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Decision Support Based on Bio-Economic Simulations for Irrigated Agriculture

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Abstract

Irrigation has been fundamental to guarantee the supply of agricultural products. Its importance increases with world demographic growth. The benefits of irrigation are: larger economic returns to agricultural activities due to higher productivity, expansion of the agricultural frontier, improvement of economic conditions for rural communities, and others. The establishment of drainage systems in wet areas brings similar benefits as irrigation. In dry areas, where irrigation is practised, drainage is an effective measure to control salinity, a problem faced by the majority of irrigated areas.

The need for the integration of irrigation and drainage in the design and management of projects is evident. An appropriate soil-water-plant-salinity management is important to guarantee sustainable agricultural production at high levels. Unfortunately, appropriate management is often lacking. Computer simulation models can be effective decision support tools for the design and management of irrigation projects, apart from contributing to agrotechnology transfer. However, few models of this kind are applicable in developing countries. One of the causes is the lack of a sufficient database.

This paper introduces a computational model for decision support for irrigated agriculture. Its flexible input data base turns it appropriate also for developing countries. The model is applicable to different scales ranging from production units to irrigation perimeters.

Components of water balance in root zones are calculated on a daily basis. Crop yields are predicted, considering stresses due to root zone water deficit or excess, and soil-water salinity. Based on these estimates and additional major economic parameters, financial and economic analyses are carried out. Optimization procedures are applied for different production scenarios, considering water, labor, area and market constraints.

The model, which is currently in its testing phase, has been applied to projects in different regions in Brazil. Its potential as a decision support tool for irrigated agriculture and technology diffusion in other situations is now verified.

Keywords: Computer simulation model, crop yield, economical analyses, soil-water-plant-salinity management

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