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EXTENDED ABSTRACT

Study on the Effect of Deficit Irrigation Composing with Controlled Vegetative on Date Palm Seedlings (CV. Barhee)

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Introduction

The world population today is about 6.5 billion, and it is estimated that it will increase to 9.1 billion by the year 2050 (UN, 2004). It is estimated that irrigation consumes more than 80% of the good quality water. Due to the reduction in available water resources, the application of water-saving strategies, such as deficit irrigation and the use of underground water resources, can reduce water usage for irrigation. One strategy for the source control is to restrict the outflow in field drains such that the height of the water table is maintained at a shallow depth that allows certain crops to utilize groundwater to satisfy a portion of their water requirements. Shallow groundwater can be a significant source of water for agricultural production, especially during the drought period. The fraction of the crop water demand that can be met by shallow water tables depends on the crop grown, irrigation and drainage management, the soil type, the depth to the water table, and the shallow groundwater salinity(Ayars et al. 2006). A wide range of crops has been successfully grown that obtained a significant portion of the crop water requirement from shallow groundwater. The types of crops range from truck crops (pepper and carrots) to grain, hay, and some tree crops (e.g. date palm) that have salt tolerances from sensitive (lettuce) to tolerant (cotton). Although such observations have been made for moderately salt-tolerant perennial crops, such as alfalfa hay, vine and tree crops have a larger potential for in- situ water use from shallow groundwater than do annual crops because of their well-developed and established root system after the first growing season. Hutmacher et al. (1996) showed that cotton (Gossypium hirsutum L.) crops can obtain 20 to 50% of their water requirement from shallow groundwater under the proper irrigation management. The timing and amounts of surface irrigation impact the extent to which crops will utilize shallow groundwater. Judicious use of deficit irrigation in combination with shallow groundwater management is necessary to achieve optimal results (Ayars et al., 1999).

Methodology

In order to investigate the effects of shallow groundwater and determine the level of deficit irrigation, an experiment was carried out on the growth of palm seedlings. This experiment was carried out based on a randomized complete block design, including three irrigation water depths and four types of drainage with 12 treatments in 3 replications (36 lysimeters) on seedlings date cultivar

Barhee in drainage lysimeters in Ahvaz during 2014–2017. The lysimeters were filled with soil and were connected to bottles with Marriotte siphons to maintain the water tables at the desired levels. Date palm seedlings (cv. Barhee) were planted in the lysimeter. Water use was calculated through the method described by Allen et al. (1998). The soil and water were analyzed before planting (Tab 1 & 2).

Table 1- Soil analysis

Ec	pH	OC	Anions (meq/l)				Total	Cations (meq/l)				Total
dS/m		%	SO_4^{-2}	Cl^-	HCO_3^{-2}	CO_3^{-2}	Anions	K^+	Na^+	Ca^{+2}	Mg^{+2}	Cations
11.2	7.45	0.3	15.77	117.5	10	--	143.27		89.05	38	14	141.05

Table 2- Water analysis

Ec	pH	(meq/lit)					
dS/m		CO_3^{-2}	HCO_3^{-2}	Cl^-	Mg^{+2}	Ca^{+2}	Na^+
3.02	7.7	1.87	0.5	9.76	5.1	5.34	0.36

The water bill was calculated using the formula below:

$$Wi + Wp + Wg - Wd = 0 \quad (1)$$

In each lysimeter, soil salinity, vegetative growth percentages, and characteristics were measured once every 6 months. The data were analyzed using SPSS 17 software, and Excel 2007 was used to draw the charts.

Results and Discussion

The groundwater contribution is higher when roots are fully developed. A large amount of the water originated either from irrigation or groundwater is added to the top zone when the crop is not fully developed yet. Therefore, this amount is not contributing significantly to the transpiration of the crop. The results showed that the survival was 100%, and the seedlings survived and grew as well. The analysis of the variance of treatments on different growth characteristics (number, length, and width of leaf and leaflet, and crown height) at various time intervals showed that the irrigation, drainage, and interactions among them had no significant effect on growth characteristics. The results showed that the volume of groundwater through the capillary rise is directly related to the amount of irrigation water required. As the amount of irrigation water increased, the amount of capillary-water rise decreased and vice versa. So, in 100% irrigation treatment, the rate of capillary rise was less than 50% of the irrigation treatment. As the age of the seedlings increased, the amount of drainage water decreased, so that in the second year after cultivation, the rate of water drainage was less than the first year.

Conclusions

Crop water use from shallow groundwater is affected by soil water flux, crop rooting characteristics, crop salt tolerance, presence of a drainage system, and irrigation system type and management. The results of this study showed that the volume of groundwater through the capillary rise is directly related to the amount of irrigation water required. As the amount of irrigation water increased, the amount of water climbed decreased and vice versa. So, in 100% irrigation treatment, the rate of capillary rise was less than 50% of the irrigation treatment. As the age of the seedlings increased, the amount of drainage water decreased, so that in the second year after cultivation, the rate of drainage water was less than the first year.

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