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Raised beds modulate physiological responses, yield and water use efficiency of wheat (Triticum aestivum L) under deficit irrigation. (2020).
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Abstract

Irrigation water scarcity has now become one of the main constraints that influence global crop production. The potential reduction in Egypt's Nile share and the current degree of deterioration of surface and ground water will certainly increase the severity of the water shortage problem in Egypt. Raised bed planting systems under deficit irrigation could be a partial solution to compensate for the negative effect of water stress on wheat plants. Two field experiments were managed successively in 2016/17 and 2017/18 to study the influence of irrigation water levels at 100% (DI_0), 80% (DI_{20}), and 60% (DI_{40}) crop evapotranspiration (ETc) and three different plantation systems (flat planting (PS_1), 60 cm raised beds (PS_2), and 120 cm raised beds (PS_3) on growth, photosynthetic efficiency, yield, and irrigation crop water productivity (I-WP) of wheat plants. The results revealed that yield reduction caused by deficit irrigation can be remunerated by the raised-bed planting method. When averaged over both seasons, the highest grain and straw yield of wheat plants was recorded under PS_2 and PS_3 compared with PS_1, while there were no significant differences between PS_2 and PS_3. Raised beds (PS_2 and PS_3) combined with DI_0 followed by DI_{20} significantly increased growth characteristics, leaf chlorophyll contents and their efficiency, stomatal conductance, yield and its components compared with PS_1 combined with DI_{40}. The highest value of I-WP (1.61 and 1.54 kg m^{-3}) was obtained under DI_{20} combined with PS_2 and PS_3, respectively. Therefore, under both land- and water-limiting conditions, such as in the current Egyptian situation, raised beds could be considered a potential planting technique for improving the growth and productivity of wheat under deficit irrigation (DI_{20}) by conserving 20% (1050 m3 ha^{-1}) of the water needed for wheat production.

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