J. Agric. Sci. Mansoura Univ., 30 (9): 5675 -5687, 2005

INFLUENCE OF SOIL SALINITY ON CEC ,GROWTH AND N P K CONTENTOF WHEAT ROOTS

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ABSTRACT

In arid and semi arid region with irrigated agriculture conditions ,excess soluble salts often occurs .Bread wheat is one of the primary crops used for human feeding .The wheat root response type of salinity tolerant and salinity sensitive cultivar against to salinity hazard is unclear . The work aimed to study the effect of soil salinity levels (0.08 ,0.2, 0.4and 0.6 %)were assessed on root growth and root cation exchange capacity in relation to N,P and K content of two wheat varieties (Sakha 92 , salinity tolerant and Gemmiza 9 , salinity sensitive)

The obtained results can be summarized in the following

Raising soil salinity level from control to 0.2 % caused an increase in root dry weight of both varieties , while soil salinity levels above 0.2 % high significantly decreased root dry weight .

Sakha 92 cv. all over the growth stages gave the highest values of root dry weight than that of the another one (Gemmiza 9) where root weight of Sakha 92 represent 108.8 % of Gemmiza 9 Cv. at tillering stage, 104.0 % at flowering and 104.9 %at maturity

Root cation exchange capacity values of wheat roots at flowering stage represented 122.70% and 169.73 % of that at tillering and maturity stage ,respectively .

Soil salinity level of 0.2% led to a rise root cation exchange capacity (average of the two wheat varieties) by 2.58% compared to control at tillering stage, and by 1.93% compared to control at flowering. At maturity, the same treatment of soil salinity led to decrease root cation exchange capacity by 9.31% (from 4.264 meq/100 gm to 3.867 meq/100 gm) compared to control.

Soil salinity level above 0.2 % decreased root cation exchange capacity of wheat roots to a large extent at flowering stage .

Root cation exchange capacity values of Sakha 92 cv. were found to be higher at any growth stage , than that of Gemmiza 9 cv.

Root cation exchange capacity positively correlated with root weight in each physiological growth stage.

Soil salinity to a large extent controls nitrogen concentration of wheat roots , which positively correlated with root cation exchange capacity at any physiological stage .

The reduction in nitrogen percent due to salinity hazard was higher in Gemmiza 9 cultivar (salinity sensitive) than that of Sakha 92 cultivar (salinity tolerant) at any growth stage.

Positive correlation between wheat roots cation exchange capacity and phosphorus percent of wheat roots was found.

Potassium concentration of roots significantly correlated with root cation exchange capacity and the correlation coefficient value differd from physiological stage to another , where it was 0.4842 for tillering , 0.7478 for flowering and 0.6095 for maturity stages.

INTRODUCTION

Plants grown under saline conditions have a reduced yield potential due to it's exposure to a higher osmotic potential , specific ion toxicity and nutritional imbalance. Roots are the first plant parts to be developed and responsible for the exogenous factor . Soil solution salinity is the utmost affecting factor constrain the normal development of root hairs and it's composition.

Root Cation exchange capacity (C.E.C.) is one of the important reproducible features of plant roots determining the nutrient absorptive capacity. The root exchange site arises from carboxylic and /or amino groups dissociation of pectic acid, aromatic alcohol, phosphoric acid radicals, and energy rich phosphorylated nitrogen compounds in cell wall membrane.

Genetic, plant age and nutritional status affect root CEC value to a large extent. Salinity is one of the major factors affecting nutritional status and root cell composition, hence, affecting root CEC value and yield.

Little attention was paid to root alteration of salt tolerant wheat varieties compared with the salt sensitive one due to salinity effect, So that this work aims to shed some light on the effect of soil salinity on root CECvalues of two wheat varieties .

MATERIALS AND METHODS

Two seasons of pot experiment were conducted during 2002/2003 and 2003 /2004 growing seasons to quantify the effect of soil salinity on the utmost important characters of wheat roots (growth and cation exchange capacity of wheat roots in relation to its nutrients content .

Non–saline clayey soils having pH value of 7.6 , EC. value of paste extract 1.72 dSm^{-1} and field capacity of 40% was used . 11 Kg oven dry soil basis were placed in closed plastic pots (cubic in shaped 25 x 25 x 25 cm). These pots were divided into 4 groups, the first group is Control (0.08%) and the latter groups were artificially salinized by adding amount of water equal saturation (73%) containing appropriate weight of calcium chloride and sodium chloride (1:1 by weight) to form salinity levels of 0.2, 0.4, and 0.6.% .

