J. Agric. Sci. Mansoura Univ., 33 (10): 7735 - 7745, 2008

RESPONSE OF SOME WHEAT VARIETIES TO SOIL SALINITY

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ABSTRACT

A pot experiment was conducted to study the effect of soil salinity on growth and mineral composition of some wheat varieties (Gemmeza 7, Gemmeza 9 , Gemmeza 10; Giza 164, Giza 168; Sakha 8, Sakha 69, Sakha 93, Sakha 94 and Sids 1). A mixture of NaCl and $CaCl_2$ with the ratio of (1:1) was added to the soil at different amounts to reach salinity levels of 6, 9 and 12d Sm^{-1}.

Dry weight of shoots and roots of all wheat varieties was significantly reduced with increasing soil salinity levels . Wheat varieties were divided into two groups according to the relative reduction of shoots dry weight; moderately tolerant (Sakha 93, Sakha 8 and Sids1) and moderately sensitive (Giza 164, Giza 168 ;Gemmeza 7, Gemmeza 9, Gemmeza 10, Sakha 94, and Sakha 69). Concentration of sodium and chloride in both shoots and roots was increased by increasing the soil salinity levels. On the other hand , potassium concentration in both shoots and roots was reduced with increasing soil salinity. The ratio of K/Na was decreased as a result of increasing soil salinity. Moreover, the relative reduction of K/Na ratio in shoots of the moderately sensitive group at all salinity levels were more than in the moderately tolerant one.

INTRODUCTION

Salinity is one of the important factors affecting growth and yield of most crops by increasing the osmotic pressure of the rooting medium, disturbing normal mineral nutrition of plants and causing toxic effects due to salinity ions Gawish *et al.* (1999-a). Also Dehdari *et al.* (2005) reported that high salinity is an important environmental factor that has a negative impact on plant growth and global crop productivity. High salt levels in soils and waters may reduce plant growth by ion toxicity, water deficit, and by affecting mineral nutrition . The inhibitory effects of salinity on plant growth are caused both by depression of the water potential of the nutrient medium (and hence restricted water uptake by plants) and the accumulation of ions in plant tissues at concentrations that may be toxic or at least give rise to ionic imbalance (Lazof and Bernstein 1999 and Borsani *et al.* 2001).

Soil salinity has been considered a limiting factor to crop production in arid and semi arid regions of the world Munns (2002) . These areas are characterized by limited rainfall and high evapotranspiration because of high temperatures .Furthermore ,excessive irrigation and inadequate drainage cause soil build up of salinity Al-Karaki (1997). Moreover Flowers *et al.* (1997) and Ghassemi *et al.* (1995) added that salinity is one of the major factors reducing plant growth and productivity worldwide, and about 7% of the world's total land area are affected by salinity .The percentage of cultivated land affected by salt is even greater, with 23% of the cultivated land being saline and 20% of the irrigated land suffering from secondary salinization .

Wheat (*Triticum aestivum* L.) is a major food crop in most of the countries where salinity is a threat, and is moderately tolerant to salinity Mass and Hoffman (1977) . In Egypt wheat is the most important and widely adapted food cereal. However, Egypt supplies only 55 % of its annual domestic demand for wheat . Therefore, it is necessary to increase wheat production by raising the wheat grain yield. Obviously, one of the most efficient ways to increase wheat yield is to improve the salt tolerance of wheat genotypes (El-Hendawy *et al.* 2005 and Pervaiz *et al.* 2002). Increasing the salt tolerance of wheat is considered much less expensive for poor farmers in developing countries than using other management practices (e.g. leaching salt from the soil Qureshi and Barrett-Lennard (1998).

In Egypt, 33% of the cultivated land is already salinized due to low precipitation (< 25mM annual rainfall) and irrigation with saline water (El-Hendawy *et al.* 2005). Moreover, Hassan *et al.* (1999) added that increasing salinity and ground water table level represent a serious problem minimized the cultivated area and productivity .

Wheat is the main stable food for Egyptian, and the total grain production is 5.7 million tons which account for 55% of the total consumption. Moreover, it is considered one of the moderately salt tolerant crops which are suitable to be cultivated under saline irrigation water Shabana *et al.* (1998). Also he added that several researches showed that wheat can be grow under moderate and highly saline irrigation water on the newly reclaimed soils of Egypt. So, Egypt government trying hardly to attain sustainable productivity of wheat under such conditions.

The objective of the present study was to classify 10 wheat varieties according to their salt tolerance and follow up the impact of soil salinity on growth and some mineral composition of shoots and roots.

MATERIALS AND METHODS

A green house experiment at NRC was conducted to evaluate the effect of soil salinity on growth and mineral composition of ten wheat varieties . The soil used in this experiment was clay loam with initial soil salinity (control) 1.3 dSm^{-1} , pH 7.4, $CaCO_3$ 3.6 %, organic matter, 1.8 % and available nutrients were 76,18 and 160 ppm for N, P and K.

