	0.845	0.910	0.839g
SR-24t	0.860	0.867	0.900	0.876f
SR-25	0.945	0.862	0.919	0.909e
SR-7	0.852	0.983	1.049	0.961c
SR-22	0.858	0.988	1.053	0.966c
SR-4	0.836	0.962	1.018	0.939d
SR-20	0.862	1.005	1.006	0.958c
SR-19	0.901	1.036	1.008	0.982b
SR-2	0.910	1.053	1.088	1.017b
SR-23	0.932	1.062	1.095	1.030a
SR-40	0.940	1.070	1.109	1.040a
Means	0.878c	0.976b	1.014a	

DMRT value for interactions at $p \leq 0.05 = 0.795$

Means of the same category followed by different letters are significantly different using DMRT test ($p \leq 0.05$)

Table 8 revealed maximum grain yield of 2402.22 kg ha^{-1} from genotype (SR-40) followed by grain yield of 2401.11 kg ha^{-1}, 2382.22 kg ha^{-1}, 2378,89 kg ha^{-1} and 2167.22 kg ha^{-1} from genotypes SR-23, SR-2, SR-19 and SR-20 respectively compared with minimum grain yield of 1870.11 kg ha^{-1} from genotype (Local). Highest grain yield (2324 kg ha^{-1}) was harvested from location of Yar Hussain compared with lowest grain yield of 2041 kg ha^{-1} from Khitab Koroona. Interaction between genotype and location revealed maximum grain yield 2536.67 kg ha^{-1} at Yar Hussain from genotype (SR-40) compared with minimum grain yield of 1755 kg ha^{-1} at Khitab Koroona from genotype local.

Table 8. Grain yield (kg ha^{-1}) of wheat genotypes as affected by locations of different salinity levels.

Genotypes	Yar Hussian	Baboo Dehari	Khitab Koroona	Mean
Local	2035.00	1820.33	1755.00	1870.11c
SR-24	2053.33	1841.00	1760.00	1884.78c
SR-25	2108.33	1818.67	1737.00	1888.00c
SR-7	2303.33	2158.33	1988.33	2150.00b
SR-22	2306.68	2130.00	2061.67	2166.11b
SR-4	2328.33	2063.33	2065.00	2152.22b
SR-20	2261.68	2185.00	2055.00	2167.22b
SR-19	2543.33	2360.00	2233.33	2378.89a
SR-2	2543.33	2346.67	2256.67	2382.22a
SR-23	2546.68	2420.00	2236.67	2401.11a
SR-40	2536.67	2360.00	2310.00	2402.22a
Means	2324.24a	2136.67b	2041.70c	

DMRT value for interactions at $p \leq 0.05 = 150$

Means of the same category followed by different letters are significantly different using DMRT test ($p \leq 0.05$)

Discussion

Biochemical parameters (i.e. shoot Na^+ and shoot K^+ contents) and grain yield of 11 genotypes were studied during current study. Results results that shoot Na^+ and K^+ concentration were significantly affected by different genotypes and salinity exposure. Our results showed that among the tested genotypes, SR-40 and SR-23 performed better in term of shoot Na^+ and shoot K^+ concentration compared with other genotypes. Genotypes SR-40 and SR-23 had maximum K^+ and less Na^+ contents in their tissue while genotype local had minimum of these parameters. These biochemical parameters (shoot Na^+ and shoot K^+ contents) are among the few markers used for assessing salinity tolerance of a particular plant species. Gorham *et al*., (1990) reported genetic diversity for salt tolerance within the species is due to degree of control of salt uptake by roots, or control of Na^+ accumulation in xylem. Mass and Hoffman, (1977) showed large differences in salt tolerance among species. These differences have been observed even at varietals level (Qureshi *et al*., 1980; Qureshi *et al*., 1990; Jamal *et al*., 2011).

Physiological mechanisms conferring exclusion of Na^+ that operate at the cellular and whole plat level have been described with particular reference to selectivity for K^+ over Na^+ (Jeschke & Hartung, 2000; Tester & Davenport, 2003). There is a strong correlation between salt exclusion and salt tolerance in many species (Munns & James, 2003) and recently reported for rice (Lee *et al*., 2003; Zhu *et al*., 2004) and wheat (Poustini and Siosemardeh, 2004). Species that retain Na^+ in woody roots or stems, a strong correlation exists between Cl^- exclusion and salt tolerance (Storey & Walker, 1999). Munns & James, 2003; Bakht *et al*., 2011 reported that genotypes with the lowest Na^+ concentration produced greatest dry matter. These low Na^+ genotypes had fewer injured leaves, and a greater proportion of living to dead leaves. The effect on growth was probably due to a better carbon balance in the genotypes with less Na^+. A similar relationship between shoot dry weight and leaf Na^+ was found in a population from a cross between high and low Na^+ genotypes. There was a strong correlation between shoot dry matter produced and Na^+ concentration in leaves between families from a cross between the genotypes with the highest and lowest Na^+. Species which cannot effectively exclude salt from the transpiration stream must have ways to handle the salt arriving in leaves as the water evaporates and salt gradually build up over time. The salt concentration in older leaves is much higher than in younger leaves at a given time. In the older leaves, the salt concentration eventually becomes high enough to kill the cells, unless they can compartmentalize the salt in vacuoles, thereby protecting the cytoplasm

from ion toxicity. The concept that salt must either be excluded from the tissues or compartmentalized in cell vacuoles, derives from the earlier discovery by biochemists that enzymes of halophytes are no longer tolerant of high concentrations of NaCl than those of non-halophytes (also called glycophytes or plants requiring sweet water).

