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Plant Response to the Soil Environment: An Analytical Model Integrating Yield, Water, Soil Type and Salinity

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An accessible solution capable of reliably predicting plant – environmental inter-relationships for variable species, climates, soils and management options is a necessary tool for creating sustainable agriculture and environmental preservation. A mechanism-based analytical solution, considering multiple environmental variables and their combined effects on plant response, was developed and tested. Water uptake by plants, water and salt leakage below the roots and yield are calculated by solving for transpiration in a single mathematical expression according to limitations imposed by root zone salinity and water status. Input variables include the quantity and salinity of applied water, terms for plant sensitivity to salinity and to water stress, potential evapotranspiration, and soil hydraulic parameters. The model was evaluated and validated against experimental data in salinity response studies, in water response studies, in studies examining combined salinity and water stresses and in studies evaluating the influence of soil hydraulic on plant response to salinity. Examples of applications of the model for agricultural and environmental management and economic analysis are presented.