The pots were arranged to form strip plot in a complete randomized block design , four levels of soil salinity and two wheat varieties (Sakha 92, salinity tolerant variety and Gemmiza 9, salinity sensitive variety) , were used. Each treatment was replicated nine times.

Five days after soil salinization , twenty grains of 2 hours water soaked wheat were dipped up to 1.5 cm in each pot and the pots are rewatered to field capacity point .

Soil water content was adjusted to be 100% of field capacity when soil moisture reached to 70% F.C. by weighing and water addition.

The emergence wheat plants were thinned to seven plants in each pot (15 days from sowing).

All phosphorus and potassium recommended doses were added after thinning as ordinary superphosphate (150 kg/fed or 2.232 g/pot) and potassium sulphate (50 kg/fed, 0.744 g / pot^{-1}). Urea–N fertilizers (2.4 g urea /pot equal to 75 N/fed) was applied in two equal doses , the first at tillering stage (30 days from sowing) and the second at flowering (75 days from sowing).

All plants of three replicates of each treatment were removed at tillering stage (40 days from sowing) , flowering (70 days from sowing) and maturity (130 days from sowing) . After shoots removal in each stage, the soil of each pot was turned over a 2mm sieve under slowly effluent of tap water until the roots became clean, and then collected, washed by distilled water and air dried .

All Plant roots were dried at 70 °C until the stable weight is reached. Portions of dry roots (oven dry basis,105 °C) were wet digested with H_2SO_4 – $HClO_4$ mixture as described by peterburgski (1964) for N, P and K determination , the concentrations were calculated on oven dray matter basis.

Cation exchange capacity of roots was determined as described by Crooke (1964) as follow : 0.2 gm of milled (passed through a 1.0 mm sieve) dry roots (80 °C) was moistened with a few drops of distilled water , little agitating must be used to completely wetted , then 200 m1 of HCl solution (0.01 N) was added and stirred intermittently for 5 minutes. The bulk of acid solution was quickly decanted, after settled out of root materials, through filter of funnel (whatman No.1). The roots were washed into a funnel using distilled water and continue to wash until washings are free of Chloride . After that the filter paper was pierced and the root material was removed by using 200 ml 1M potassium chloride (pH.7). The pH root-KCl suspension was determined and retained to the initial pH value by 0.01 N KOH addition during the arbitrary 5 minutes titration time, then cation exchange capacity of roots was expressed as meq / 100gm .

Collected data were subjected to the statistical analysis, the technique of analysis variance (Anova) for a combined analysis between years in strip plot in randomized complete block design (R.C.B) according to Gomez and Gomez (1984). The treatments means were compared by using the least significant difference .

RESULTS AND DISCUSSION

Data illustrated in Table (1) show the effect of soil salinity on root weight (two years average) of the studied wheat varieties at different physiological stages of growth . Raising soil salinity level from control to 0.2 % caused an increase in crude root dry weight of both varieties. This synergistic effect (average of studied varieties) amounted by 39.6 % at tillering , 5.6 % at flowering and 14.8 % at maturity stage .

Soil salinity levels above 0.2 % high significantly decreased the root weight , where at tillering stage the root weight was decreased by 8.2 and 14.1 % with a concomitant soil salinity increase from control (0.08 %) to 0.4 and 0.6 % , respectively . At flowering and maturity stages, the root weight also decreased with increasing soil salinity levels above 0.2 % but the decrease was lower compared with that of tillering stage. At flowering, the decrease was 3.1 and 6.4 % due to salinity rising from control to 0.4 and 0.6 % , respectively. At maturity, 3.9 and 5.8 % reduction due to the same increase in soil salinity level. These results are in agreement with that of Ali *et al.* (2002), they found that 53% reduction in root dry matter yield at 75 mM NaCl compared with that of control

Table (1): Effect of soil salinity on root dry weight of the studied wheat varieties at different physiological stages of growth

Soil salinity level	Tillering stage				Flowering stage				Maturity stage			
	Wheat varieties		Mean	LSD	Wheat varieties		Mean	LSD	Wheat varieties		Mean	LSD
	Sa.92	Ge.9			Sa.92	Ge.9			Sa.92	Ge.9		
cont	1.505	1.340	1.423	0.025 0.038	3.915	3.715	3.816	0.017 0.026	5.890	5.750	5.820	0.011 0.015
0.2%	2.060	1.915	1.986		4.105	3.960	4.029		6.745	6.010	6.378	
0.4%	1.355	1.260	1.306		3.760	3.630	3.695		6.655	5.535	5.595	
0.6%	1.548	1.180	1.228		3.630	3.505	3.568		5.540	5.420	5.480	
Mean	1.548	1.423			3.851	3.703			5.958	5.679		
LSD	0.008		0.012		0.021		0.030		0.014		0.023	
Int.LSD		5.650	8.220			NS				NS		

Sa.92 = Sakha 92 **Ge.9 = Gemmiza 9**

Data plotted in Fig (1) show that Sakha 92 cv. all over the growth stages gave the highest values of root weight than that of the another one (Gemmiza 9) and the difference between variety means in this parameter is highly significant .

