

B. Dong · D. Molden · R. Loeve · Y. H. Li · C. D. Chen ·
J. Z. Wang

Farm level practices and water productivity in Zhanghe Irrigation System

Received: 1 May 2004 / Accepted: 24 September 2004 / Published online: 10 November 2004
© Springer-Verlag 2004

Abstract China, the biggest rice-producing country in the world, has put considerable effort into finding ways to conserve water in rice cultivation. One very promising practice, intermittent submerged irrigation (ISI) was reported to be applied on farmers' fields over a large area in the Zhanghe irrigation system (ZIS), which serves about 160,000 ha of irrigated land, which is intensively cultivated with rice. To better understand the actual farmer practices, the degree to which farmers adopt ISI, the resulting water productivity, and implications for farm and system water management, a water accounting methodology developed by IWMI was applied at farm and a larger meso scale. Two areas were observed: Tuanlin, where ISI was reported to be widespread (with ISI), and Wenjiaxiang, where farmers were reportedly not adopting ISI (without ISI). The field water level measurements demonstrate that farmers at the "with ISI" site follow a

practice similar to the theoretical ISI techniques by letting ponding levels drop to the soil surface several times during the cropping season. At the "without" site, farmers keep higher water levels ponded, and do not let water levels drop to the soil surface as often as the "with" site. A major determinant of practice is ease of access to water. At the "with" site, farmers have access to a variety of sources such as ponds and drains. At the "without" site, access to water was primarily from canal water, without the degree of flexibility as areas that had a water source near the field. The process fraction of gross inflow at field scale (rice evapotranspiration divided by irrigation plus rain) ranged between 0.66 and 0.93, remarkably high values showing how effective farmers are in converting water sources to productive evapotranspiration. The on-farm water accounting results show that with ISI, the average values of irrigation water applied over two years 1999–2000 are 22% less than without ISI, and the yields approximately the same. The resulting water productivity values per unit of irrigation water ($WP_{\text{irrigation}}$) are 20% higher under ISI practices, but per unit of evapotranspiration water productivity results are similar. The meso site study yielded surprising insights into overall water management in the area. In the years 1999 and 2000, at the meso sites, the irrigation duty in Tuanlin (with ISI) was 29% and 21% less than in Wenjiaxiang (without ISI), respectively, resulting in $WP_{\text{irrigation}}$ values of 24% and 26% higher at Tuanlin than Wenjiaxiang. But values of process fraction of gross inflow were considerably reduced at the meso scale ranging between 0.12 and 0.29, with considerable drainage outflow observed. Different land uses, trees, roads, villages, and ponds, begin to play an important role in overall water resource management at this scale. Drainage water from fields plus runoff served as supplies to ponds within the meso area as well as downstream reservoirs. Ponds play a very important role as an additional source of water, and in fact facilitate the uptake of ISI practices. This demonstrates that there are multiple strategies at play influencing water savings and productivity beyond ISI in the management of water within the area.

B. Dong (✉)
Department of Irrigation and Drainage Engineering,
Wuhan University,
430072 Wuhan, China
e-mail: dongbinh@public.wh.hb.cn
Fax: +86-27-87888155

D. Molden · R. Loeve
International Water Management Institute (IWMI),
P.O. Box 2075, Colombo, Sri Lanka

R. Loeve
FutureWater,
Eksterstraat 7, 6823 DH Arnhem, The Netherlands

Y. H. Li
National Center of Irrigation and Drainage Development,
Ministry of Water Resources,
100053 Beijing, China

C. D. Chen
Zhanghe Administrative Bureau,
448156 Jingmen, China

J. Z. Wang
Tuanlin Experimental Station,
Zhanghe Administrative Bureau,
448156 Jingmen, China