The experiment included 40 treatments which were the contribution of 4 salinity levels and 10 wheat varieties. The different wheat varieties were (Gemmeza7, Gemmeza 9, Gemmeza 10; Giza 164, Giza 168; Sakha8, Sakha 69, Sakha 93 , Sakha 94 and sids 1).The levels of salinity were the initial soil (Ec1.3 dSm^{-1}) and the salinized soil using different amount of a mixture from NaCl and $CaCl_2$ in ratio(1:1) to reach salinity levels of 6,9 and12 dSm^{-1}. Seven seeds of each variety were sown at mid of November in each pot which containing 8 Kg soil. Each pot received the recommended fertilizer dose, 1.3 gm urea (46%N) in two times, at sowing and after two weeks, and 0.8 gm supper phosphate (15%P_2O_5) and 0.4g potassium sulphate (48% K_2O) before sowing ,which is equivalent to160Kg urea, 100 kg supper phosphate and 50 kg potassium sulphate / feddan. The pots were irrigated to maintain the moisture percent at approximately 90 % of field capacity.

After12 days from sowing, plants were thinned to 4 plants /pot. and the experiment was extended 60 days, after which plants were harvested, collected and separated to shoots and roots, washed with distilled water and dried at 70 C° for constant weight . Dry weight of both shoots and roots were recorded., and ground for chemical analysis. The analysis of soil samples, shoots and roots were carried out according to Cottenie *et al.* (1982)., Data were subjected to statistical analysis according to (SAS,1991).

RESULTS AND DISCUSSIONS

1-Effect of soil salinity levels on plant growth of different wheat varieties:

1-1 Dry weight of shoots and roots :

Data in Table (1) indicated that the shoots and roots dry weight of different wheat varieties were significantly decreased by increasing soil salinity levels.

It showed also that the highest shoots dry weight at 1.3 dSm^{-1} (control) was recorded by Giza 168 variety (14.65g/pot), while the lowest value was recorded by Giza 164 variety(12.28 g /pot). The obtained data revealed also that the reduction of dry weight of shoots and roots was fluctuated from variety to another.

Table (1): Effect of different salinity levels on shoots and roots (g/pot) dry weight of various wheat varieties.

Variety	Shoots					Roots				
	Soil salinity levels (dSm^{-1})									
	1.3	6	9	12	Mean	1.3	6	9	12	Mean
Sakha 93	13.62	12.50	11.52	10.74	**12.10**	2.54	2.24	2.10	1.99	**2.22**
Sakha 8	13.50	12.00	10.96	9.94	**11.60**	2.95	2.03	1.88	1.65	**2.13**
Sids 1	13.85	11.96	11.08	10.92	**11.95**	2.33	1.52	1.33	1.15	**1.58**
Giza 164	12.28	8.94	8.08	7.85	**9.29**	2.56	1.84	1.59	1.36	**1.84**
Giza 168	14.65	11.25	9.46	9.08	**11.11**	2.66	1.70	1.52	1.35	**1.81**
Sakha 69	14.32	10.11	8.70	8.12	**10.31**	2.63	1.52	1.35	1.17	**1.67**
Sakha 94	14.48	10.50	9.94	8.71	**10.91**	2.44	1.77	1.53	1.38	**1.78**
Gem.7	14.30	10.55	9.90	8.25	**10.75**	2.30	1.65	1.43	1.22	**1.65**
Gem.9	12.88	9.70	8.73	7.60	**9.73**	2.55	1.92	1.59	1.30	**1.84**
Gem. 10	14.04	11.14	10.04	8.74	**10.99**	2.92	1.93	1.69	1.55	**2.02**
Mean	**13.79**	**10.87**	**9.84**	**8.99**		**2.59**	**1.81**	**1.60**	**1.41**	
LSD at 0.05	**Sal.***	**Var.****	**SxV*****			**Sal.***	**Var.****		**SxV*****	
	0.34	**0.54**	**1.08**			**0.05**	**0.08**		**0.15**	

