

EGU2020-12855

<https://doi.org/10.5194/egusphere-egu2020-12855>

EGU General Assembly 2020

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Drought tolerant quinoa and irrigation scheduling in the Sahel

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Quinoa's resilience to drought stress conditions makes the crop suitable for the Sahel. It can support grain production during the dry season and can be considered an alternative crop for alleviating food insecurity within the region. The modelling of quinoa in new environments, beyond its origin, is required given its rapid worldwide expansion. Crop water models are of interest as pressure on water resources is growing and irrigation scheduling is portrayed as the best option for water optimisation. The AquaCrop model is used to simulate crop's development and derives optimal frequencies and net applications of irrigation. Due to limited water resources in the region, different irrigation schedules (i.e. full irrigation (FI), progressive drought (PD), deficit irrigation (DI) and extreme deficit irrigation (EDI)) are proposed for analysing yield and biomass responses to water stress conditions. Quinoa yields are stabilised under PD, thereby prioritising maximum water productivity rather than maximum yields. When comparing to FI, PD simulations show a 13 % yield reduction (0.97 Mg ha^{-1} for FI vs. 0.85 Mg ha^{-1} for PD), but water savings are as much as 25 % (415 mm for FI vs. 307 mm for PD). Water optimisation is reached by watering less (310 mm) but with more frequent irrigation events (28 rather than 20). The accuracy of model's simulations, as normalised-root-mean-square-error (NRMSE), is of 13.1 % for biomass and 13.6 % for grain yield (average of calibration and validation treatments).