

Water use efficiency as subject to irrigation management on the field scale – a case study from Fergana Valley

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Water resources in the Fergana Valley are strongly affected by water demand in agricultural production. Cotton and wheat are major crops in the region. About 90% of the water consumption is covered by irrigation (mainly fed from surface water bodies), as precipitation during the growing season does not suffice to cover the water demand of the crops. Water use efficiency is low due to poor maintenance of irrigation systems, little knowledge on water saving practices and a lack of economic incentives to implement water saving technologies. Despite a general awareness of the problems in water management in agriculture, detailed studies on water use efficiency and the impact of irrigation management on water resources on a regional or field scale are scarce.

This study analyses the effect of current water management on water resources and water use efficiency in cotton and wheat production. The analysis is based on field experiments and modelling approaches. The study was done in the frame of the CAWA project (“Water in Central Asia”, www.cawa-project.net). On the field scale, the isotopic signature of soil water is used to quantify the evaporative loss of groundwater. High evaporative losses indicate unproductive water losses, i.e. a large amount of irrigation water is not used for biomass production. On the scale of a Water Users Association, the water footprint of cotton and wheat production was calculated with the CROPWAT model. The amount of virtual water stored in the harvested commodity was calculated using land use, irrigation and harvest data. Furthermore, climate change scenarios (i.e. temperature increase) were applied to assess future water demand in agricultural production.

The results indicate that water consumption for agricultural production is high. However, even without implementing expensive irrigation systems, water use efficiency could be increased by adapting the irrigation scheduling. Evaporative losses from groundwater are highest when the groundwater is close to the surface. Given that Global Circulation Models predict a substantial temperature increase for Central Asia, future plant water demand and evapotranspiration losses will increase and aggravate water scarcity in the region. Water and irrigation management has to adapt to these changing environmental conditions in order to avoid water conflicts in the region.