Osmotic adjustment has been considered a crucial process in plant adaptation to salinity, because it sustains tissue metabolic activities and enables re-growth upon removing the stress but varies among genotypes (Morgan, 1984). However, in terms of crop yield there are not many field studies showing a consistent benefit from osmotic adjustment (Quarrie *et al*., 1999), presumably because turgor maintenance in cells is often associated with slow growth (Serraj & Sinclair, 2002). Nevertheless, osmotic adjustment is important in roots enabling their sustained growth under decreasing water availability in the soil. Osmotic adjustment is normally a slow process and is triggered by the synthesis of osmotic compounds including amino acids such as proline, aspartic acid and glutamic acid (Samuel *et al*., 2000; Hamilton & Heckathorn, 2001) and methylated quaternary ammonium compounds (e.g., glycine betain and alanine betain) (Rathinasabapthi *et al*., 2001; Sakamoto & Murata, 2002). In addition to decreasing cell osmotic potential thus allowing the maintenance of water absorption and cell turgor under water deficit, these solutes may protect the cell membrane under dehydration. Ibrahim *et al*., (2007) reported a marked increase in K^+ contents of wheat varieties under salt stress. The increase was highest in tolerant cultivars and lowest in sensitive cultivars (Bhatti *et al*., 2004). Shoot K^+ contents of various wheat genotypes reduced significantly under salt stress (Ali *et al*., 2005). Potassium (K^+) contents in plants are a good indicator of salinity tolerance. Lower uptake of K^+ by various varieties under saline conditions hampers overall production of these varieties. Tahir *et al*., (2006) reported that K^+ concentration had a vital role in improvement of plant water status and minimizing the toxic effects of Na. The genotypes which are tolerant to salt stress could avoid this adverse effect through selective ion transport to leaf from soil by maintaining higher K^+ versus Na^+.

Grain yield of the 11 genotypes under study were also significantly affected by genotypes and locations (salinity levels). Genotypes SR-40 and SR-23 had maximum grain yield. Similarly locations which had minimum salt in their soil had maximum grain yield. Reduction in plant growth and yield as a result of salt stress has been reported in several other plant species (Ashraf & McNeilly, 1990; Shafi *et al*., 2010; Shazma *et al*., 2011). Accumulation of excessive salt in cell wall modifies the metabolic activities of the cell and limits the cell wall elasticity. In addition, secondary cells appear sooner and cell wall becomes rigid as a consequence the turgor pressure efficiency in cell enlargement decreases. These processes may also reduce growth and yield performance of wheat crop. Our results also agree with those reported by Ashraf *et al*., (2005) and Munns *et al*., (2006). Varietals differences for yield and yield components in saline conditions have been revealed by Slavich *et al*., 1990; Jamal *et al*., (2011). It was revealed from these results that increasing salinity levels had progressively decreased growth and development which might be due to decreased water potential of rooting medium due to high ion concentration (Munns *et al*., 1995) and accumulation of Na^+ and Cl^- ion to toxic levels in leaves interfering metabolic processes viz. photosynthesis, protein synthesis etc. going on in cytoplasm (Ibrahim, 2003 and Shafi *et al*., 2011). High concentration of these ions in the rooting medium reduced the uptake of other essential ions as K^+, Ca^+ and NO_3 etc. Similarly, Harris *et al*., (2001); Fortmeier & Schubert (1995) and Jamal *et al*., (2011) concluded that significant decrease in plant performance occurs due to salinity stress. There may be also indirect effect of salt on plant growth due to decrease in photosynthetic activities. Water deficiency may occur in the growing regions because of insufficient osmotic adjustment or increased resistance to water flow (Flowers *et al*., 1991). In addition, selective absorption of essential ions under saline condition for osmotic adjustments is an energy demanding process and plant uses its energy at the cost of growth and economic yield (Nieman, 1980; Yeo, 1983). It is concluded that the measured parameters of 11 wheat genotypes tested has provided the useful information to asess genetic differences for performance under salinity stress. Genotypes, SR-40 and SR-23 performed better where as the performance of genotype local and SR-25 was poor when exposed to locations of different salinity levels. The yield performance of the location (Yar Hussain) was best compared with other locations (i.e. Baboo Dehari and Khitab Koroona).

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