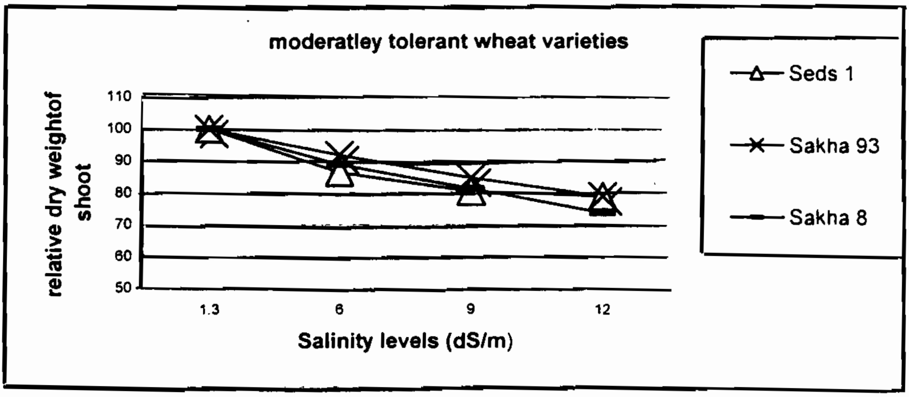
*Salinity **Variety ***Salinity x Variety

The highest reduction of shoots and roots dry weight was recorded by Sakha 69 variety at 12 dSm^{-1} (57.0 and 44.0%) while the lowest was noticed by Sakha 93 variety (78.9 and 78.0%). Almost similar results were observed by Sarahan and Abd El-Salam (1999) who investigated the effect of five levels of soil salinity on growth of wheat plants and found that increasing soil salinity decreased the weight of dry matter .They attributed the negative effect of salinity on biomass production to lowering the plant water potentials , specific ion toxicities or ionic imbalances. Plants protect themselves from

NaCl toxicity by minimizing Na^+ uptake and transport to the shoots. Saleh (1998) found also that the use of saline water decreased the dry matter yield of wheat plants. In this respect, Reggiani *et al.* (1994) pointed out that shoot and root growth of wheat cultivars which differ in salt sensitivity was progressively inhibited by increasing NaCl concentration up to 150 mM. Also, Irshad *et al.* (2002) reported that, increasing salinity levels decreased dry matter production of shoot and root. (Al-Karaki, 1997) attributed the reduction in dry weight of wheat plants due to increasing salinity levels as a result of a combination of osmotic and specific ion effects.

1-2 Classification of wheat varieties according to their salinity tolerance:

Dry weight of shoots of treated plants, expressed as a percentage of the dry weight of control could be used as index of salinity tolerance (Shannon *et al.* 1983). According to the relative shoot dry weight Fig (1) the varieties could be divided into two groups , moderately tolerant (Sakha 8,Sakha 93 and Sids1) and moderately sensitive (Giza164, Giza 168, Sakha 94, Sakha69, Gemmiza7,Gemmiza9 and Gemmiza 10).



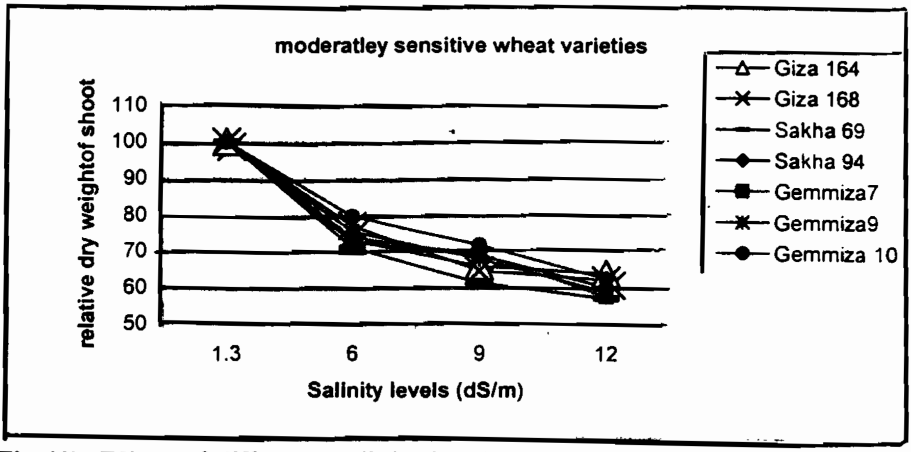


Fig (1): Effect of different salinity levels on relative dry weight of shoots of various wheat varieties

It could be noticed (from Fig. 1) that the relative shoots dry weight of the moderately tolerant group (Sakha8 and93 and Sids1) decreased to about 90% at (Ec =6 dSm^{-1}) while the decrement was about 75% for the moderately sensitive group. Moreover, the relative reduction at (Ec =12 dSm^{-1}) was about 80% and 60% for the tolerant and sensitive groups , respectively.

2-Ion concentration of wheat varieties :

2-1 Sodium

The accumulation of Na and /or Cl in plants is toxic and has been considered a limiting factor to growth inhibition especially under high salinity levels . Thus the distribution of ions in the different parts of the plant is an essential factor of the mechanism of salt tolerance Greenway and Munns (1980).

Data in Table (2) indicated that Na-concentration in both shoots and roots was increased as a result of increasing soil salinity levels. This results was in agreement with Maggio *et al.* (2007) who found that ,the concentration and accumulation of sodium in plants was related to soil salinity levels .

