Tropentag, September 17-19, 2018, Ghent

"Global food security and food safety:
The role of universities"

Agro-Ecological Zoning and Yield Gap Assessment of Wheat in Iran

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Abstract

The increasing global demand for food requires a sustainable intensification of crop production also in low-yielding areas. To improve crop production there is a need to estimate spatially explicit yield gaps (Yg), i.e., the difference between potential yield (Yp) and actual yield (Ya). Quantifying Yp and Yg is essential for prioritising research and formulating food security policies. A bottom-up approach was followed to estimate Yp and Yg, in which these parameters were first estimated for specific locations in wheat producing areas and subsequently up-scaled to country level based on spatial distribution of crop area and climate zones. The analysis was based on data from 28 weather stations within 11 key agro-climatic zones covering 65 % of the total harvested area of irrigated wheat in Iran. The CERES-Wheat model was used to estimate Yp at each selected location based on long-term weather data (1998–2013) and management practices. Temporal and spatial analysis showed that the actual wheat yield varied between 1.0 and 6.2 Mg ha^{-1}, while the yield gap variation was between 1.4 and 5.9 Mg ha^{-1} and decreased with the increase of actual yields (r= -0.59). The national weighted average of Ya was 3.4 Mg ha^{-1} and Yg was 3.8 Mg ha^{-1} (Ya/Yp = 47 %). Furthermore, Yp and yield gaps varied considerably among different regions due to water availability, climate, and management practices. Using 80 % of the Yp as an exploitable level, the average actual wheat yield could be increased by 2.3 t ha^{-1} or 68 %. Our findings highlight the potential for improving the wheat yield in Iran and regional advantages for wheat production.

Keywords: Attainable yield, crop model, food security, wheat, yield gap

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