Effect of soil water management and different sowing dates on maize yield and water use efficiency under drip irrigation system

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A 2-year field experiment (2012–2013) was conducted to evaluate the yield and water use efficiency (WUE) response of maize (\textit{Zea mays L.}) to different soil water managements at different sowing dates. The experiment included three sowing dates (22 June, 6 July and 21 July) and four irrigation regimes based on maximum allowable depletion (MAD) of the total available soil water (TAW). The irrigation treatments were marked by I\textsubscript{1} to I\textsubscript{3} as 40\%, 60\% and 80\% MAD of TAW, respectively, and with no irrigation. The results showed that grain yield reduced when planting was delayed in both years, ranging from 6105 to 4577 kg ha\textsuperscript{-1} in 2012 and from 7079 to 5380 kg ha\textsuperscript{-1} in 2013. However, WUE increased when planting was delayed from 22 June until 21 July. Also the highest grain yield was observed in the first irrigation treatment (MAD = 40\%) in both years, and the highest WUE was obtained in the second irrigation treatment (MAD = 60\%) with 1.64 and 1.61 (kg m\textsuperscript{-3}) in 2012 and 2013, respectively. These findings suggest that delay in planting date and the use of MAD = 60\% treatment in Mediterranean-type region such as Golestan, Iran, can be useful in saving water that is highly important in such regions.

Keywords: maize; deficit irrigation; sowing date; water use efficiency; Gorgan

Introduction

According to FAO in 2013, agriculture currently uses about 70\% of the total water withdrawal, mainly for irrigation. With the increasing demand for food, competition for water is rising (WWAP 2014). Turner (2004) declared that one of the greatest challenges in agriculture is developing technologies or agronomic options to improve water use efficiency (WUE). Martin et al. (1990) classified irrigation programs as full or deficit irrigation, based on plant, soil, and climate conditions. Deficit irrigation is a strategy to increase WUE and yields per unit of water applied (Kamkar et al. 2011). Before implementing a deficit irrigation program, it is necessary to determine the crop yield response to water stress, either during defined growth stages or throughout the whole season (Kirda & Kanber 1999). In many crops, including maize, drought stress is one of the most important factors in decreasing yield. Under deficit irrigation practices, it may be necessary to make a few modifications to agronomic practices, such as adopting flexible

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