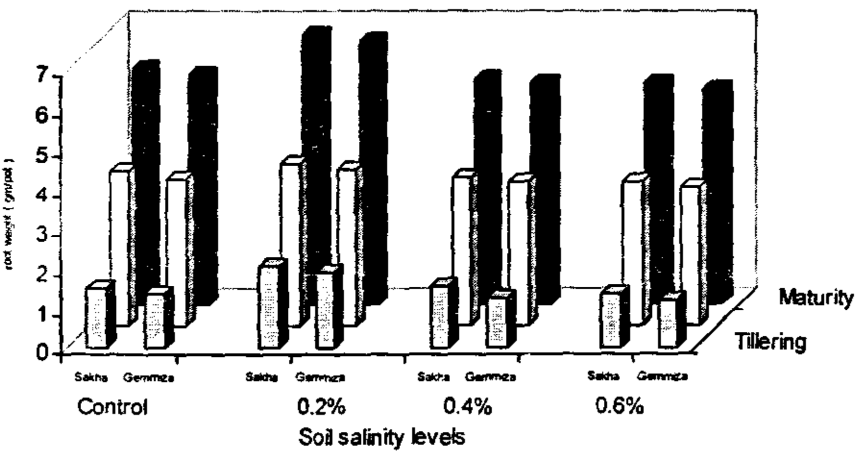

Fig (1): Effect of soil salinity on root dry weight of the studied wheat varieties at different physiological stages of growth.

The root weight of Sakh 92 represents 108.8 % of Gemmiza 9 Cv. at tillering stage, but the difference was minimized (104.0 and 104.9) with the progressive (flowering and maturity) age of plant. These results are in agreement with those of Gupta and Srivastava (1989) and Ashraf et al .,(2000). They outlined that , the salt tolerant wheat cultivar was superior to susceptible one in maintenance of higher root growth under salt stress.

Highly significant differences were found as a result of salinity–variety interaction only in the first physiological stage and the highest and the lowest values were achieved with the treatment of Sakha 92 variety + 0.2 % soil salinity and Gemmiza 9 variety + 0.6 % soil salinity , respectively.

Data postulated in Table (2) show the effect of soil salinity on root cation exchange capacity of the studied wheat varieties at different physiological stage of growth.The whole mean of root cation exchange capacity was increased from 5.252 meq/100g dry weight at tillering stage to 6.443 meq/100g dry weight at flowering stage , then decreased at maturity to 3.796 meq/100 dry weight . Root cation exchange capacity at flowering stage represented 122.70% of that at tillering stage and 169.73% of that at maturity stage. Similar results were obtained by Srivastava and Srivastava (1992), their data showed that the root cation exchange capacity of nitrogen (60 ppm) fertilized wheat increased from 7.14 meq /100gm at tillering stage, to 9.81 meq /100gm at flowering stage then decreased after that to 9.0 and 7.0 meq /100g roots at ripening and maturity stage, respectively. In non fertilized wheat, the root cation exchange capacity increased from 5.21 at tillering stage to 8.80 meq/100g then decreased to 5.20 at ripening and to 4.0 meq/100g at maturity.

Table (2): Effect of soil salinity on root CEC of the studied wheat varieties at different physiological stages of growth.

Soil salinity level	Tillering stage				Flowering stage				Maturity stage			
	Wheat varieties		Mean	LSD	Wheat varieties		Mean	LSD	Wheat varieties		Mean	LSD
	Sa.92	Ge.9			Sa.92	Ge.9			Sa.92	Ge.9		
Cont	5.573	5.451	5.512	0.044	7.693	7.579	7.636	0.026	3.832	4.696	4.264	0.017
0.2%	5.731	5.577	5.654		7.863	7.702	7.783		3.920	3.813	3.867	
0.4%	5.399	5.311	5.355		6.093	5.612	5.853		3.645	3.568	3.607	
0.6%	4.732	4.240	4.486	0.029	4.774	4.228	4.501	0.017	3.493	3.398	3.447	0.013
Mean	5.359	5.144			6.606	6.280			3.723	3.869		
LSD	0.021		0.030		0.008		0.012		0.004		0.007	
Int.LSD	0.431		0.627		0.505		0.735		0.060		0.087	

Sa.92 = Sakha 92 Ge.9 = Gemmiza 9

Data of the same Table clearly show that the first level of soil salinity (0.2%) led to a rise in root cation exchange capacity (average of the two wheat varieties) by 2.58% compared to control at tillering stage, and by 1.93% compared to control at flowering. At maturity, the same increase in soil salinity led to a decrease in root cation exchange capacity by 9.31% (from 4.264 meq/100 gm to 3.867 meq/100 gm) compared to control.

