Effect Of Using Some Salt Affected Soil Reclamation Systems On The Characteristics And Productivity In Bane Salama Area- West Of Delta Egypt

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A Thesis Submitted In Partial Fulfillment
Of
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ABSTRACT

Expanding problems of water salinity have become serious issues of concern as its affect on productivity and threaten the sustainability of agriculture. Using the materials (i.e., Magnetite, Humic acid, and Gypsum) by adding to the soil (as soil amendments) and Amino acids by foliar application (to increase the resistant of the plants to the saline stress). With and without compost showed a significant effect in curing the detrimental effect of the salinity on the plant growth and productivity. In the experiment used a different saline water wells (360 mgl^{-1}- 0.56 dSm^{-1}, 2045 mgl^{-1}- 3.20 dSm^{-1}, and 3000 mg l^{-1} – 4.69 $dSm^{-1)}$ and saline compost (4480 mgl^{-1} – 7 dSm^{-1}). The results showed that humic acid had the best significant effect in curing the effect of water and compost salinity followed by amino acids and the least were magnetite and gypsum.

Key words: **Water salinity – Humic acid- Amino acids- Magnetite- Gypsum- Compost- wheat.**

Introduction

Water salinity is an increasing threat for agriculture and is a major factor in reducing plant productivity; therefore, it is necessary to better understand the reasons for its development and how to obtain sufficient control over the phenomenon. Salinity can be result of both natural occurrence and human behavior.

Salinity problems occur in non-irrigated lands as a result of water losses through evaporation, transpiration. Possibly salt input through rain, and seawater drift. Additionally, salinity can develop due to careless usage of several fertilizers, irrigation with saline water, or over-irrigation that causes capillary movement of hidden salts from irrigation water.

Evaporation and transpiration reduce the water content of soil by removing pure water as vapor. The water losses concentrate the solutes that are left behind in the soil solution. This concentration is sometimes referred to as "salt build-up" and it may increase further when there is no opportunity to flush out and drain the accumulated salts. When the solutes in the active root zone reach a certain concentration, some changes take place in plant performance, especially in salt sensitive species, and plant injuries can be seen. When there is a high concentration of Na^+ (Sodium) in soil, it is referred to as "Salinity". When Cl^- (Chloride) or other salts are involved, it is referred as "Salinity".

Szabolcs (1989), has made quite a different estimate of the world wide salt-affected surface areas (including also non-irrigated land): about 340 million ha (23%) of cultivated lands are saline and another 560 million ha (37%) are sodic. These figures indicate that, approximately, one-third of the developed agriculture lands in arid and semiarid regions reflect some degree of salinity accumulation. In some agriculture systems as much as 50% of the presently irrigated land is salinized.

Rhodes *et al.* (2004), confirm that, certain ions in saline waters can be specifically toxic to plants, if present in excessive concentrations or proportions**.** If particular concern are Sodium (Na), Chloride (Cl), and Boron (B). While not often toxic to plants, a few solutes sometimes (through not frequently) found in natural saline waters may accumulate in plant parts at levels that can be toxic to consumers, if their diet is largely restricted to this food. Such elements include Selenium (Se) , Arsenic (As) , and Molybdenum (Mo). Standards for such specific toxicants in waters are usually given in terms of their individual concentrations. **Cardon *et al*. (2003),** stated that salinity problems are caused from the accumulation of soluble salts in the root zone. These excess salts reduced plant growth and vigor by altering water uptake and causing ion-specific toxicities of imbalances. Establishing good drainage is generally the cure for these problems, but salinity problems are often more complex. Proper management procedures, combined with periodic tests, are needed to prolong the productivity of salt affected soils.

In view of these facts, the present study was aimed to investigate the effect of using some materials (i. e. humic acid, magnetite and gypsum) as soil application and amino acids as foliar application to medicate the effect of saline water on growth characters, chemical composition and the yield of grains and straw of wheat.

