# Water use in wheat production in Iran: A comparative analysis of irrigated and rainfed production in Golestan Province

Til Feike[1], Ronja Strauch[1] and Maryam Tahmasebi[2]
[1]Julius Kühn-Institut, Institute for Strategies and Technology Assessment, Kleinmachnow
[2]University of Zabol, Zabol
E-mail of corresponding author: ronjastrauch@msn.com

Iran is a water-scarce country and agricultural use of water resources needs to be strategically planned to ensure a sustainable relationship between the economy, society and the environment. Trade-offs between higher yield outcomes, blue water application and agricultural input must therefore be studied and carefully weighted. This study investigates on regional agricultural water use in Golestan province using the water-driven crop modelling programme AquaCrop in combination with field data from 540 Iranian wheat producers.

In the cropping seasons 2011-2014 actual water productivities range between 0.802 kg/m³ for the producer population which cultivates under rainfed conditions ($PG_{rf}$; n=277) and 0.951kg/m³ for producers who reported use of irrigation ($PG_{irri}$; n=260). As a result of numerous simulations, stress rates of 55% ($PG_{rf}$) and 50% ($PG_{irri}$) were applied to align simulation results with actual yields for each producer. Based on this model calibration, the following scenarios were developed to simulate and compare different irrigation plans with assumed actual production conditions: (i) no irrigation (ii) supplemental irrigation (iii) full irrigation. Supplemental irrigation increased yields by 16% and 6% for $PG_{rf}$ and $PG_{irri}$, respectively, full irrigation 19% and 8%. Yet, increased water applications decreased $WP_{ET}$ by on average 4%. Results indicate that current limiting growth conditions other than water availability inhibit desired $WP_{ET}$ increases. Only changing irrigation management does not lead to the necessary improvements in regional water use. The simulated partitioning of evaporation and transpiration throughout crop development indicates great potential to decrease the non-productive evaporation from the production process to increase $WP_{ET}$. In the region, maximum ratios of transpiration to total evaporation were simulated as high as 85% achieved under optimal production conditions under supplemental irrigation reducing the non-productive share of water use to the maximum. Minimum ratios for $PG_{rf}$ and $PG_{irri}$ are as low as 32% when simulating actual production conditions under a full irrigation schedule.

Under simulated optimal production conditions, water use could be optimized and water productivities were almost twice as high for given climatic and soil conditions in the region ($PG_{rf}$: 1.499kg/m³; $PG_{irri}$: 1.698kg/m³). With the same amount of water, 96% ($PG_{rf}$) and 98% ($PG_{irri}$) more output could be produced. To combine actual yield information with a crop modelling programme produced valuable site-specific data with the explanatory power to describe current and potential water use situations in the region.