International Conf. on Water Resources & Arid Environment (2004)

Using Under Ground Brackish Water in Cultivation of Saline Sandy Land Under Dried Condition of South Sinai Governorate

M. M. Selim

*Field Crop Research Department National Research Centre ,Dokki EL.- Tahrier Street,**Cairo , Egypt***

Abstract

More than 90% of the world's water is seawater and more than half the world's underground water supplies are saline, and the proportion is increasing as fresh water supply was depleted. Under dry land condition of South Sinai salinity is one of the most critical problems facing improving agriculture. Agriculture is suffered from both salt-affected soil beside saline underground water used for irrigation. Clearly there is a need for cultivars of different crops that can be grown under saline conditions .Number of economic crops were tabulated according to their tolerance to salt concentration and their expected yield percentages. The applicability of saline water for irrigation depends upon the concentration, composition of salts dissolved therein and the degree to which plants can tolerate salts. Sodium is the major toxic cation. It exerts many on plant growth. One harmful effect of sodium is that it disrupts potassium nutrition. Tritical (triticosecale spp.) is classified as moderate-salt tolerant crop, however varital differences are existed. Therefore, field experiments over 3 years were carried out at Beer-Abou Kalam Experimental Station, Tour-Sinai, South Sinai Governorate, aimed at evaluation some quantitative and qualitative characters of some tritical strains from CIMMYT to saline condition. Primary trait was conducted aimed at screened some genotypes. Results concluded that variation in salt tolerance has been observed among different strains. The most promising strain were sown in two field experiment. Growth, yield, yield component characters were determined. Seed quality was also taken into consideration. Results showed that genotype x environment one of the most important factor in crop production

Introduction

Salinity is considered the main threat to sustainability of the agriculture production in new reclaimed land in Egypt . High salt concentration in soil solution

generates a high osmatic pressure and correspondingly a low water potential and some nutritve inbalance (Prathapar, S. A,2000) .

Throughout the world, fresh water supplies are being depleted and became insufficient to be used in cultivation to meet and cover the food demand of an increasing population. Thus, exploring the possibility of using saline water for irrigation is of great importance. Increasing salinity level in the root media induced significant decrease in plant growth and retard dry matter accumulation as well as decrease final yield (Gupta and Baijal,1984; Hagganl et al., 1984 ; Hammad et al ., 1988; et al., 1992) . The applicability of saline water for irrigation depended upon the concentration, composition of salts dissolved therein and the degree to which plants can tolerate salts (El-Saidi 1997). Under South Sinai condition water supply is limited and agriculture depended upon underground brackish water, which contain varying amounts of dissolved salts ranged between 1500-6000 ppm (Ashour and Selim 1994). In addition, land is saline contains high percent of $CaCO_3$. Many attempts for long time experiments were done for economically exploit this condition.

Genotype performance X environment interaction considered to be one of the most important strategy to improve final yield for several crops (EL-Sayed et al., 1990 and Noaman et al ., 1990) Under South Sinai condition crop production can be developed, if the proper genotypes are selected (Ashour et al., 1992). Ashour and Selim 1994 concluded that the effect of variety x environment interaction considered to be one of the most important strategy to improve crop production. In this connection, Bassiouny (1985) also reported that there were great differences in the response of various cultivars of several crops to the agro-ecological conditions .

Therefore, the present work was carried out to study some growth parameters, grain yield and quality as well as chemical composition of some Tritical strains as compared with wheat and Barley cultivars grown under saline condition of South Sinai region .

Materials and Methods

Primary trait was conducted aimed at screened some Tritical genotypes from CIMMY (International Program). Results concluded that variation in salt tolerance has been observed among different strains. The most promising strains were sown in two locations differ in their salinity level. Growth, yield, yield component characters were determined. Seed quality was also taken into consideration.. The experimental design was a complete randomized block one with five replications. Field was prepared as recommended and normal cultural practices of growing wheat were followed (Organic manure and calcium superphosphate (15.5 $\%P_2O_5$) were added during soil preparation at the rate of $25m^2$ and 150 kg. per fed., respectively). Before commencement the

experimental treatments the chemical analyses of both soil and under ground water used for irrigation were performed according to Jackson, (1967). The results of the analysis are presented in Tables 1, 2 and 3 .The experimental unit area was 10 m^2 (3m x3.5 m)

Seeds of tested crops (wheat, barley and tritical) were sown in both sides of the ridges on November 2 nd and 10 th in the first and second seasons ,respectively.

After sowing nitrogen fertilizer was applied at three equal doses (after 21, 45 and 90 days,from sowing , respectively) by the rate of 60 unit of N/fed. as ammonium nitrate (33.5 %).