Raising soil salinity levels from control (0.08 %) to 0.4 % and 0.6 % led to a decrease in root cation exchange capacity by 2.85 % and 18.61 % at tillering stage , respectively. At flowering , soil salinity levels of 0.4 and 0.6 % decreased root cation exchange capacity by23.35 and 41.06 % compared with control. At maturity , root cation exchange capacity was decreased by 15.41 and 19.16 % due to increase the soil salinity level from control(0.08 %) to 0.4 and 0.6 % , respectively .

Data of that Table and Fig also reveal that soil salinity above 0.2 % decreased root cation exchange capacity of wheat to a large extent at flowering stage . The present results are confirmed by that of Leont *et al.*, (1988) They pointed out that the wheat root cation exchange capacity was negatively correlated with Nacl salinity level . but in some cases root cation exchange capacity didn't fall under conditions of 0.4 % Nacl salinity.

Data of Table(2) also stated that highly significant differences were found between variety mean values of cation exchange capacity , over the physiological stage studied . These results are in agreement with that of Rengel and Robinson (1989), They found significant differences in root CEC of varieties within the same species .

As shown in Fig 2 root cation exchange capacity values of Sakha 92 cv. were found to be higher at any growth stage than that of Gemmiza 9 cv. where root cation exchange capacity values of Gemmiza 9 cv. represent 95.98 , 95.07 and 97.19 % of that of Sakha 92 cv. at tillering , flowering and maturity stages , respectively. This increase in root cation exchange capacity partially may be due to the highest root growth (Fig 1), higher decomposition of dead roots from the root-bound pots, thus creating more organic acid exchange sites and a greater absorbing area per unit weight (Mouat and Walker ;1959).

Soil salinity level of 0.6% significantly decreased root cation exchange capacity of the studied cultivars where root cation exchange capacity of Sakha 92 cv. was decreased from 5.573 meq /100 gm at control to 4.732 meq /100 gm (15.09 % reduction) and the corresponding rise of soil salinity caused a decrease in root cation exchange capacity of Gemmiza 9 cv. amounted by 22.22 % at tillering stage. At flowering , as shown from Fig (2) the highest value of root cation exchange capacity for each variety was obtained at soil salinity level of 0.2 % , and the increase is higly significant compared to control. soil salinity levels of 0.4 and 0.6 % significantly reduced the root cation exchange capacity of the studied varieties , where , the root cation exchange capacity reduction amounted by 37.94 % and 44.21 % at soil salinity level of 0.6 % compared with control treatment for sakha 92 and Gemmiza 9 , respectively .

The lowest values of root cation exchange capacity for each cultivar were found at maturity stage compared with the earliest growth stages (tillering and flowering stages) . the synergistic effect of soil salinity level of 0.2 % was not found at this stage , where root cation exchange capacity value for each cultivar was decreased with increasing soil salinity level .

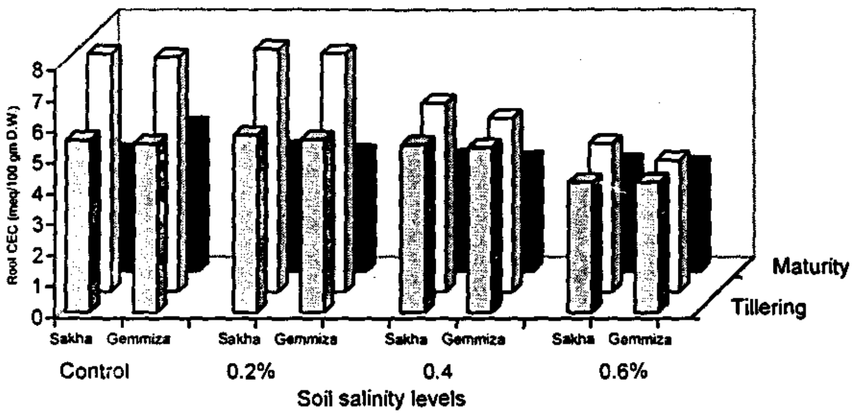

Fig (2): Effect of soil salinity on root CEC of the studied wheat varieties at different physiological stages of growth.

