Biosystems Engineering
Volume 93, Issue 2 , February 2006, Pages 139-152

doi:10.1016/j.biosystemseng.2005.11.005 Cite or Link Using DOI

Development and Evaluation of a Model for Yield Production of Wheat, Maize and Sugarbeet under Water and Salt Stresses

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Received 17 January 2005; accepted 9 November 2005. Available online 4 January 2006.

Scientists should provide technical information to guide farmers and policy makers in making decisions that optimise the dual objectives of high crop yield and low environmental degradation. Quantifying the combined effects of irrigation amount and water salinity on yield and leaching experimentally is expensive. Computer simulation models that integrate the effects of management on crop growth and salt leaching beyond the root zone provide a less expensive means of supplemental information gained from field experimentation. The objectives of this study were to develop and evaluate a model that describes the soil water and salt effects on yield of sugarbeet, winter wheat and maize in a semi-arid region. The developed model was based on soil water balance, and yield functions of evapotranspiration and electrical conductivity of soil saturation extract. The model was calibrated with experimental data for winter wheat and sugarbeet and validated with experimental data for maize. This model was applicable to determine crop yield at different salinity levels of irrigation water, leaching fraction, and amounts of applied water for wheat, sugarbeet, and maize in the study areas, especially for ordinary irrigation intervals, *i.e.* less than 10 days. However, it was modified by a correction coefficient for prediction of yield for irrigation intervals greater than 7 days due to interaction effects of soil water and salt stress on crop yield. The model was properly applied for farm irrigation water management under different salinity levels of irrigation water. Therefore, this model is a valuable tool for farm irrigation management in the study area under different levels of salinity.

Notation

a coefficient of relative yield due to soil salinity change

b yield reduction coefficient due to salt stress, % S^{-1} m