



Climate Change Impacts on Silage Maize in Germany

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Silage maize is one of the most widespread cultivated plants in Germany because it is a main supplier of biomass in the course of the energy transition. Silage maize yield is susceptible to unfavorable environmental conditions such as dry and wet spells. Knowledge of these factors can help to mitigate welfare losses and can be used to estimate the impact of climate change on crop yields. Statistical crop models routinely use meteorological variations to estimate crop yield although soil moisture constitutes the primary source of water for plant growth. In an earlier study, the intra-seasonal predictive capacity of soil moisture for the estimation of silage maize yields in Germany was investigated (Peichl et al. 2018). The main result is that soil moisture anomalies have exploratory skills which vary in magnitude and direction depending on the month. The most important seasonal effects are then combined here in a reduced panel model to enable a more holistic climate impact assessment. These effects are soil moisture of June and August, which show opposite detrimental effects, and July temperature and precipitation. It is worth noting that the models used in this study neglect effects such as increased CO₂ fertilization and agricultural adaptation measures. To estimate soil moisture anomalies, climate projections derived from five regional climate models (RCMs) of the ENSEMBLES project under A1B scenario are used to force the mesoscale Hydrological Model (www.ufz.de/mHM). The meteorological data are demeaned to correct for systematic biases of the RCMs. The approach is based solely on anomalies. Silage maize yield variations are predicted for the reference period 1971 – 2000 and projected for the climate periods 2021 - 2050 and 2070 - 2099. For all RCMs, on average crop yield is projected to decrease for both climate periods ranging from -1.2 to -10.5 decitonnes/hectar (dt/ha) for the period 2021 – 2050 and -3.7 to -39.1 dt/ha until the end of the century. The maximum projected yield loss is less than 10 % of the average yield in Germany for the period 1999 – 2015 (447 dt/ha). Among the different explanatory variables no single driver of crop yield anomalies could be identified. This highlights that multiple seasonal determinants are required for accurate estimation of crop yield variation.

Reference:

M. Peichl, S. Thober, V. Meyer, and L. Samaniego: The Effect of Soil Moisture Anomalies on Maize Yield in Germany. *Nat. Hazards Earth Syst. Sci. Discuss.*, 2018, accepted.