As illustrated in Equations 1, 2 and 3, root cation exchange capacity positively correlated with root weight in each physiological growth stage.

- *Wheat root weight (gm/ pot)at tillering stage = 0.3803(wheat roots CEC meq/100 gm d.w.) -0.5117 (r=0.3929) (1)*
- *Wheat root weight (gm/ pot)at flowering stage = 0.2656 (wheat roots CEC meq/100 gm d.w.) +4.181 (r=0.5872) (2)*
- *Wheat root weight (gm/ pot)at maturity stage = 2.3992 (wheat roots CEC meq/100 gm d.w.) – 2.9137 (r=0.7286) (3)*

This pattern of correlation arises from salinity which may hindered the root growth , decreasing the ratio of highly active roots tips to the relatively inactive part.

Data of Table (3) pointed out that at different physiological stages, the studied soil salinity levels high significantly affect nitrogen concentration of wheat roots ,where, soil salinity level of 0.2 % increase nitrogen concentration of root compared to control (two cultivars average). The nitrogen concentration of roots was increased from 0.198 % to 0.219 % (15.9 % increase) at the end of tillering stage , from 0.263 % to 0.288 % (9.5 % increase) at flowering and from 0.150 % to 0.180 % (20 % increase) at maturity. Soil salinity levels above 0.2 % drastically decreased nitrogen concentration of roots , where , 0.6 % soil salinity caused 27.8 % reduction at tillering stage compared with control , the same increase in soil salinity level caused 19.77 and 27.7 % reduction at flowering and maturity stages , respectively.

Table (3): Effect of soil salinity on Nitrogen concentration (%) Of the studied wheat varieties roots at different physiological stages of growth.

Soil salinity level	Tillering stage				Flowering stage				Maturity stage			
	Wheat varieties		Mean	LSD	Wheat varieties		Mean	LSD	Wheat varieties		Mean	LSD
	Sa.92	Ge.9			Sa.92	Ge.9			Sa.92	Ge.9		
Cont	0.210	0.185	0.198	0.018	0.275	0.245	0.263	0.009	0.155	0.145	0.150	0.008
0.2%	0.230	0.205	0.219		0.305	0.270	0.288		0.185	0.175	0.180	
0.4%	0.185	0.155	0.186		0.245	0.220	0.235		0.145	0.120	0.133	
0.6%	0.160	0.125	0.143	0.012	0.220	0.200	0.211	0.006	0.125	0.095	0.110	0.006
Mean	0.197	0.168			0.264	0.235			0.153	0.134		
LSD	0.003		0.004		0.007		0.009		0.007		0.012	
Int.LSD	NS				NS				0.021		0.030	

Sa.92 = Sakha 92 Ge.9 = Gemmiza 9

From the above mentioned discussion , soil salinity to a large extent controls nitrogen concentration of wheat roots , which positively correlates with root cation exchange capacity at any physiological stage as in the following equations

- *Nitrogen content(%) of wheat roots at tillering stage =0.0555 (wheat root CEC meq/100 gm d.w.) -0.1094 (r = 0.6802) (4)*
- *Nitrogen content(%) of wheat roots at flowering stage = 0.0214 (wheat root CEC meq/100 gm d.w.)+ 0.1112 (r = 0.7203) (5)*
- *Nitrogen content(%) of wheat roots at maturity stage =0.1582 (wheat root CEC meq/100 gm d.w.)-0.4382 (r = 0.836) (6)*

These results are in coincidence with that of Holah , (1972) who found a positive correlation (r = 0.825) between cation exchange capacity of roots and it's nitrogen content (roots of sixteen crops were studied, among of them, wheat) and by Kulkarni and Savant (1977), they confirmed that soil compaction increased root cation exchange capacity through it's incremental effect on nitrogen content of roots (%) , Carboxyl groups on root surface and root diameter of the crop plants studied.

Data of Fig 3 stated that sakha 92 cultivar (salt tolerant variety) has a higher nitrogen content than that of Gemmiza 9 (salt sensitive one).The difference between variety means in this parameter is highly significant at any physiological growth stage , where , nitrogen content of Sakha 92 represent117.26 , 112.34 and 114.18 % of that of Gemmiza 9 at tillering , flowering and maturity stages , respectively .

The nitrogen reduction percent due to salinity hazard almost higher in Gemmiza 9 cultivar (salinity sensitive) than that of Sakha 92 cultivar (salinity tolerant) at any growth stage, where soil salinity level of 0.6% caused a reduction in N percentage amounted by 32.4 compared with 23.81 % at tillering, 18.37 compared with 16.7 % at flowering , 34.5% compared with 16.7% at maturity for sakha 92 ang gemmiza 9 , respectively .

