

Agricultural adaptation to reconcile food security and water sustainability under climate change: the case of cereals in Iran

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Abstract

In this study, we simulate the crop yield and water footprint (WF) of major food crops of Iran, for the historical (1980-2010) and the future (2041-2070) climate. Then, we assess the effects of three agricultural adaptation strategies to climate change in terms of potential blue water savings and the degree to which these savings reduce unsustainable blue water consumption. These adaptation strategies are (i) off-season cultivation, (ii) early planting, and (iii) benchmarking the WF of cereals. We find that the annual consumptive water use increases in both irrigated and rainfed croplands. This is most noticeable in the arid regions, where consumptive water use increases by roughly 70% under climate change. To alleviate additional pressure on blue water resources, off-season cultivation is the most effective adaptation strategy with blue water savings of 14-15 billion $\text{m}^3 \text{y}^{-1}$. However, this strategy is accompanied by significant production losses. Second most effective is WF benchmarking which results in blue water savings of 1.1-3.5 billion $\text{m}^3 \text{y}^{-1}$. The early planting strategy is less effective, but still leads to blue water savings of 1.7-1.9 billion $\text{m}^3 \text{y}^{-1}$. In the same order of effectiveness, these three strategies can reduce blue water scarcity and unsustainable blue water use in Iran under current conditions. However, we find that these strategies don't mitigate water scarcity in all provinces, nor in all months of the year. Further research is required to find adaptation strategies to reconcile food security and sustainable water use throughout the country, with consideration of socio-economic impacts as well.

Cereals production under Climate change