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EFFECT OF SILICON ON THE TOLERANCE OF WHEAT (TRITICUM AESTIVUM L.) TO SALT STRESS AT DIFFERENT GROWTH STAGES: CASE STUDY FOR THE MANAGEMENT OF IRRIGATION WATER

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This paper aims to determine the most tolerant growth stage(s) of wheat to salinity stress with the addition of silicon. The aim was to investigate whether saline water could be used instead of good quality water for irrigation without implicating a greater risk to crop production. Local wheat cv. Gimmiza 11 was germinated and grown in sand cultures. Four different NaCl salinity levels were used as treatments: 0, 60, 90 and 120 mM. This was in the presence of 0 and 0.78 mM Si which added as sodium meta-silicate ($Na_2SiO_3 \cdot 9H_2O$). Both the NaCl and Si treatments were carried out using a full strength nutrient solution that was adjusted at pH 6.0 and used for irrigation in four replications. The application of Si with the saline nutrient media significantly enhanced superoxide dismutase (SOD) and catalase (CAT) activities in plant leaves at the booting stage compared to the other stages. This was associated with a marked decline in the H_2O_2 content. At the booting stage, the Si treatment promoted CAT activity in 120 mM NaCl-stressed leaves compared to the leaves treated with only 120 mM NaCl solution. SOD showed greater prevalence at the booting stage when Si was added into the saline media and it also revealed maximum activity at the milky stage with salinity stress. This was associated with a smaller reduction in shoot fresh and dry weights, greater reduction in the leaf Na^+ content and an increase in the K+ content, which ultimately increased the cytosolic K^+/Na^+ ratio. Chlorophyll a and b and carotenoid (total photosynthetic pigments) were also higher at the booting stage of salt-stressed plants treated with Si compared to other stages. Accordingly, Si application enhanced the salt tolerance of wheat and reduced the inhibitory effect of Na^+ and oxidative stress damage as growth proceeded towards maturity, particularly at the booting stage. This shows that saline water can be used for wheat irrigation at the booting stage (much water is consumed) when good quality water is not available for supplemental irrigation. A field study is needed to confirm the greenhouse results.

Biography

I earned my B.SC. (1969) and M.SC. (1975) degrees from the Department of Soil and Water Sciences, Faculty of Agriculture, Alexandria University-Egypt. I started my research career as Research Assistant (1970) in the Soil Salinity Lab. At Alexandria. In 1980, I transferred to the Catholic University of Louvain in Belgium, reading for my Ph.D degree in the Faculty of Agricultural Sciences in the field of Clay Mineralog. The study was on reactions of magnesium with silicon under arid soil environments. From 1986 to 1990, I worked as Expert in management of low lands in Benin (West Africa), via Egypt-Fund for technical cooperation for Africa. In 1993, I got one year Post-Doctoral Researcher at the University of California in Riverside, Department of Soil and Environmental Science working on the effect of organic waste compost on soil-phosphorous availability. In 1995, I promoted to Assistant Professor, and later on to Professor in 2006, Currently, I focused my research on silicon benefits to plants. I shared the inception workshop of the phase II of water benchmarks of CWANA of the International Center for Agricultural Research in Dry Areas (ICARDA), March 2010 in Cario. In 2014 and 2017, I shared the 6th and 7th International Conference on Silicon in Agricluture which held in Stockholm, Sweden and Banglore, India respectively. Now, I'm member in the silicon society, ISSAG as well as some other different scientific professional bodies. I'm author or co-author of more than 40 scientific publications.

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