



Irrigation management and water use efficiency in cotton and wheat production - a case study from Ferghana Valley, Uzbekistan

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Cotton and wheat production in Fergana Valley (Uzbekistan) depend on irrigation as precipitation during the growing season does not suffice to cover the water demand of the crops. Irrigation, mainly fed from surface water bodies, covers about 90% of the water consumption 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 in Uzbekistan, 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 aims to analyse the effect of current water management on water resources and water use efficiency in cotton and wheat production based on field experiments and modelling approaches. We present results from a Water Users Association in the Ferghana Valley, Uzbekistan. The study was done in the frame of the CAWA project ("Water in Central Asia", www.cawa-project.net). On the field scale, the evaporative loss of groundwater was quantified by using isotopic signatures of soil water in various soil depths. High evaporative losses indicate that a large amount of irrigation water is not used for biomass production and accounts for unproductive water losses.

On a regional scale, we applied the CROPWAT model to calculate the water footprint of cotton and wheat production. Land use, irrigation and harvest data from the Water User Association were used to calculate the amount of virtual water stored in the harvested commodity. Furthermore, climate change scenarios (i.e. temperature increase) were applied to assess future water demand in agricultural production. Combining the field scale experimental and the regional scale modelling approaches allowed to quantifying the irrigation efficiency and to identify the major challenges in water management (at least from a hydrologic perspective) in the region.

The results show that water consumption for agricultural production is high, especially when compared to cotton and wheat production in countries with improved and more efficient irrigation technologies. The model results indicate that even without implementing expensive irrigation systems, water use efficiency could be increased by adapting the irrigation scheduling. Evaporative losses from groundwater depend largely from the depth of the groundwater, i.e. the closer the groundwater is to the surface, the higher are the evaporative losses. 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.