

The Effect of Soil Moisture Anomalies on Maize Yield in Germany

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Abstract. Crop models routinely use meteorological variations to estimate crop yield. Soil moisture, however, is the primary source of water for plant growth. The aim of this study is to investigate the intra-seasonal predictability of soil moisture to estimate silage maize yield in Germany. It is also evaluated how approaches considering soil moisture perform compared to those using only meteorological variables. Silage maize is one of the most widely cultivated crops in Germany because it is used as a main biomass supplier for energy production in the course of the German Energy Transition. Reduced form fixed effect panel models are employed to investigate the relationships in this study. These models are estimated for each month of the growing season to gain insights into the time varying effects of soil moisture and meteorological variables. Temperature, precipitation, and potential evapotranspiration are used as meteorological variables. Soil moisture is transformed into anomalies which provide a measure for the inter-annual variation within each month. The main result of this study is that soil moisture anomalies have predictive skills which vary in magnitude and direction depending on the month. For instance, dry soil moisture anomalies in August and September reduce silage maize yield more than 10 % other factors being equal. On the contrary, dry anomalies in May increase crop yield up to 7 % because absolute soil water content is higher in May compared to August due to its seasonality. With respect to the meteorological terms, models using both temperature and precipitation have higher predictabilities than models using only one meteorological variable. Also, models employing only temperature exhibit elevated effects.