

Effect of Deficit Irrigation on Barley Yield and Water Productivity through Field Experiment and Modeling at Koga Irrigation Scheme, Amhara Region, Ethiopia

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Abstract : The insufficiency of water is the most severe restraint for the expansion of agriculture in arid and semi-arid areas. An important strategy for increasing water productivity and improving water productivity deficit irrigation at different growth stages is important to advance the yield and Water Productivity of barley in water scarce areas. A field experiment was conducted at the Koga irrigation scheme in Ethiopia to examine barley yield response to different irrigation regimes and validate the aqua crop model. The experimental setup comprised six randomized treatments (T) with three replications for one irrigation season because of financial limitations. The irrigation regimes were selected 100%, 75%, and 50% application levels in different growth stages of gross irrigation requirements using trial and error in order to select the optimal water application level. The treatments were: no stress at all (T1), 25% stressed during all crop stages (T2), 50% stressed at all stages (T3), 50% stressed at the development stage (T4), 50% stressed at mid-stage (T5) and 50% stress at initial and late season (T6). The agronomic parameters, including canopy cover, biomass, and grain yield, were collected to compare the ground-based crop yield and the aqua crop model. The results showed that the initial and late stages and stress 25% through the whole season were the right time for practice deficit irrigation without significant yield reduction. The highest (2.62kg/m³) and the lowest (2.03 kg/m³) water productivity were found under T3 and T4, respectively. The stress of 50% at the mid-growth stage and stress 50% of the full irrigation water requirement at all growth stages significantly ($\alpha=5\%$) affected the canopy expansion, biomass and yield production. The aqua Crop model performed well in simulating the yield of barley for most of the treatments ($R^2 = 0.84$ and $RMSE = 0.7 \text{ t ha}^{-1}$).

Keywords : aqua crop, barley, deficit irrigation, irrigation regimes, water productivity

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