Literature Review

The literature review dealt with the effect of some amendments on wheat plants that irrigated with different saline wells water. That could be classified under the following topics:-

1-Effect of saline water on plant and soil:-

Salinity is a major environmental stress and is a substantial constraint to crop production. Increased salinization of arable land is expected to have devastating global effects, resulting in 30% land loss within next 25 years and up to 50% by the middle of 21 st centuries **(Wang, *et al.* 2003).**

Water scarcity in the Mediterranean basin, especially in countries in arid zone with high rates of population growth, urbanization and industrialization, appears as one of the main factors limiting agricultural development. Within the next 25 years, although irrigated areas will increase, large quantities of fresh water supplies will be diverted from agriculture to meet the growing water demand in the municipal and industrial sectors in the region. In order to overcome water shortages and to satisfy the increasing water demand for agriculture development, the use of water of low quality (brackish, drainage) is becoming important in many countries **(Hamdi *et al.* 1995 and Correia, 1999).**

The use of saline water is a promising alternative. However, the development of appropriate practices for the use of saline water for irrigation requires an adequate understanding of how salts in the irrigation water affect the soil and plant. Crop type, water quality and soil properties determine to a large extent the management practices required to optimize production. Several examples of successful use of saline water for irrigation can be found in Mediterranean region **(Rhodes *et al*. 1992).**

Rhodes *et al*.(2004), Chemical and physical characteristics of irrigation waters are discussed in detail by **Ayers and Westcott (1985).** Hence, only brief descriptions of terminology, units and key parameters are given in this publication. The parameters of relevance, in this case, are restricted to those which predominantly affect crop production either directly of indirectly. The limiting values of the quality parameters vary considering depending upon circumstances of use.

There are also nature causes of salinity. Numerous investigators have noted that water within sedimentary strata becomes increasingly saline with an increase in depth. In general, the sequence noted is sulphate-rich water near the surface, saline bicarbonate water at an intermediary level and more concentrated chloride water at an intermediary level and more concentrated chloride water at greater depth **(Craig 1980).**

Rhodes (1992), concluded that it was impossible to set precise standards of irrigation water quality for wide applicability. The suitability of irrigation management, cultural practices and climatic conditions.

Livett (1980), reported that the main negative effect of salinity comes from the osmotic effect on plant water uptake which eventually affects growth and yield.

Rhodes *et al*.(2004), confirm that , certain ions in saline waters can be specifically toxic to plants , if present in excessive concentrations or proportions. of particular concern are sodium (Na) chloride (Cl), and boron (B). While not often toxic to plants, a few solutes sometimes (through not frequently) found in natural saline waters may accumulate in plant parts at levels that can be toxic to consumers , if their diet is largely restricted to this food. Such elements include selenium (Se), arsenic (As), and molybdenum (Mo). Standards for such specific toxicants in waters are usually given in terms of their individual concentrations.

Salt accumulation in root zone causes the development if an osmotic stress(osmotic effect) and disrupts cell ion homeostasis by including inhibition in the uptake of essential nutrient like K^+ ,Ca^{2+} and NO^-_3 (possibly leading to nutrient deficiency) and accumulation of Na^+ and Cl^- to potentially toxic levels within cells (specific ion effect) **(Marschner,1995 and Zhu,2001).** These primary stresses induce the generation of reactive oxygen species (ROS)**(Melloni *et al*.2003),** cause hormonal changes **(Munns,2002),**alter carbohydrates metabolism**(Gao *et al*. 2007),** reduce the activity of certain enzymes **(Munnes,1993)**, and impair photosynthesis **(Loreto *et al*. 2003).** As a consequence of these metabolic modifications, cell division and elongation declines or it may be completely inhibited and cell death is accelerated **(Hasegawa *et al.* 2000).** At a whole-plant level the impacts of salinity are reflected through declines in growth, reduction in yield, and in more acute cases, leaf injuries, which can lead to complete defoliation of plants and their subsequent desiccation. Actual response to salinity varies with growing conditions including climatic and soil factors, agronomic and irrigation management, crop variety and the sensitivity of crops at different growth stages.