Table (2): Effect of different salinity levels on sodium concentration (%) in shoots and roots of various wheat varieties

Variety	Shoots					Roots				
	Soil salinity levels (dSm^{-1})									
	1.3	6	9	12	Mean	1.3	6	9	12	Mean
Sakha 93	0.48	0.53	0.57	0.63	**0.55**	0.32	0.42	0.56	0.74	**0.51**
Sakha 8	0.50	0.55	0.59	0.65	**0.57**	0.35	0.42	0.52	0.66	**0.49**
Sids 1	0.51	0.59	0.62	0.67	**0.60**	0.32	0.40	0.50	0.7	**0.48**
Mean	**0.50**	**0.56**	**0.59**	**0.65**		**0.33**	**0.41**	**0.53**	**0.70**	
Giza 164	0.61	0.66	0.70	0.76	**0.68**	0.30	0.45	0.55	0.75	**0.51**
Giza 168	0.60	0.63	0.69	0.75	**0.67**	0.28	0.40	0.53	0.76	**0.49**
Sakha 69	0.60	0.75	0.85	0.90	**0.78**	0.30	0.42	0.50	0.70	**0.48**
Sakha 94	0.62	0.66	0.72	0.77	**0.69**	0.33	0.40	0.55	0.73	**0.50**
Gem. 7	0.59	0.63	0.66	0.74	**0.66**	0.28	0.43	0.52	0.72	**0.49**
Gem. 9	0.61	0.65	0.72	0.80	**0.70**	0.29	0.42	0.58	0.73	**0.51**
Gem. 10	0.60	0.64	0.72	0.79	**0.69**	0.28	0.45	0.53	0.72	**0.50**
Mean	**0.60**	**0.66**	**0.72**	**0.79**		**0.29**	**0.42**	**0.54**	**0.73**	
Grand mean	**0.57**	**0.63**	**0.68**	**0.75**		**0.31**	**0.42**	**0.53**	**0.72**	
LSD at 0.05		Sal.*	Var. **	SxV***		Sal.*	Var.**		SxV***	
		0.02	**0.03**	**0.05**		**0.01**	**0.02**		**0.05**	

*Salinity **Variety ***Salinity x Variety

The presented data revealed also that the mean values of Na concentration in various treated wheat varieties ranged from 0.55 to 0.78 and from 0.48 to 0.51 for shoots and roots, respectively. The lowest Na concentration in shoots was recorded for Sakha 93, while the highest was noticed for Sakha 69, while for roots the lowest value was found in Sakha 69, and the highest one was recorded for Sakha 93 variety.

Concerning the interaction effect between soil salinity and wheat varieties , it was noticed that for each variety, increasing soil salinity levels increased Na concentration in shoots and roots. This effect becomes more pronounced in shoots of the moderately sensitive varieties. Furthermore, the varieties which considered moderately sensitive to salinity had higher concentration of sodium in shoots. In contrast, the moderately tolerant varieties accumulated Na in the roots. This can be attributed to the capacity of some varieties to excluded Na from shoot, which is correlated to salt tolerance degree. Such results are in close agreement with Mansour *et al.* (1993) and Khan *et al.* (2001) who found that both Na and Cl in both shoots and roots of wheat seedlings increased proportionally with increasing salinity levels. Abdel-Aal *et al.*(2008) pointed out that sodium and chloride concentration were increased in both shoots and roots of tomato seedlings by increasing the level of soil salinity. In this respect , Gawish *et al.* (1999 -b). reported that the content of Na and Cl were more positively responded in shoots, particularly for relatively salt tolerant variety. In addition to that Yahya (1998) pointed also that tolerance to salinity depends mainly on the ability of the roots to limit transport of Na to leaves and shoot apex.

2-2 chloride:

Data represented in Table (3) revealed that the concentration of Cl in both shoot and roots increased by increasing soil salinity levels .

Table (3): Effect of different salinity levels on chloride concentration(%) in shoots and roots of various wheat varieties