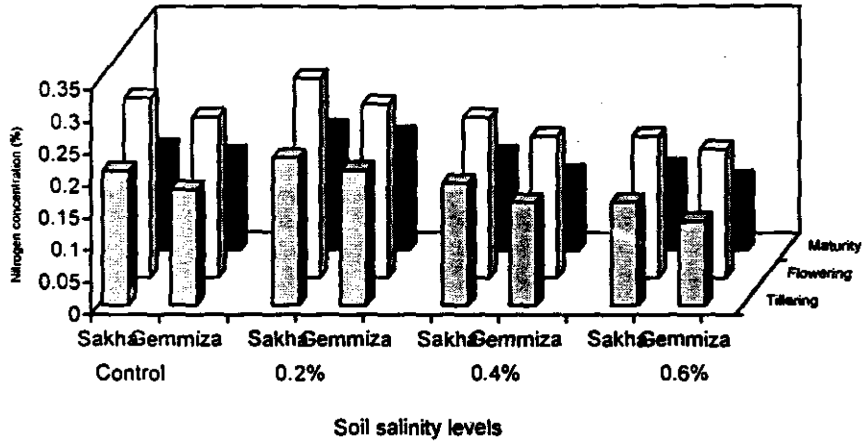

Fig (3): Effect of soil salinity on root nitrogen content of the studied wheat varieties at different physiological stages of growth.

Salinity–variety interaction didn't prove any significant effects at both tillering and flowering stages. At maturity stage the differences between nitrogen content of treatment (salinity–variety) means are significant .

The highest nitrogen content (0.250 % , general mean) of wheat root was found at flowering stage, followed by that at tillering and the lowest one at maturity stage (0.143 %) .

Data of Table (4) and Fig (4) show soil salinity , variety and salinity–variety interaction effect on phosphorus concentration of wheat roots at different physiological stages of growth.

Table (4): Effect of soil salinity on phosphorus concentration (%) 0f the studied wheat varieties roots at different physiological stages of growth.

Soil salinity level	Tillering stage				Flowering stage				Maturity stage			
	Wheat varieties		Mean	LSD	Wheat varieties		Mean	LSD	Wheat varieties		Mean	LSD
	Sa.92	Ge.9			Sa.92	Ge.9			Sa.92	Ge.9		
cont	0.202	0.197	0.200	0.002	0.346	0.345	0.346	0.003	0.141	0.139	0.140	0.002
0.2%	0.195	0.190	0.193		0.388	0.335	0.337		0.130	0.128	0.129	
0.4%	0.189	0.180	0.184		0.330	0.327	0.328		0.121	0.120	0.121	
0.6%	0.181	0.174	0.177	0.001	0.323	0.320	0.321	0.002	0.116	0.113	0.115	0.001
Mean	0.192	0.185			0.334	0.332			0.127	0.125		
LSD	0.001		0.002		0.001		0.002		0.006		0.009	
Int.LSD	0.005				NS				NS			

Sa.92 = Sakha 92 Ge.9 = Gemmiza 9

The highest concentrations of phosphorus for each cultivar (0.346 % for Sakha 92 and 0.345 % for Gemmiza 9) were obtained at flowering stage under soil salinity level of control (0.08 %) and the lowest values, 0.116 and 0.113, were obtained at maturity stage under soil salinity level of 0.6 % for Sakha 92 and Gemmiza 9 cultivar, respectively.

The following equations summarized the root CEC–Phosphorus concentration relationship at different physiological stages .

- *phosphorus content(%) of wheat roots at tillering stage = 0.0141(wheat root CEC meq/100 gm d.w.) + 0.1144 (r = 0.5982) . (7)*
- *phosphorus content(%) of wheat roots at flowering stage = 0.0064 (wheat root CEC meq/100 gm d.w.) + 0.2918 (r = 0.8311) . (8)*
- *phosphorus content(%) of wheat roots at maturity stage = 0.0443 (wheat root CEC meq/100 gm d.w.) – 0.0369 (r = 0.5848). (9)*

These results reflect the positive correlation between wheat roots cation exchange capacity and phosphorus percent of wheat roots. These results are in agreement with those of Holah (1972) who found a positive correlation (r = 0.873) between these variables .

Data of that Table also show that the differences between variety mean values are highly significant at any physiological age of plant , but , salinity–variety interaction doesn't significantly affect phosphorus concentration of roots except for that at tillering stage .