Cardon *et al.* (2003), stated that salinity problems are caused from the accumulation of soluble salts in the root zone. These excess salts reduced plant growth and vigor by altering water uptake and causing ion-specific toxicities or imbalances. Establishing good drainage is generally the cure for these problems, but salinity problems are often more complex. Proper management procedures, combined with periodic tests, are needed to prolong the productivity of salt affected soils.

The main impact of increasing salinity is a loss in the productive capacity of the land. Salinity also damages farm and public infrastructure, such as water supplies, roads, fence, buildings, pipes and underground systems. Sever salting makes the soil more susceptible to secondary land degradation processes, such as soil structure decline, erosion and sodicity **(EPA2000 a and EPA2000b).**

Ashraf and Orooj (2006), found that increasing salt levels of the growth medium caused a marked inhibitory effect on fresh and dry weight of both shoots and roots. However, adverse effect of salt was more pronounced on root biomass as compared to that on shoot biomass.

Cardon *et al*.(2003), stated that the saline soils cannot be reclaimed by chemical amendments, conditioners or fertilizers. A field can only be reclaimed by removing salts from the plant root zone.

Rhodes *et al*.(2004), reported that, in addition to total salt concentration, sodium and p H can adversely affect soil properties for irrigation and cropping. At high levels of sodium relative to divalent cation in the soil solution, clay minerals in soils tend to swell and disperse and aggregates tend to slake, especially under conditions of low total salt concentration and high p H.

The use of saline drainage water in Egypt was reported by **Abu-Zeid (1988).** About 2.3 thousand million m^3 of drainage wastewater are discharged annually to the Mediterranean Sea via return to the Nile River in Upper Egypt, 12 thousand million m^3 are used for irrigation about 405000 ha of land. About 75 percent of the drainage water discharge into the sea has a salinity of less than 3000 mg/l. The policy of the Government of Egypt is to use drainage water directly for irrigation if its salinity is less than 700 mg/l, to mix it 1:1 with Nile water (180 to 250 mg/l) if the concentration is 700 to 1500, or 1:2 or 1:3 with Nile water if its concentration is 1500 to 3000 mg/l.

Salinity is a complex environmental constraint that present two main components : an osmotic component due to decreased in the external osmotic potential of the soil solution and an ionic component linked to the accumulation of ions which become toxic at high concentration (mainly Na^+ and Cl^-). The accumulation of these elements leads to decrease the absorption availability of essential elements (e.g., potassium and calcium) **(El- Bassiouny & Bekheta, 2001).**

Tester & Davenport,(2003) and Ashraf & Foolad,(2007), found that salinity is a major a biotic stress reducing the yield of wide variety of crops all over the world.

Wang *et al.*(2003), reported that, salinity may occur when there is irregular irrigation, inadequate drainage, wrong fertilizer application, and it extremely increases particularly in a cultivation that is protected.

Plants growing in saline media come across generally with major drawbacks. The first is the increase in the osmotic stress due to high salt concentration of soil solution that decreases water potential of soil. The second is the increase in concentration of Na & Cl, and inhibition of mineral nutrients uptake
(Marschner, 1995).

The salt stress is an intricate phenomenon involving osmotic stress, specific ion affected and nutrient deficiency which adversely affects different physiological and biochemical mechanisms concerned with plant growth and development. Plants, however have evolved different mechanisms to cope with the injurious effects of salt stress **(Tiwari *et al.*, 2010).**

Salinity stress in plants retards all major growth processes that have been examined. Such processes as cell division and enlargement, production of proteins and nucleic acids, energy metabolism and increase in plant mass are adversely affected **(Basalah, 1991).**

Agricultural crops face different types of biotic and abiotic stresses. Among abiotic stresses, salinity is very harmful and adversely affects the agricultural production. However productivity and internal drainage of saline soil can be restored to some extent by better management practices like combination of physical and chemical treatments **(Zia *et al.*, 2006).**

High salinity adversely affects biological functions in ecosystem and causes degradation of soil and water resources **(Sumner, 2000).**