SYMP-07

A framework for the analysis and improvement of crop water productivity

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Total food crop production still needs to increase to feed a growing world population, and this increase needs to be accomplished under increasing scarcity of (irrigation) water. This challenge has lead to the notion that crop water productivity (WP) needs to be increased. The debate on how to increase WP is confounded by different definitions and scale levels of analysis. Moreover, improvements in WP do not necessarily mean the production of more food. A systematic framework built on generic principles for the analysis of WP can help to identify interventions that can contribute to the dual goal of increasing food production while using less scarce irrigation water resources. To this end, a conceptual framework with four principles is proposed that can be applied at different scales: 1) increase transpirational crop water productivity (or transpiration efficiency), 2) increase the storage size for water in time or space, 3) increase the proportion of non-irrigation water inflows to the storage pool, and 4) decrease the non-transpirational water outflows of the storage pool. These principles can be applied to the improvement of genetic resources (plants) and to the improvement of natural resource management. A systems approach is used in identifying strategies to implement these generic principles at different spatial scales. In a systems approach, the boundary conditions define the components of inflow and outflow, the nature and size of the storage pool, and determine which of the flow rates are internally or externally determined. The framework can help analyze and understand the underlying mechanisms of technologies that enhance crop water productivity. This understanding, in its turn, can help identify extrapolation domains for such technologies and estimate their potential in meeting (future) food demands through a wise use of water. In this lecture, the framework is illustrated with examples for rice at the plant, field and (small) agricultural landscape level.