After 100 days from sowing, representative plant sample was taken from three replicates of each crop for the two locations to determine some growth parameters plant height, number of tillers as well as fresh and dry weight per square meter.

At harvest time, a sample of square meter (m^2) was randomly pulled from inner rows from each plot for determined yield and yield component characters were studied i.e, number of spikes/m^2, number of grains per spike and 1000-grain weight . Grain and straw yield per feddan were also calculated.

The obtained data were statically analysed by analysis of variance. The data of the two seasons showed nearly the same trend Thus, a combined analysis was done according to Gomez and Gomez (1984) .Means of the treatment were compared by the least significant difference (LSD) at 5% level of significance which developed by Waller and Duncan (1969

Results and Discussion

Effect of saline conditions on growth parameters:

Data presented in Table 4 reveal that growth parameters of tested crops grown under saline conditions were significantly decreased by increasing the level of salinity (in the second location as compared with the first one. The decrement in plant height, number of tillers as well as fresh and dry weight per square meter result of increasing salinity levels may be mainly due to increasing salt concentration in root medium, combined with reduction in possibility of plant absorption of essential mineral nutrients and consequently reduced plant growth .The obtained results are also showed that tritical strains surpassed either wheat or barley. Data obtained are in full agreement with those obtained by Nour El-Din et al., 1984 ; Abd EL-Gawad et al.,1990and Ashour and Selim 1994 .

Further more, results presented in the same tables clearly show that tritical strains herein exhibited significant differences among themselves in most growth parameters. These results might be attributed to the differences between strains in their genetic constituents particularly concerning the tolerance to salinity. Similar results for evaluation barley varieties under saline conditions were reported by Shehata, 1989.

Noman et al., 1990 noticed that salinity inhibits plant growth of barley due to the accumulation of ions to a toxic level after the beginning of cell division. Edmeades et al., 2001 came to the same conclusion concerning influenced of different stress conditions on crop production.

Effect of saline conditions on yield and yield component characters:

Data in Table (5) clear that yield and yield components criteria viz. number of spikes/m^2, number of grains / spike ,1000 grain weight in grams ,grain yield
Using Under Ground Brackish Water in Cultivation Saline Sandy Land Under Dried Condition of South
(ton/fed.) and straw yield (ton/fed.) of tritical surpassed the other two crops wheat and barley. The superiority of tritical as compared with both might be due to the differences in growth parameters. In addition to it may be also due to the differences in their genetical constitution especially in turn relative salt tolerance. Data in the same table worthy clear that the increasing in salinity levels led to slight decrease in yield and yield component characters. The decrement in the values of the above mention parameters under stress conditions confirmed the results obtained by Hagganl and Abd EL-Halem ,1984;Nour El-Din etal.,1984 ; Hindi et al.,1990 and Ashour and Selim,1994.

Effect of saline conditions on chemical constituents of grains:

Data presented in Table (6) showed that wheat and barley contained the highest percentage of protein and proline. Where as Ash and total carbohydrate % seems not to be significantly affected due to crop differences. From the obtained results in the same table it can be concluded that under such condition tritcal seems to be the most adapted crop. Data are agree with the data reported by Nour El-Din etal.,1984 ; Hindi et al.,1990 and Ashour and Selim,1994.

References

Abd Elgawad, A.A., A.A.Kishk,M.A.Abou Shetaia,and W.K.Hassan,1990. Studies on the productivity of wheat plants under salinity of Wadi Sudr. Proc. 4 th Conf. Agron. !: 111-166.

Ashour,N.I. 1992. Final report of the project (Growing Varities of field crops tolerating salinity and drought in Sinai). Academy of Scientific Research and Technology- National Research Centre.

Ashour, N.A and M.M.Selim 1994. Yield responses of barley varieties to saline conditions in South Sinai Governorate.Egypt, Agron.,19,No. 1-2,149-160.

Bassiouny, A.H. 1985. Studies on yield potentiality in wheat.Ph.D. Thesis, Fac.Agric.Zagazig Univ.

Edmeades,G.O.,M.Cooper.,R.Lafitte.,C.Zinselmeier.,J.M.Ribaut.,J.E.Habben.,C. Lofflerand M.Banziger2001. Abiotic stresses and staple crops . CAB International Crop Science ed. J.Nosberger.,H.H. Geiger and P.C.Struik pp.137-154..

El-Sayed, A.A.,Noaman,M.M.,Cecarelli, S.,Asaad,F.A and F.M.EL-Rayes 1990. Yield stability characteristics of some barley cultivars grown under different environments.1.Under low rained conditions. Proc.4thConf. Agron., Cairo (1)42-50.