Variety	Shoots					Roots				
	Soil salinity levels (dSm^{-1})									
	1.3	6	9	12	Mean	1.3	6	9	12	Mean
Sakha 93	1.58	1.77	1.96	2.50	**1.95**	0.22	0.50	0.92	2.12	**0.94**
Sakha 8	1.60	1.84	2.14	2.80	**2.10**	0.28	0.56	0.92	2.04	**0.95**
Sids 1	1.70	1.86	2.16	2.85	**2.14**	0.22	0.52	0.94	2.08	**0.94**
Mean	**1.63**	**1.82**	**2.09**	**2.72**		**0.24**	**0.53**	**0.93**	**2.08**	
Giza 164	1.93	2.46	2.80	3.38	**2.64**	0.29	0.66	1.08	2.24	**1.07**
Giza 168	2.04	2.52	3.12	3.72	**2.85**	0.22	0.70	1.14	2.16	**1.06**
Sakha 69	2.17	2.70	3.36	3.86	**3.02**	0.26	0.62	1.01	2.29	**1.05**
Sakha 94	2.10	2.63	3.42	3.90	**3.01**	0.26	0.59	0.97	2.29	**1.03**
Gem. 7	2.05	2.27	2.76	3.36	**2.61**	0.26	0.77	0.88	2.18	**1.02**
Gem. 9	2.11	2.60	3.12	3.54	**2.84**	0.29	0.62	1.17	2.16	**1.06**
Gem. 10	2.14	2.50	2.90	3.48	**2.75**	0.24	0.57	0.97	2.24	**1.01**
Mean	**2.08**	**2.53**	**3.07**	**3.61**		**0.26**	**0.65**	**1.03**	**2.22**	
Grand mean	**1.94**	**2.31**	**2.77**	**3.34**		**0.25**	**0.61**	**1.00**	**2.18**	
LSD at 0.05	**Sal.***	**Var.****		**SxV*****		**Sal.***	**Var.****		**SxV*****	
	0.04	**0.07**		**0.14**		**0.01**	**0.02**		**0.04**	

* Salinity **Variety ***Salinity x Variety

Generally the concentration of Cl in shoots ranged between 1.95 and 3.02 and between 0.94 and 1.07 % in roots. Moreover, it can be noticed that, the concentration of chloride in the moderately tolerant varieties lower than its concentration in the moderately sensitive ones. At the same time, the concentration of Cl in shoots reached about 3-4 fold than roots.

This finding is confirmed by those of Pereze –Alfocca *et al* . (1996) who found also that Cl in tomato shoots was 3-6 times higher than Na. they attributed the great Cl accumulation in shoots to maintain an osmotic gradient at moderately salinity . The obtained results are in agreement with those of Mansour *et al.*(1993), Sarhan and Abd El-Salam (1999) and Khan, *et al.* (2001).

In addition Badr and Shafei (2002) Investigate that salinity increased the Na and Cl concentrations in the leaves of both varieties, whereas the salt tolerant variety accumulated appreciable less Na and Cl than the salt sensitive variety.

2-3 potassium:

Data in Table (4) emphasized that, the concentration of potassium decreased in both shoots and roots of all wheat varieties as a results of raising soil salinity level. Moreover , the average values of K% in shoots ranged between 2.20and 2. 88% and between 1.34 and 1.57 % in roots. Furthermore, the percentage of reduction of K% as average in shoots and roots of moderately tolerant varieties was 34% and 23% respectively.

Table (4): Effect of different salinity levels on potassium concentration (%)in shoots and roots of various wheat varieties

Variety	Shoots					Roots				
	Soil salinity levels (dSm^{-1})									
	1.3	6	9	12	Mean	1.3	6	9	12	Mean
Sakha 93	3.68	3.01	2.61	2.20	2.88	1.85	1.70	1.43	1.30	1.57
Sakha 8	3.91	2.98	2.50	2.10	2.87	1.68	1.51	1.32	1.10	1.40
Sids 1	3.72	2.68	2.20	1.95	2.64	1.88	1.66	1.39	1.15	1.52
Mean	3.77	2.89	2.44	2.08		1.80	1.62	1.38	1.18	
Giza 164	3.92	2.50	1.80	1.40	2.41	1.83	1.64	1.29	1.20	1.49
Giza 168	3.80	2.40	1.70	1.30	2.30	1.75	1.58	1.25	1.09	1.42
Sakha 69	3.75	2.30	1.70	1.05	2.20	1.80	1.62	1.19	0.98	1.40
Sakha 94	3.85	2.35	1.65	1.25	2.28	1.75	1.50	1.23	1.08	1.39
Gem. 7	3.70	2.35	1.70	1.20	2.24	1.86	1.60	1.30	1.25	1.50
Gem. 9	3.90	2.55	1.75	1.25	2.36	1.90	1.64	1.35	1.28	1.54
Gem. 10	3.66	2.45	1.75	1.10	2.24	1.65	1.46	1.19	1.04	1.34
Mean	3.80	2.41	1.72	1.22		1.79	1.58	1.26	1.13	
Grand mean	3.79	2.56	1.94	1.48		1.80	1.59	1.29	1.15	
LSD at 0.05	Sal.*	Var.**		SxV***		Sal.*	Var.**		SxV***	
	0.051	0.082		0. 16		0.03	0.05		0.09	

*Salinity **Variety ***Salinity x Variety

While The corresponding values of the sensitive varieties was 53% and 26% , respectively. The inhibition effect of salinity on potassium concentration in plant organs may be due to the antagonism effect between excess of sodium as well as calcium and potassium. Almost similar results were observed by Begum *et al.* (1992) who showed that NaCl salinity decreased accumulation of K in wheat seedlings. Also Singh *et al.* (1992) in a greenhouse experiment revealed a decrease in uptake of K by wheat plants with increasing levels of salinity. Moreover, the presence of high external Na concentration inhibited the uptake of potassium Yahya (1998) and Drihem and Pilbeam (2002).

