

Modelling the economic tradeoffs between allocating water for crop production or leaching for salinity management

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Abstract

Salinisation threatens the sustainability of irrigation agriculture and needs to be managed through leaching practices. Under conditions of water scarcity a tradeoff exists between allocating water for salinity management and production. Currently no model in South Africa is able to model explicitly the impact of salinity management through leaching on the economic efficiency of irrigation farming, taking the opportunity cost of water under limited water supply conditions into consideration. The main objective of this paper is to develop a robust non-linear optimisation model that is able to determine endogenously the impact of declining irrigation water quality on the economic efficiency of irrigation farming. A data envelopment framework was used to integrate recently developed soil water salinity crop-yield production functions and leaching functions to model the complex interactions involved in water allocation decisions. Results showed that it is profitable to reduce the area irrigated under limited water supply conditions in order to release water for leaching purposes. When more water, but still a limited amount of water, is allocated to the farmer, his willingness to pay for water will increase if irrigation water deteriorates. Thus, the conclusion is that leaching is profitable irrespective of the water supply conditions.

Keywords: salinity, leaching, economics, trade-off, non-linear optimisation, data envelopment analysis