

RESEARCH ARTICLE

Application of the AquaCrop model and response surface method to determine the optimum irrigation water and seeding density for wheat growing under sprinkler irrigation system

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Abstract

This study aimed to determine the optimal seeding density and irrigation water for maximizing wheat yield, water productivity and income using the AquaCrop model and response surface method (RSM). The AquaCrop model was calibrated and validated using experimental data from two successive growing seasons. The AquaCrop simulations for grain yield, biomass, soil water content, evapotranspiration and canopy cover were satisfactory and acceptable. After calibration, the model simulated the grain yield for 47 years with five seeding densities and four irrigation schedules. By applying RSM to the AquaCrop model outputs over 47 years, it was found that irrigation water amounts of 747, 198 and 747 mm, along with seeding densities of 211, 188 and 208 kg ha⁻¹, respectively, maximized the wheat yield, water productivity and profit per unit area. A seeding density of 162.4 kg ha⁻¹ combined with a total of 350 mm of irrigation water and rainfall resulted in the highest water productivity. This study demonstrated the reliability of the AquaCrop model in predicting wheat grain yield under various irrigation and seeding density conditions, providing valuable insights for farmers and agricultural experts to optimize crop productivity and profitability.

KEYWORDS

line-source sprinkler system, profit per unit area, water productivity

Cette étude visait à déterminer la densité de semis optimale et l'eau d'irrigation pour maximiser le rendement du blé, la productivité de l'eau et le revenu à l'aide du modèle AquaCrop et de la méthode de surface de réponse (RSM). Le modèle AquaCrop a été étalonné et validé à l'aide de données expérimentales de deux saisons de croissance successives. Les simulations AquaCrop pour le rendement en grains, la biomasse, la teneur en eau du sol, l'évapotranspiration

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