2-4 Potassium / Sodium ratio :

Data represented in Table (5) showed that the K/Na ratio in both shoots and roots decreased by increasing soil salinity levels. The reduction was more pronounced at high salinity concentration. Moreover, the percentage of reduction of K/Na in shoots of the moderately tolerant varieties was lower than that of the sensitive groups. This results were in agreement with the finding of Gawish *et al.* (1999-c) who reported that the K/Na ratio decreased with increasing NaCl salinity , particularly for the relatively salt sensitive wheat varieties. Opposite picture were obtained particularly for the relatively salt tolerant variety.

Goudarzi and Pakniyat (2008) pointed out that wheat cultivars were compared for salt NaCl& Na_2SO_4 in ratio (1:1) tolerance using three treatments : 1.26 (control) , 6.8 and 13.8 dSm^{-1} in a greenhouse. During vegetative growth, in general tolerant cultivars with better agronomic performance, contained low Na and higher K and K/Na ratio compared to non tolerant one content Moreover, Badr and. Shafei (2002) pointed out that potassium concentration in wheat leaves decreased with increasing salinity in different wheat varieties , but the salt tolerant variety still maintained a much higher K concentration which of course minimized Na/K ratio .Moreover, Munns *et al.* (2006) reported that salt tolerance is associated with low rates of transport of Na to shoots, with high selectivity for K over Na

Table (5): Effect of different salinity levels on K/Na ratio in shoot and root of various wheat varieties

Variety	Shoots					Roots				
	Soil salinity levels (dSm^{-1})									
	1.3	6	9	12	Mean	1.3	6	9	12	Mean
Sakha 93	7.74	5.69	4.58	3.49	**5.38**	5.84	4.07	2.56	1.76	**3.56**
Sakha 8	7.89	5.46	4.25	3.25	**5.21**	4.80	3.62	2.55	1.67	**3.16**
Seds 1	7.33	4.57	3.55	2.92	**4.59**	5.89	4.17	2.79	1.64	**3.62**
Mean	**7.65**	**5.24**	**4.13**	**3.22**		**5.51**	**3.95**	**2.63**	**1.69**	
Giza 164	6.46	3.79	2.57	1.85	**3.67**	6.13	3.65	2.35	1.60	**3.43**
Giza 168	6.37	3.83	2.48	1.74	**3.61**	6.32	3.97	2.36	1.44	**3.52**
Sakha 69	6.29	3.08	2.00	1.16	**3.13**	6.06	3.86	2.39	1.40	**3.43**
Sakha 94	6.23	3.56	2.29	1.62	**3.43**	5.33	3.76	2.24	1.48	**3.20**
Gem. 7	6.31	3.77	2.61	1.62	**3.58**	6.68	3.73	2.50	1.74	**3.66**
Gem. 9	6.45	3.95	2.43	1.56	**3.60**	6.56	3.92	2.33	1.76	**3.64**
Gem. 10	6.11	3.83	2.44	1.40	**3.45**	5.95	3.25	2.25	1.44	**3.22**
Mean	**6.32**	**3.69**	**2.40**	**1.56**		**6.15**	**3.73**	**2.35**	**1.55**	
Grand mean	**6.72**	**4.15**	**2.92**	**2.06**		**5.96**	**3.80**	**2.43**	**1.59**	
LSD at 0.05	**Sal.***	**Var.****		**SxV*****		**Sal.***	**Var.****		**SxV*****	
	0.021	**0.33**		**ns**		**0.20**	**0.31**		**0.63**	

***Salinity** ****Variety** *****Salinity x Variety**

REFERENCES

Abdel-Aal, Y.A.; Abou-Zeid, S.T. and Shaimaa H.N. El-Sapagh. (2008). Response of tomato seedlings to soil salinity . J. Agric. Sci. Mansoura Univ. 33 (2), 1701-1716.

Al-Karaki, G. N. (1997). Barely response to salt stress at varied levels of phosphorus . J. Plant Nutr. 20 (11): 1635-1643.

Badr, M.A. and Shafei, A .M. (2002). Salt tolerance in two wheat varieties and its relation to potassium nutrition. AL-Azhar J. Agric. Res., (35) : 115-128.