EL-Saidi,M. T.1997. Salinity and its effect on growth, Yield and some physiological processes of crop plants. In strategies for improving salt tolerance in higher plants. (Eds P.K.,Jaiwal,R.P. Sing and Anju Gulati). Oxford and IBH publishing Co. Pvt. Ltd. New Delhi, Calcutta, and Enfield (USA) (6)111-127.

Gomez, K.A and A.Gomez 1984. Statistical procedures for agricultural research . 1st ed. John Wiley Sons, New Yourk.

Gupta,G., and B.D.Baijal.1984. Influence of different levels of sodium chloride on barley seeding growth of certain cultivars (Hordeum Vulgare L.).Indian J. Agric.Res. 18:18-40.

Hammad,A.H.,A.K.Abd EL-Halem.,T.O.A.Orabi,and M.M. Hussein 1992. Effect of gamma irradiation and salinity on growth, yield and its components and composition of barley. Egypt.J.Agron.13:101-108.

Hagganl ,A.M.,A.Ranf., and M.A. Zahid,1984. Salt tolerance studies on wheat in farmers fields. Pakistan .J.Agric.Res.5:2:78-81.

Hindi. l.H.A.,R.A.Mitkees;A.H.EM.K.Moshref,1990. Effect of genotype, environment and their interaction on bread wheat . 4 th Conference of the Egypt. Soci. Crop Sci.,Cairo,1:13-27.

Jackson,M.L.1967. Soil chemical analysis. Prentice Hall, New Delhi.

Nour E-Din,A.N., AM.Hegazi., M.A. Abd EL-Gawad, and M.O.M.Salem,1984. Growth response of some wheat cultivars to cycotreatment under Wadi Sudr region condition Egypt. J.Agron.9:75-81.

Noman, M.M.,A.A. EL-Sayed., A.Zahour., F.A. Assad and F.M. EL-Rayes. 1990. Yield stability characteristics of some barley cultivars grown under different environments.11. Under mild water stress conditions. Proc. 4th Conf. Of the Egyptian Soc. Crop. Sci. ., Sept., (1) , 51-57.

Prathapar,S.A.2000. Water Shortages in the 21st century. In: Cadman.H.ed. . The Food and Environment Tiyhtrope.Australian Centtre for International Agric. Rese. Canberra.pp.125-133.

Shehata,Mona.M. 1989. Physiological studies on the tolerance of some sugar beet varieties to salinity, Ph.D.Thesis, Facultyof Agric.., Cairo Univ., Egypt.

Waller, R.A. and D.B.Duncan. 1969. Symmetric multiple Comparison Problem , Amer.Stat.Assoc. Jour.December, 1485-1503.

Table (1) : Mechanical analysis of the soil of the experimental site

Depth m.	Locations	Particle size distribution%				Texture Class
		Coarse sand	Fine sand	Silt	Clay	
O- 30	1	60.4	22.5	8.2	9.1	Sand
	2	50.2	32.7	9.1	8.0	Sand
30-60	1	40.6	41.4	9.6	8.4	Sand
	2	43.1	40.0	10.5	6.4	Sand

Table (2) : Chemical analysis of the soil of the experimental site

DepthCm.	Locations	E.c. mmhos/m	pH	Macro- nutrients (meq/100gsoil)			Micro-nutrient (ppm)				O.M %	$CaCo_3$%
				K	Na	Mg	Fe	Mn	Zn	Cu		
0 - 30	1	5.57	8.4	0.37	21.2	0.49	1.7	1.2	1.0	trace	0.88	14.3
	2	6.80	8.4	0.56	21.3	0.44	1.5	1.1	1.0	trace	0.78	13.9
30 – 60	1	5.92	8.9	0.43	22.4	0.43	1.5	1.1	1.0	trace	0.76	12.7
	2	7.20	8.7	0.44	22.6	0.46	1.7	1.2	1.0	trace	0.77	12.5

Table (3): Chemical analysis of the under ground irrigated water

Locaction	Salinity		pH	Cations (meq/IL)				Anions (meq/1L)			Adj SAR
	E.c mhos/m .	ppm		Na^{+}	K^{+}	Ca^{++}	Mg^{++}	Cl-	SO4	Hco_3	
1	3.66	2342	8.1	9.3	0.6	3.5	1.1	9.0	4.1	1.4	9.1
2	4.14	2649	8.1	9.8	0.6	3.8	1.2	9.6	4.3	1.6	9.4

Table (4) : Effect of varietal differences on growth parameters of Wheat ,barley and tritical cultivars grown under saline conditions of South Sinai Governorate (average of two seasons)