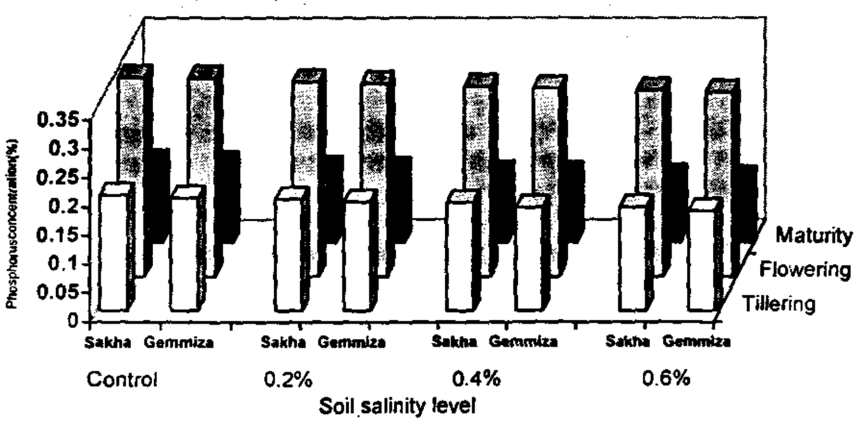

Fig (4): Effect of soil salinity on root phosphrus content of the studied wheat varieties at different physiological stages of growth.

The results of Table (5) and Fig (5) show potassium concentration in roots of the studied wheat varieties as affected by soil salinity levels at physiological growth stages ,where, potassium concentration of roots at any growth stage significantly decreased as soil salinity increased and soil salinity level of 0.6 % reduce potassium concentration of wheat roots by 8.32 %, at tillering stage, 7.74 % at flowering stage, compared with control. These results are in agreement with that of Roy *et al.*, (2003).They stated that potassium content in early growth stage wheat roots was decreased with salinity increase (0.35 , 0.4 , 8.0 , 12.0 and 16.0 dS/m) . At maturity 13.84 % reduction due to soil salinity increase from 0.08 to 0.6%, the highest reduction at maturity mainly due to it's lost through roots excudative process and the nature foundation of that element in plant cell .

Table (5): Effect of soil salinity on potassium concentration (%) Of the studied wheat varieties roots at different physiological stages of growth.

Soil salinity level	Tillering stage				Flowering stage				Maturity stage			
	Wheat varieties		Mean	LSD	Wheat varieties		Mean	LSD	Wheat varieties		Mean	LSD
	Sa.92	Ge.9			Sa.92	Ge.9			Sa.92	Ge.9		
cont	1.934	1.909	1.923	0.014	1.977	1.950	1.964	0.016	1.138	1.102	1.120	.011
0.2%	1.873	1.822	1.847		1.927	1.884	1.901		1.061	1.034	1.048	
0.4%	1.818	1.785	1.802		1.866	1.831	1.849		1.014	0.991	1.003	
0.6%	1.778	1.748	1.763	0.009	1.829	1.794	1.812	0.011	0.976	0.954	0.965	0.008
Mean	1.851	1.816			1.900	1.865			1.047	1.020		
LSD	0.006	0.009			0.007	0.011			0.003	0.004		
Int.LSD	0.599				NS				NS			

Sa.92 = Sakha 92 Ge.9 = Gemmiza 9

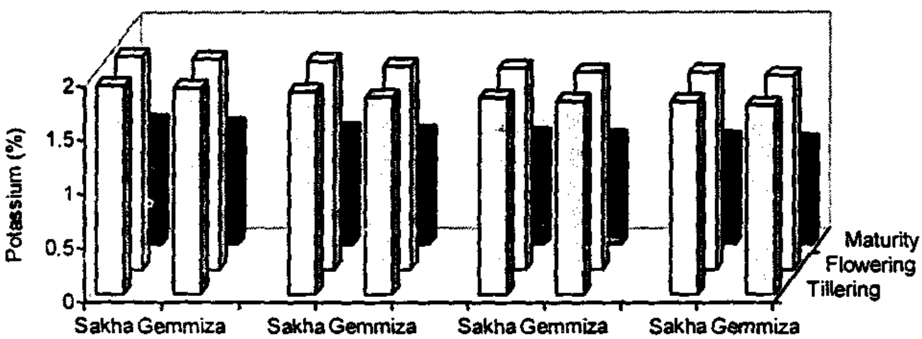

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Fig (5): Effect of soil salinity on root potassium content of the studied wheat varieties at different physiological stages of growth.

In general a slight increase in potassium concentration occurs at flowering stage and a height decrease of that at maturity stage compared with that at tillering stage .

