Effect of saline water and drip irrigation on tomato yield in sandy calcareous soils amended with natural conditioners

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Introduction

Water research studies in Saudi Arabia clearly showed sever depletion of groundwater and deterioration of ground water quality in certain area of the country, where salinity became a major problem in old agricultural oasis. Therefore, the scientifically applied research program related to water saving, conservation and salinity in agriculture is essential, where agricultural activities account for more than 85% of the total water consumed. Also, adoption of modern irrigation techniques is needed to be emphasized to increase water use efficiency. Drip irrigation is the most effective way to apply directly water and nutrients to plants and not only save water but also increases yields of vegetable crops (Tiwari et al.,1998; Al-Omran et al. 2005). Ayars et al. (2001) reported from their studies on subsurface drip irrigation and furrow irrigation in the presence of shallow saline ground water that yield of drip irrigated tomato were greater under drip irrigation than under furrow irrigation. Phene et al. (1991) reported that subsurface drip irrigation improved water use efficiency (WUE) of tomato plants. Drip irrigation system will provide an advantages using saline water with more frequent irrigation to keep a high soil matric and low salt concentration in the root zone (Malash et al., 2005; Abdegawad et al., 2005; Yurteren et al., 2005). Abdegawad et al., 2005) reported that water use efficiency (WUE) was higher with drip irrigation over traditional methods on different tomato varieties. They also find that higher sugar content of tomato fruit using saline irrigation water compared with that irrigated with non-saline water.

Materials and methods

Field experiments were conducted at the college experimental station in both greenhouse and open field in 2005-2007 seasons. It consists of clay deposits at a rate of 2% and organic manure at rate of 10%, three irrigation water applied levels, using surface and subsurface drip irrigation. Two source of water was used in the experiment, well water with electrical conductivity (EC) of 3.7 dS/m well above the threshold value of ECw for tomato and water with ECw of 0.6 dS/m. sA field experiment has been established in 2002 to- 2003. In brief, the soil was non-saline, non-sodic, calcareous and sandy texture. The irrigation systems layout is surface and subsurface drip irrigation while water quality was highly saline and moderately sodicfor the well water.

Tomato (*Lycopersicon esculentum L.* cv. Bascal) seedlings were transplanted on 15 Nov. The experiment has been laid out following the complete randomized block design with three replicates for each treatment. Each treatment consists of 7 drippers (2.8 m tubing) and the distance between two rows was about 1 m. Three seedlings were transplanted at each dripper. Irrigation was commenced after transplantation and continued every other day until the end of experiment. Fertigation was used to deliver N-P-K soluble fertilizers to the plant root zone. Fruits were picked five several times weighted, and the total yield was determined.

Twenty soil samples were collected before irrigation from the root zone area on a grid bases (15 cm apart) around the dripper at the three growth stages. Water contents were determined by gravimetric method and alt distributions were assessed by measuring ECe.

Results and discussions

The results showed a significant decrease in yield with saline water in both season and the decrease was more apparent in the open field experiment. Results also indicated that yield was significantly increased with the increase of irrigation level, whereas WUE significantly decreased with increase of irrigation level. The average yield increased by about 12% in high

irrigation level compared to moderate irrigation level. WUE decreased by 49.0% at moderate irrigation level and decreased by 55% at high irrigation level. Clay deposits gave a better yield in the greenhouse experiment compare to organic manure. The differences between surface and subsurface drip on yields and WUE were also significant**.**

Soil salinity

Data of salt distribution in the root zone area for all water regimes and emitters depth treatments at the beginning and the end of each season were graphically illustrated using Surfer Software. Data of surface drip irrigation (zero depth of emitters) were presented in Fig. 1. It indicated that salt distribution differ between the beginning and the end of the season. The figure also, showed that the soluble salt distribution was high on the surface and decreased gradually with depth to the lowest values at 30-45 cm depth. Salt accumulation was relatively high at the end of the season Table 1. It appears that salt accumulation in the field was an important factor in reducing yield in the second season which is in contrast with study reported by Wan et al. (2007) that salinity of 1.1- 4.9 dSm-1 had little effect on tomato yield. However, as Shalhevet (1994) stated that it is still controversial whether the reduction in water uptake with increasing salinity is the cause or the result of reduction in growth.

Table 1 Soil salinity (ECe dSm-1) at different dates of growing seasons

Depth cm	Date				
	Aug. 2005	Dec. 2005	March 2006	Dec. 2006	March 2007
0 – 15	3.60	6.24	8.08	6.54	8.46
15 – 30	2.80	3.12	3.38	3.50	6.04
30 - 45	2.40	2.30	2.42	3.20	3.34

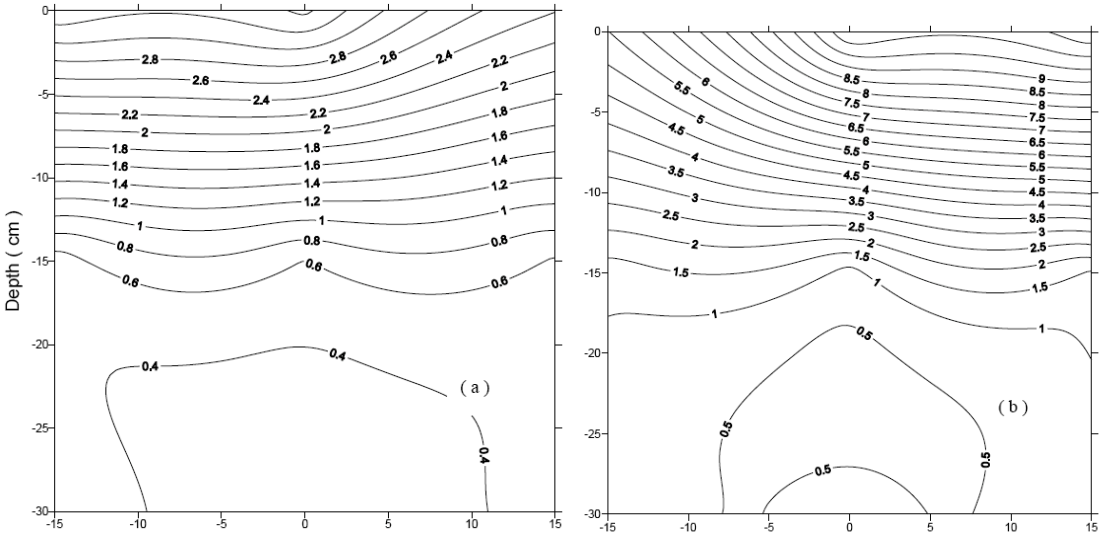

Figure 1 Salt distribution (ECe, dSm-1) in the root zone at the beginning (a) and the end (b) of the growing season.

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