Locations	Crops	Plant height, cm.	No. of tillers/m^2	Fresh Weight,g/m^2	Dry Weight,g/m^2
First Location	Wheat Sakha -8	97.9	503.9	1438.9	295.2
	Barley Hybrid-89	62.0	355.0	1097.8	236.9
	Tritical - T10	117.2	325.7	1642.7	365.8
	Tritical - T11	124.3	332.0	1688.9	376.8
	Tritical - T26	138.0	358.8	1743.7	384.3
	Tritical - T32	136.2	322.9	1722.3	376.5
	Tritical - T129	112.2	314.8	1687.8	376.6
General Mean		112.5	359.0	1574.6	344.6
L.S.D at 0.05 % level		5.7	25.6	47.6	17.8
Second Location	Wheat Sakha -8	68.9	468.1	1168.6	256.2
	Barley Hybrid-89	60.9	309.9	998.6	219.9
	Tritical - T10	103.4	337.8	1329.7	288.7
	Tritical - T11	105.3	314.6	1230.9	266.3
	Tritical - T26	115.7	395.5	1319.7	282.9
	Tritical - T32	112.6	324.8	1245.9	286.5
	Tritical - T129	100.7	322.7	1189.8	275.7
General Mean		95.4	353.3	1211.8	268.0
L.S.D at 0.05 % level		2.6	22.7	57.7	13.3

Table (5) : Effect of varietal differences as well as salinity levels on yield and yield components of Wheat ,barley and tritical cultivars grown under saline conditions of South Sinai Governorate (average of two seasons)

Locations	Crops	No.of Spikes/m^2	No.of grains/spike	Spik length cm.	1000grain weight (g)	Grain yield Ton/fed.	Straw yield Ton/fed.
First Location	Wheat Sakha -8	418.5	41.72	10.1	39.82	2.21	2.5
	Barley Hybrid-89	302.9	48.30	9.8	36.23	1.70	1.3
	Tritical- T10	325.7	58.23	14.1	41.22	2.43	2.7
	Tritical- T11	332.0	48.72	11.8	39.66	2.27	2.4
	Tritical- T26	358.8	50.78	12.3	40.60	2.45	2.4
	Tritical- T32	322.9	47.48	11.5	40.33	2.34	2.6
	Tritical- T129	314.8	44.59	10.8	40.55	2.32	2.3
General Mean		339.3	48.55	11.49	39.77	2.24	2.3
L.S.D at 0.05 % level		12.5	3.2	1.7	1.8	0.41	0.21
Second Location	Wheat Sakha -8	396.9	39.57	9.1	37.4	2.06	2.4
	Barley Hybrid-89	288.5	42.79	8.7	36.2	1.70	2.1
	Tritical - T10	319.8	55.32	13.4	39.4	2.32	2.3
	Tritical - T11	302.5	42.93	10.4	39.6	2.26	2.4
	Tritical - T26	317.9	45.00	10.9	39.4	2.37	2.3
	Tritical - T32	298.8	42.33	10.2	39.6	2.30	2.2
	Tritical - T129	304.8	40.70	9.6	39.4	2.25	2.4
General Mean		318.45	44.09	10.33	38.71	2.18	2.3
L.S.D at 0.05 % level		21.8	3.2	1.3	3.4	0.10	0.12

Table (6): Effect of varietal differences on chemical constituents of Wheat , barley tritical grains grown under saline conditions of South Sinai Governorate (average of two seasons)

Locations	Crops	Protein %	Total Carbohydrate %	Ash %	Proline Content (U mol/gm)
	Wheat Sakha -8	12.8	20.6	1.9	14.6
	Barley Hybrid-89	10.2	64.6	3.1	15.8
First	Tritical - T10	9.4	66.7	2.2	13.9
Location	Tritical - T11	9.5	64.8	2.1	14.2
	Tritical - T26	9.7	62.7	2.2	15.6
	Tritical - T32	9.3	71.2	1.9	14.3
	Tritical- T129	9.0	74.1	2.2	14.2
General Mean		10.0	60.7	2.2	14.7
L.S.D at 0.05 % level		2.4	n.s	n.s	1.6
	Wheat Sakha -8	11.3	24.7	2.2	22.8
	Barley Hybrid-89	9.7	66.8	3.4	23.9
Second	Tritical - T10	8.4	71.5	2.6	24.2
Location	Tritical - T11	8.9	72.3	2.4	25.7
	Tritical - T26	8.3	71.4	2.6	25.4
	Tritical - T32	8.5	72.5	2.2	24.8
	Tritical- T129	8.8	73.4	2.3	25.2
General Mean	9.1	64.7	2.5	24.6	
L.S.D at 0.05 % level	1.2	n.s	n.s	1.4	