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Evaluation of wheat genotypes and some soil properties under saline water irrigation

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Abstract Sixteen genotypes of spring wheat (*Triticum aestivum* L.) from different countries were evaluated for salt stress tolerance in the greenhouse under saline water irrigation. Five treatments, (T_1) = tap water (control), (T_2) = 25 mM NaCl, (T_3) = 50 mM NaCl, (T_4) = 75 mM NaCl and (T_5) = 100 mM NaCl were applied for each genotype grown in two seasons. Soil properties were also evaluated under these levels of water salinity. The results indicated that Number of tillers/plant, number of leaves/plant, leaves area/plant at vegetative stage, biomass, days to heading, number of kernels/spike, 1000-kerenl weight, grain yield, K^+ concentration and K^+/Na^+ ratio were decreased under salinity treatments as compared with control, and hence Na^+ concentration was increased. Salinity levels, 25, 50, 75 and 100 mM NaCl reduced grain yield by 14.57%, 29.59%, 42.80% and 55.78%, respectively, as compared with the control treatment. After plant harvesting, soil pH decreased significantly in all soil treatments irrigated with saline water from 7.95 to 7.8. Soil electrical conductivity (EC) increased in all treatments from 3.28 to 6.22 dS/m. The irrigation with saline water caused increase in soluble cations and anions in all soil treatments. Available Mn, Zn and Cu increased in all treatments compared with control. This study suggests that wheat genotypes Shakha 93, HAAMA-14 and Shakha 8 can be selected to grow under salinity stress conditions.

Introduction

In Egypt, agriculture land depends on irrigation water from the River Nile. In the recent years, water recourses are decreased and limiting factors for cultivate land due to demand food production increased (Mohamed et al., 2007). Therefore it is necessary to search for another sources of water irrigation such as reclaimed waste water, recycle water by product, sea water, drainage water and ground water to develop the most suitable irrigation schedule and to get the optimum plant yield for different regions. The use of saline water may be a potential source for suitable irrigation for some crops especially wheat and barley particularly in the arid and semi-arid regions of the world. They are capable of tolerating certain levels of salinity, which vary with different species, varieties and ecotypes (D'Amico et al., 2004).

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Wheat is the most important and widely adapted food cereal in Egypt. Wheat has a good high productively under saline conditions (Ragab et al., 2008). Therefore, it is necessary to increase wheat production in Egypt by raising the wheat grain yield. However, a difference in the salt tolerance among genotypes may also occur at different growth stages. The varietal differences in salinity tolerance that exist among crop plants can be utilized through screening programs by exploiting appropriate traits for salt tolerance (Kingsbury et al., 1984). Grain yield is frequently used in crops such as wheat as the main criteria for salt tolerance (Jafari-Shabestari et al., 1995). Other agronomic traits such as number of tiller, fertile tillers with other indices have been used for the assessment of salt tolerance. These parameters are the main criteria for selecting other complex traits such as resistance to salinity are not satisfying (Flowers and Yeo, 1995). Salinity is one of the major factors reducing plant growth and productivity and also affects about 7% of the world's total land area (Flowers et al., 1997). Egypt is one of the countries that suffer from severe salinity problems. For example, 33% of the cultivated land is already salinized due to low precipitation (< 25 mM annual rainfall) and irrigation with saline water (Ghassemi et al., 1995). The effect of high salinity on plant can be observed at the whole plant level in terms of plant death and/or decrease in productivity due to increase NaCl concentration (Parida et al., 2004). However, it is believed that selection and breeding would be more successful in achieving maximum attainable tolerance, if it were based directly on the relevant agronomic and physiological mechanism(s) (Noble and Rogers, 1992). Salt stress results in a considerable decrease in the tap and dry weights of leaves, tillers and fertile tillers (Chartzoulakis and Klapaki, 2000). On the other hand, soil EC values increased with increasing saline water irrigation (Ragab et al., 2008). The plants tend to take up more Na and exclude K with increasing NaCl concentration (Werner and Finkelstein, 1995). The K^+/Na^+ ratio is decreased under salt stress (Tammam et al., 2008). The objectives of this study were: (i) to evaluate sixteen genotypes of wheat crops under different levels of saline water. (ii) to determine some soil properties and Na^+ and K^+ concentration in plant.

Materials and methods

Plant materials

Sixteen genotypes of spring wheat (*Triticum aestivum L.*) from different countries were evaluated for salt stress tolerance in the greenhouse under different levels of saline water. The entry name and the source providing of the sixteen genotypes used in this study were; line 210, line 1009 and line 103 obtained by Prof. Dr. Kamal A. Kheiralla, Agronomy Department, Faculty of Agriculture, Assiut University, Egypt. Sedes1, Giza 168, Sahel 1, Shakha 93, Shakha 69, Sedes12 and Shakha 8 from Egypt; (Triso) from IPK-gatersleben Genebank-Germany, (GOUMRIA-19, HAAMA-14, QAFZAH-18 and SEIF-4) from ICARDA-Syria (Table 1).

Table 1 Brief description of the name and the origin of sixteen genotypes.

No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Genotypes	Sides1	Triso	Giza 168	Line 210	Sahel 1	GOUMRIA-19	Shakha 93	Shakha 69	line 1009	Line 103	HAAMA-14	QAFZAH-18	HAMAM-4	SEIF-4	Shakha 8	Sides12
Origin	Egypt	Germany	Egypt	Egypt	Egypt	ICARDA	Egypt	Egypt	Egypt	Egypt	ICARDA	ICARDA	ICARDA	ICARDA	Egypt	Egypt