Begum, F.; Karmoker, J. I.; Fattah, Q.A. and Maniruzzaman, A. F. M. (1992). The effect of salinity on germination and its correlation with potassium, sodium, chlorine accumulation in germinating seeds of *Triticum aestivum* L .C.F Akbar. Plant and Cell Physiol., (33): 1009.

Borsani, O.; Cuartero, 1.; Femandez, J.A.; Valpuesta, V. and Botella, M.A. (2001). Identification of Two Loci in Tomato Reveals Distinct Mechanisms for Salt Tolerance. Plant Cell, (13): 873-887.

Cottenie, A.; Verloo, M.; Kiekense, L.; Velghe, G. and Camerlynck, R. (1982). Chemical analysis of plants and soils . State Univ. of Belgium Gent, Hand Book, 1-63.

Dehdari, A .; Rezai. A. and Maibody, S. A. M. (2005). Salt tolerance of seedling and adult bread wheat plants based on ion contents and agronomic traits . Commun. Soil Sci. and Plant Anal., 36: 2239-2253.

Drihem, K. and Pilbeam, D. J. (2002). Effect of salinity on accumulation of mineral nutrients in wheat grown with nitrate – nitrogen or mixed ammonium: nitrate – nitrogen. J. Plant Nutr., 25 (10): 2091-2113.

El-Hendawy, S. E.; Hu, Y.; Yakout, G. M.; Awad, A. M.; Hafiz, S. E. and Schmidhalter, U. (2005). Evaluating salt tolerance of wheat genotypes using multiple parameters. Europ. J. Agron., (22): 243–253.

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.

Gawish, Sh.M.; El-Leboudi, A.E.; Abdel -Aziz S.M. and Ahmed M.R. M. (1999 a). Studies on Salt Tolerance of Certain Wheat Varieties I. Evaluation Studies for Salt Tolerance and Growth Behavior of Plants Grown Under Saline Conditions. Egypt. J. Soil Sci., 39 (4): 437 – 451.

Gawish, Sh.M.; El-Leboudi, A.E.; Abdel-Aziz S.M. and Ahmed M.R.M. (1999 b). Studies on salt tolerance of certain wheat varieties 11.Status and translocation of both sodium and chloride along with nitrogen and phosphorus nutritional elements in plants grown under saline conditions. Egypt. J. Soil Sci., 39 (4): 453-470.

Gawish, Sh.M.; El-Leboudi, A.E.; Abdel-Aziz S.M. and Ahmed M.R.M. (1999 c). Studies on salt tolerance of certain wheat varieties 111.Status and translocation of Certain macronutrients along with ion balance in plants grown under saline conditions. Egypt. J. Soil Sci., 39 (4): 471-489.

Ghassemi, F.; Jakeman, A.J. and Nix, H.A. (1995). Salinization of land and water resources. University of New South Wales Press Ltd., Canberra, Australia.

Goudarzi, M. and Pakniyat, H. (2008). Evaluation of wheat cultivars under salinity stress based on some agronomic and physiological traits. J. agri. and Social Science, 4 (1): 35- 38.

Greenway, H. and Munns, R. (1980). Mechanisms of salt tolerance in non-halophytes. Annual review of plant physio. 31: 149-180.

Hassan, M.M.; EL-Masry, T.A. and Abou-Arab, A.A. (1999). Effect of salinity on growth , yield and elemental concentrations in tomato. Egypt. J. Hort., 26: 187-198.

Irshad, M.; Honna, T.; Eneji, A. E. and Yamamoto S. (2002). Wheat response to nitrogen source under saline conditions. J. Plant Nutr., 25 (12): 2603-2612.

Khan, M .A.; Gul. B. and Weber, D. J. (2001). Effect of salinity on the growth and ion content of salicornia rubra. Commun . Soil Sci. plant Anal., 32(17&18):2965-2977.

Lazof, D.B. and Bernstein, N. (1999). Effects of Salinization on Nutrient Transport to Lettuce Leaves: Consideration of Leaf Developmental Stage. New Phytol. , 144: 85-94.

Maggio, A.; Raimondi, G.; Martino, A. and De Pascale, S. (2007). Salt stress response in tomato beyond the salinity tolerance threshold Environmental and Experimental Botany, 59: 276-282.

Mansour, M.M.; Stadelmann, E. J. and Lee, O.Y. (1993). Salt accumulation of *Triticum aestivum* by choline chloride, plant growth, mineral content and cell permeability. Plant Physiol. Biochem., 31: 341.

Marschner, H.(1998). Mineral Nutrition of higher plants, Second Edition Academic Press Limited London NW 17DX. 660-680.

Mass. E.V. and Hoffman, G. F.(1977). Crop Salt Tolerance-Current Assessment. J. Irr. Drainage Div. ASCE 103: 115-134.

Munns, R. (2002). Comparative physiology of salt and water stress. Plant Cell Environ., (25): 239-250.

