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Yield gap analysis for Tanzania – The impacts of climate, management, and socio-economic impacts on maize yields

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Abstract

Food security will be the biggest challenge for Tanzania in the next decades. Besides, Tanzania has a multifarious ecosystem, which is endangered through not adapted agronomic practices. Current innovation strategies focus mostly either on the issue of food security or on environmental damages, but rarely on both issues. However, both issues are very crucial. With crop models, a wide range of agricultural practices can be investigated to show possibilities to optimize the application of these practices. Model assessments allow to separate the effects of agronomic and climatic conditions. The process-based model SWIM (Soil and Water Integrated Model) can compute the impacts of agronomic practices and thus develop strategies to decrease the yield gap between actual (farm) yields (Y_a) and potential yields (Y_p). The Y_p are limited through the nutrient (Y_n) and water supply and reduced by pests, diseases, and weeds. Furthermore, socio-economic impacts are also relevant (knowledge, tradition, or culture). These impacts can be captured by statistical crop models. Due to regional-adapted, integrated agronomic practices, Y_a can be increased and thus the yield gap between Y_a and Y_p can be decreased. However, enhanced yields due to sufficient nutrient supply are more sensitive on climate (higher yield volatility). In particular, for innovative farmers increase the production risk of climate change impacts. These endangered adaptation from farmers and therefore both food security and the environment. However, not all influences between Y_a and Y_n can be explained by agronomic (fertilizer application, harvest time, tillage, and plant protection) and climatic conditions. Additionally, the Y_a are affected by a broad range of non-biophysical, socio economic constraints. To decrease the yield gap on regional level, agricultural practices and knowledge are required, which consider regional-specific the issue of food security and environmental protection in a balanced ratio.

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