Evaluation of Sorghum density as affected by two water qualities under drip irrigation system

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1. Introduction

Dwindling supplies of quality water for irrigation and competition from other users are forcing farmers to use poor quality water, more specifically high in salinity or saline irrigation water, particularly in developing countries (Shani and Dudley, 2001). The drip irrigation is the most efficient system in delivering just the required amount of water directly in the crop root-zone (Shalhevet 1991). The use of such system is particularly important where limited water resources, including saline groundwater, are used for irrigation due attention should be given to minimize root-zone salinity through appropriate management practices, including leaching.

2. Material and Methods

The experiment was conducted at the Arid Land Research Center, Tottori University during 2005 growing seasons, from April to August, in a plastic greenhouse. Drainage water was collect by using small pipe was connected between experiment pot and small covered pan was installed in the 30 cm beneath. During the irrigation season four crop densities using pot with four replicates was used. In each replicate pot (diameter 0.30 m and height 0.6 m), the sub-main pipe of the drip irrigation system (DIS) was divided into three lateral lines and on each line there were 4 emitters that were 60 cm apart and each emitter irrigated one pot. The DIS was operated at 0.1 MPa to achieve an emitter discharge of 2 L h^{-1}. Fertilizer was applied uniformly to each pot when the soil was plowed (180 kg h^{-1} N, 45 kg h^{-1} P, 80 kg h^{-1} K). At the end of experiment the grain yield for each plot were determined.

During the growing season the treatments consisted of two irrigation water level. The water irrigation applied was top water (0.11 dS m^{-1}) and saline water (5.40 dS m^{-1}). Irrigation input was equivalent to 100% of daily open-pan evaporation, which was measured in the greenhouse applied daily. For details of the computation pertaining to this particular greenhouse conditions please see Ould Ahmed et al. (2007). The total top water and saline water input was 760 and 725 mm, respectively for each pot.

3. Result and discussion

Figure 1 show temporal variation of drainage water as affected by different sorghum density and water quality. The data indicated that the amount of water was less under higher density (three, and four-plant per emitter) compared to low densities (one and two-plant per emitter) regardless of water qualities. Statistical analysis show significant differences between treatment under top water and saline water. However, the accumulative amount of drainage water was almost double under saline irrigation. Thus, could be attributed to osmotic pressure where the plant cannot observe water under saline condition.

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Data of electrical conductivity of drainage water (ECd) was impacted by sorghum density, particularly under saline water irrigation. The result showed there was no significant difference between treatments under top water, (Fig. 2). Though, there were differences in the ranges in ECd of the treatments under saline water irrigation, the mean±sd indicate higher significant difference among thus treatments (Fig. 2). The highest ECd was observed in the higher density under saline water (four-plant per emitter) 7.31±1.5 dS m^{-1} followed by three-plant per emitter was 5.70±1.1 dS m^{-1}; two-plant per plot was 4.10±1.2 dS m^{-1}, and one-plant per emitter was 2.7±0.9 dS m^{-1}. Thought, the grain yield was affected by water quality as well as by crop density. However, the highest grain yield was observed in lower density (one-plant and two-plant per emitter) under top water 0.030 and 0.031 kg $plant^{-1}$, respectively compared with 0.027 and 0.019 for higher density (three-plant and four plant per emitter), respectively. Data indicated that there were no significant differences between low density treatments.

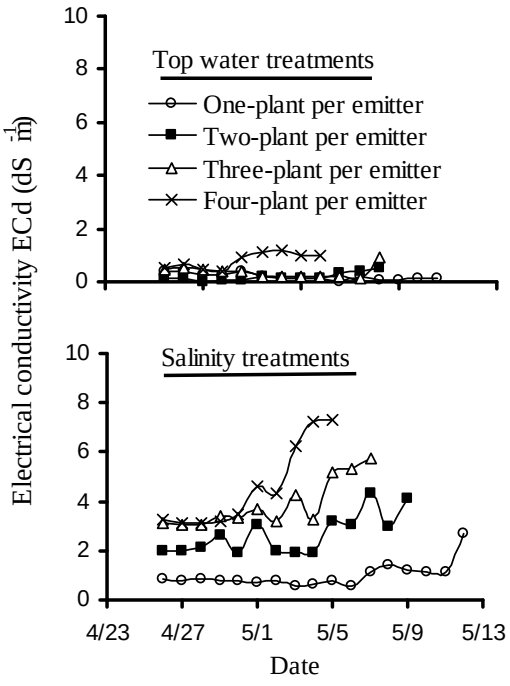

Fig.1 Electrical conductivity of drainage water during the experiment period.

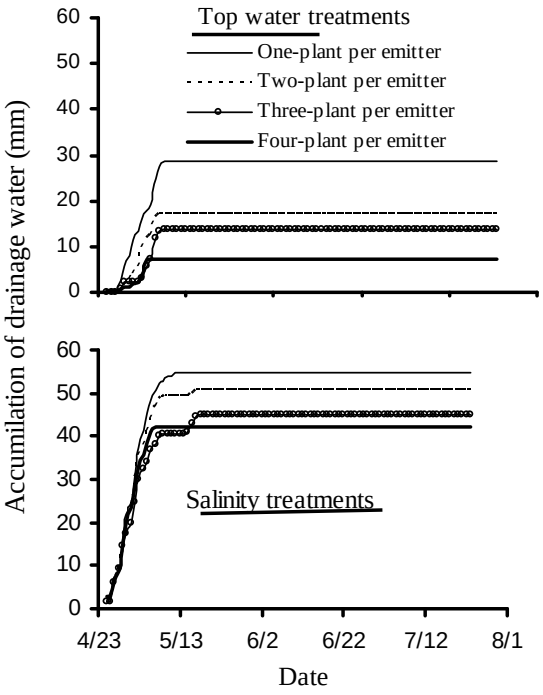

Fig.2 Accumulations of drainage water from different sorghum plants densities and two water qualities.

4. Result

The grain yield of different sorghum density, grown on dune sand and irrigated with 0.11 and 7.32 dS m^{-1} water, indicated that the crop was affected by plant density and water quality. However, we highly recommend that each emitter should not plant more than one plant under saline condition.

References

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