Equations from (10 to 12) pointed out that potassium concentration of roots significantly correlated with root cation exchange capacity. the correlation coefficient values differ from physiological stage to another , where it is 0.4842 for tillering , 0.7478 for flowering and 0.6095 for maturity stages.

- *Potassium content (%) of wheat roots = 0.0866(wheat roots CEC meq/100 gm d.w.)+1.3786 (10)*
- *Potassium content (%) of wheat roots =0.0406(wheat roots CEC meq/100 gm d.w.)+1.6229 (11)*
- *Potassium content (%) of wheat roots =0.2642(wheat roots CEC meq/100 gm d.w.)+0.0619 (12)*

Data of Table (5) also indicate that , the variety mean values high significantly differ at different growth stages and the highest obtained values with Sakha 92 cv .

Salinity–variety interaction doesn't significantly affect potassium concentration of roots at any growth stage , but the highest value (1.977 %) was obtained with the treatment of soil salinity level of control + Sakha 92 Cv. at flowering stage and the lowest one (0.954 %) was obtained with the treatment of soil salinity level of 0.6 + Gemmiza 9 Cv. at maturity stage .

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تأثير ملوحة التربة على السعه التبادلية الكاتيونيه والنمو والمحتوى النيتروجيني والفوسفورى والبوتاسي لجذور القمح

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أقيمت هذه الدراسه بهدف تحديد تأثير ملوحة التربة(بدون تمليح و٠,٢ و ٠,٤ ٠,٦% .) على السعة التبادلية الكاتيونية لجذور صنفين من القمح هما سخا ٩٢ (متحمل للملوحة) وجميزة ٩ (حساس للملوحة) والعلاقة بين ذلك التأثير و كل من إنتاج المادة الجافة وتركيزات العناصر (N P K) فى جذور النبات

وكان ملخص النتائج المتحصل عليها كالتالي :

١- رفع مستوى الملوحة من المستوى القياسي إلى ٠,٢% أدى إلى زيادة وزن الجذور لكلا الصنفين ومستويات الملوحة الأعلى من ٠,٢% أنقصت معنويا متوسط وزن الجذور لكليهما

٢- متوسط وزن الجذور للصنف سخا ٩٢ فى أي مرحلة من مراحل النمو كان أعلى من مثيلتها للصنف الأخر(١٠٨,٨ فى مرحلة التفريع—١٠٤,٠ فى مرحلة التزهير -١٠٤,٩ فى مرحلة النضج)

٣- أعلى قيم للسعة التبادلية الكاتيونية لجذور القمح كانت عند التزهير (متوسط عام) وهى تمثل ١٢٢,٦٨ % من قيمتها أثناء التفريع التي تعادل١٣٨,٣٦ % من ذات القيمة عند النضج.

٤- مستوى ملوحة تربة ٠,٢% أدى إلى زيادة السعة التبادليــة الكاتيونيــة للجذور بمتوسط ٢,٥٨ % للصنفين في مرحلة التفريع و إنخفضت هذه الزيادة إلى ١,٩٣ % أثناء التزهير ولكن نفس المستوى من الملوحة أدى إلى نقص السعة التبادلية للجذور بمتوسط ٩,٨١ % فى مرحلة النضج .

٥- مستويات الملوحة الأعلى من ٢و% قللت السعة التبادلية الكاتيونية للجذور بدرجة كبيرة وبخاصة أثناء التزهير.

٦- عند أي مستوى ملوحة تربة وأي مرحلة نمو كانت السعة التبادلية الكاتيونية لجذور الصنف المقاوم للملوحة (سخا ٩٢) أكبر ؛عا للصنف الحساس للملوحة (جميزة ٩).

٧- السعة التبادلية الكاتيونية للجذور ارتبطت ايجابيا مع الوزن الجاف للجذور فى كل مرحلة فسيولوجية على حدة.

٨- ملوحة التربة إلى حد كبير تتحكم فى تركيز النتروجين فى جذور القمح والذي ارتبط إيجابيا مع السعة التبادلية للجذور.

٩- النقص فى محتوى الجذور من النيتروجين نتيجة لتأثير الملوحة كان أكبر فى جميزة ٩ عنه فى سخا ٩٢.

١٠- وجد إرتباط معنوي موجب بين محتوى الجذور من الفوسفور والسعه التبادلية الكاتيونيه لهذه الجذور .

١١- السعه التبادلية الكاتيونيه للجذور إرتبطت ايجابيا مع تركيز البوتاسيوم فيها وإن تغيرت قيمة معامل الارتباط بتغير المراحل الفسيولوجية.