Agricultural water management

A review of strategies, methods and technologies to reduce non-beneficial consumptive water use on farms considering the FAO56 methods

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Abstract

In the past few decades, research has developed a multitude of strategies, methods and technologies to reduce consumptive water use on farms for adaptation to the increasing incidence of water scarcity, agricultural droughts and multi-sectoral competition for water. The adoption of these water-saving practices implies accurate quantification of crop water requirements with the FAO56 crop coefficient approach, under diverse water availability and management practices. This paper critically reviews notions and means for maintaining high levels of water consumed through transpiration, land and water productivity, and for minimizing non-beneficial water consumption at farm level. Literature published on sound and quantified experimentation was used to evaluate water-saving practices related to irrigation methods, irrigation management and scheduling, crop management, remote sensing, plant conditioners, mulching, soil management and micro-climate regulation. Summary tables were developed on the benefits of these practices, their effects on non-beneficial water consumption, crop yields and crop water productivity, and the directions for adjustment of FAO56 crop coefficients when they are adopted. The main message is that on-farm application of these practices can result in water savings to a limited extent (usually < 20%) compared to sound conventional practices, however this may translate into large volumes of water at catchment scale. The need to streamline data collection internationally was identified due to the insufficient number of sound field experiments and modelling work on the FAO56 crop water requirements that would allow an improved use of crop coefficients for different field conditions and practices. Optimization is required for the application of some practices that involve a large number of possible combinations (e.g. wetted area in micro-irrigation, row spacing and orientation, plant density, different types of mulching, in-field water harvesting) and for strategies such as deficit irrigation that aim at balancing water productivity, the economics of production, infrastructural and irrigation system requirements. Further research is required on promising technologies such as plant and soil conditioners, and remote sensing applications.