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EXTENDED ABSTRACT

The Effect of Tape Irrigation Levels and Scheduled Surface Irrigation on Yield and Irrigation Water use Productivity of two Watermelon Varieties in Khuzestan

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Introduction

Watermelon is one of the most important profitable vegetables in Khuzestan. A mild water stress helps watermelon to develop the root system. Water stress has a negative effect on the yield of watermelon but it increases the quality of the fruit. Watermelon is usually planted in mid-June and is irrigated in a furrow irrigation which, generally, has low application efficiency. The high amount of water consumption, especially in the early stages of growth, requires considering the drip irrigation method. Recently, using drip (tape) irrigation has become more common in Khuzestan. However, there is not enough information regarding the impact of pressurized irrigation systems on the performance of watermelon varieties. Therefore, the current research was conducted with the aim of evaluating tape irrigation levels on watermelon varieties in Northern Khouzestan.

Methodology

This study was conducted during two years in Safiabad Agricultural Research Center to compare the effect of tape irrigation versus scheduled furrow irrigation (FI) on the yield of two varieties of watermelon. The altitude, latitude, and longitude of the experimental site are 81 m, 32º15´N, and 48º26´E, respectively. Soil texture was clay loam, well drained, without salinity (ECe=1.1 ds m-1), with 0.65 percent organic carbon. The average gravimetric water content at field capacity and the permanent wilting point were 22 and 12%, respectively. Water quality at the site was high enough for irrigation with EC equaling 0.44 dS m-1, and pH equaling 7.8. The quality class of irrigation water was C2S1 based on Will-Cox (Alizadeh, 1997). The experiment was conducted in split plot based on a randomized complete block design with three replications. The main plot was a four-level water supply requirement including 50 (T50), 75 (T75), 100 (T100) and 125 (T125) percent of water requirment by tape irrigation and furrow irrigation methods. The subplot included two common cultivars of watermelon (Crimson Sweet and Charleston Gray). Each plot had four 15- m long and 4.5 m apart tape irrigation laterals.

Typically, Seeds were sown after preparing the land and measuring the physical and chemical conditions.

For calculating irrigation water depth in tape irrigation systems, daily evaporation from a class A evaporation pan of the Safiabad weather station (nearby the experimental field) was collected, and reference evapotranspiration (ET0) was calculated after applying a pan coefficient of 0.8. Crop evapotranspiration (ETc) was calculated by multiplying the reference evapotranspiration (ETo) by watermelon crop coefficient (Kc). Irrigation water amounts were determined using the following equation (Alizadeh, 1997):

$$T_d = ET_C \times (0.1 \times P_d{}^{0.5})$$

where T_d is the net irrigation water amount (mm), ETc is the crop evapotranspiration (mm) and P_d is the crop coverage (%). In the furrow irrigation (FI) method, soil moisture content was measured before each irrigation event in the root zone depth using the weighing method. The amount of water input to each plot was monitored with flow meter for tape irrigation methods and WSC flume was used for the FI method to monitor the water input. After fruit ripening, fruit yield and yield component were measured. Finally, MSTATC statistical program was used to carry out the analysis. Treatment means were separated by Duncan's multiple range test.

Results and Discussion

The volume of water consumed in FI in the first and second years was 781.7 and 753.4 mm, respectively. However, the values for crop water requirement (ET) in the first and second years was estimated to be 466 and 415 mm, respectively. Previous studies showed that watermelon water use ranged from 550 to 620 mm (Simsek et al., 2004; Erdem and Yu¨ksel, 2003; Orta et al., 2003). The amount of water requirement of the plant and the volume of intake water in surface irrigation treatment (F100) of the first year were more than that in the second year, but the amount of water penetrated in the second year was more than in the first year. This occurred due to 10-day delay in planting in the second year and the difference in evaporation in the two years of the study. Also, the total evaporation of the second year's growth period (1050 mm) was less than the first one (1200 mm), resulting in less water consumption than the second year in comparison with the first year.

Analysis of variance of the first and second years showed that there were a significant difference between the levels of irrigation in the yield and the productivity of water use. Yield reductions in T50 treatment was statistically significant at 0.05 level. T125 treatment had the maximum yield with 52.5 ton/ha and T50 had the minimum yield with 42.5 ton/ha. Fruit yield reductions in T50 treatments compared to unstressed treatment (T100) was 13.6%. Earlier studies on watermelon showed that yield values were between 50 and 80 t ha-1 (Orta et al., 2003; Simsek et al., 2004; Erdem and Yuksel, 2003) under no water stress conditions.

There was a significant difference in watermelon water use efficiency (WUE) in 1 percent level for irrigation systems and irrigation levels. WUE values ranged from 6 to 17.1 kg m^{-3}. WUE value was higher in T50 compared to other treatments and tape irrigation levels were higher than furrow irrigation (with the value of 6 kg m^{-3}).These results show that T75 could be recommended to farmers to save water under limited water conditions, without significantly reducing the fruit yield.

The cultivar and the interaction between irrigation regimes and cultivars did not have any significant effect on yield and quality of watermelon.

Conclusions

The results showed that increasing water consumption led to an increase in the amount of watermelon yield. The increase in yield, however, did not fit the increase in water consumption. The overall results of this study showed that using tape irrigation with 125% and 75% irrigation requirments was advisable in no water restriction and water restriction conditions, respectively, for watermelon cultivation in areas with semi-heavy texture and climatic conditions similar to the site of this research.

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