Munns, R.; James, R. A. and Läuchli, A. (2006). Approaches to increasing the salt tolerance of wheat and other cereals. Journal of experimental Botany, 57 (5): 1025-1043.

Pereze –Alfocca F.; Balibrea, M.E.; Santa- Cruz, A. and Estañ, M.T. (1996). Agronomical and physiological characterization of salinity tolerance in a commercial tomato hybrid. Plant and Soil, (180): 251-257.

Pervaiz, Z.; Afzal, M.; Xi, S.; Xiaoe, Y. and Ancheng, L. (2002). Physiological parameters of salt tolerance in wheat. Asian J. Plant. Sci. (1): 478–481.

Qureshi, R.H. and Barrett-Lennard. (1998). Three approaches for managing saline, sodic and waterlogged soils. In: Elbasam, N., Damborth, M., Laugham, B.C. (Eds.), Saline Agriculture for Irrigated Land in Pakistan. Kluwer Academic Publishers, The Netherlands, pp. 19–28.

Reggiani, R.; Bozo, S. and Bertani, A. (1994). Changes in polyamine metabolism seedlings of three wheat *(Trilicum aestivum* L.) cultivars differing in salt sensitivity. Plant Sci. 102-121.

Saleh, A.L. (1998). Effect of irrigation water quality on vegetative growth and mineral composition of wheat (*Triticum aestivum*) grown in sandy and clay loam soils. Egypt. J. Appl. Sci. ,13 (5): 320-380.

Sarahan, S.H. and Abd El-Salam., H.Z. (1999). Effect of soil salinity, nitrogen fertilization and their interactions on wheat plant. J. Agric. Sci. Mansoura Univ., 24 (4): 2071- 2075.

(SAS) Statistical Analysis System, Institute (1991). SAS User's guide Version 8 , SAS Inst. Cary, N.C.

Shabana. M.K.; Wassif, M.M.; Saad S.M. and Ashour, I.A. (1998). Effect of some soil amendment on the quantity and some chemical properties of Wheat Yield under Irrigation with saline water conditions. Desert Inst. Bull. Egypt. 48 (1): 197-207.

Shannon ,M.C.; McCreight, J.D. and Draper, J.H. (1983). Screening test for salt tolerance in lettuce. J. Amer. Soc. Hort. Sci. ,(108): 225-230.

Singh, G.P.; Bhanm S. and Narwalm R.P. (1992). Efficiency of different nitrogen sources in wheat grown under normal and saline soil conditions. Crop Res. 5: 160.

Yahya. A. (1998). Salinity effect on growth and on uptake and distribution of sodium and some essential mineral nutrient in sesame J. Plant Nutr.. 21(7):1439-1451.

إستجابة بعض أصناف القمح لملوحة التربة

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نفذت تجربة أصص لدراسة تأثير ملوحة التربة علي النمو والتركيب المعدني لبعض أصناف القمح (جميزة٧ ، جميزة ٩, ،جميزة ١٠ ،جيزة ١٦٤, جيزة ١٦٨ ، سخا ٨ , سخا ٦٩ , سخا ٩٣، سخا ٩٤ و سدس ١) وذلك باستخدام خليط من كلوريد الصوديوم وكلوريد الكالسيوم بنسبة ١: ١والذي اضيف الي الأرض وأدي الي الحصول علي تركيزات لملوحة التربة وهي ٦, ٩ و١٢ ديسيمنز /م . أدت زيادة مستويات الملوحة الي نقص الوزن الجاف لكل من الأجزاء الخضرية والجذور لكل أصناف القمح . و بناءا علي الوزن الجاف النسبي للأجزاء الخضرية فقد قسمت أصناف القمح الي مجموعتين هما أصناف متوسطة التحمل للملوحة (سخا ٩٣و سخا ٨ و سدس ١) وأصناف متوسطة الحساسية للملوحة (جيزة ١٦٤ ,جيزه ١٦٨ ،جميزة ٧، جميزة ٩، جميزة ١٠ ، سخا ٦٩ و سخا ٩٤). أدت زيادة مستويات ملوحة التربة الي زيادة تركيز كل من الصوديوم والكلوريد في كلا من الأجزاء الخضرية والجذور . بينما إنخفض تركيز البوتاسيوم في كل من الأجزاء الخضرية والجذور بزيادة ملوحة التربة. كما أدت زيادة ملوحة التربة الي انخفاض النسبة بين تركيز البوتاسيوم الي الصوديوم , علاوة علي ذلك كان الإنخفاض النسبي بين تركيز البوتاسيوم الي تركيز الصوديوم في الأجزاء الخضرية لمجموعة الأصناف متوسطة الحساسية عند كل مستويات الملوحة أكبر من الأصناف المتوسطة التحمل.