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ARTICLE

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Abstract In the context of increased competition for water, growing more rice with less water will be one of the major challenges of the 21st century. This paper examines water savings and issues of scale in water productivity. The main objective is to understand if and how field-scale interventions scale up to subbasin-scale water savings in the Zhanghe Irrigation District (ZID) in Hubei Province, central China. Our results confirmed that on-farm water-saving practices result in higher water productivity per unit of irrigation water at the field scale due to lower irrigation water input. However, the question is, if these field-scale practices have led to "real" water savings; savings which can be transferred to other agricultural and non-agricultural uses without lowering existing production levels. To investigate this question, we examined water use and productivity at four different scales: field scale, meso scale, main canal command scale, and subbasin scale using the water accounting methodology. The study clearly demonstrates the high dependence on the scale of water use and productivity parameters. Depleted fraction and water productivity per unit of gross inflow and irrigation water varied dramatically across scale. Thus, it is not possible to conclude from field-scale observations that basin level water savings will or will not take place. The major reasons for these scale effects are the lateral flow of water across boundaries, differing land use patterns across scales, and changing water management patterns across scales. In the ZID, going from field and meso scale to even larger scales, water productivity per unit of irrigation increases to even higher levels than at the field scale. Here it becomes clear that the ZID, with its possibilities of reuse of drainage return flows and capturing rainfall and runoff in all the reservoirs within the system, is very effective in capturing and using water productively. Factors that influence water productivity and depleted fraction are on-farm water savings as well as the reuse of drainage water, effective capturing and utilization of rain, and canal water management. The scope for additional real water savings in the Zhanghe Irrigation District is limited. Only 13% of the combined rainfall and Zhanghe reservoir irrigation water releases flow out of the basin. A further reduction in drainage surface outflow from the ZID may have negative downstream effects on other water uses, including environmental uses. The main lessons learned are that (1) employing a combination of factors—on-farm practices, reuse, and canal operations—can be an effective means of conserving water resources within irrigation systems, (2) the scope for savings must be considered by an analysis at larger scales (i.e. irrigation system or basin scale), and may be less than thought because of the interactions of these factors. The results clearly indicate that scale effects are important for understanding and planning for water savings and water productivity.

Keywords Water saving · Water accounting · Scaling-up · Rice · China

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