

Response of Wheat (*Triticum aestivum* L.) to Deficit Irrigation Management in the Semi-Arid Awash Basin of Ethiopia

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Abstract : Crop production in arid and semi-arid regions of Ethiopia is largely limited by water availability. Changing climate conditions and declining water resources increase the need for appropriate approaches to improve water use and find ways to increase production through reduced and more reliable water supply. In the years 2021/22 and 2022/23, a field experiment was conducted to evaluate the effect of limited irrigation water use on bread wheat (*Triticum aestivum* L.) production, water use efficiency, and financial benefits. Five irrigation treatments, i.e., full irrigation (100% ET_c/ control), 85% ET_c, 70% ET_c, 55% ET_c, and 40% ET_c, were evaluated using a randomized complete block design (RCBD) with four replicates in the semi-arid climate condition of Awash basin of Ethiopia. Statistical analysis showed a significant effect of irrigation levels on wheat grain yield, water use efficiency, crop water response factor, economic profit, wheat grain quality, aboveground biomass, and yield index. The highest grain yield (5085 kg ha⁻¹) was obtained with 100% ET_c irrigation (417.2 mm), and the lowest grain yield with 40% ET_c (223.7 mm). Of the treatments, 70% ET_c produced the higher wheat grain yield (4555 kg ha⁻¹), the highest water use efficiency (1.42 kg m⁻³), and the highest yield index (0.43). Using the saved water, wheat could be produced 23.4% more with a 70% ET_c deficit than full irrigation on 1.38 ha of land, and it could get the highest profit (US\$2563.9) and higher MRR (137%). The yield response factor and crop-water production function showed potential reductions associated with increased irrigation deficits. However, a 70% ET_c deficit is optimal for increasing wheat grain yield, water use efficiency, and economic benefits of irrigated wheat production. The result indicates that deficit irrigation of wheat under the typical arid and semi-arid climatic conditions of the Awash Basin can be a viable irrigation management approach for enhancing water use efficiency while minimizing the decrease in crop yield could be considered effective.

Keywords : crop-water response factor, deficit irrigation, water use efficiency, wheat production

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