

Agriculture and Climate Change - Adapting Crops to Increased Uncertainty (AGRI 2015)

How much did extreme weather events impact wheat yields in Germany? - A regionally differentiated analysis on the farm level

Horst Gömann^{a*}

^a*Thünen-Institute of Rural Studies, Bundesallee 50, 38116 Braunschweig, Germany*

Abstract

Variations of climate are a major cause of uncertainty in crop yields. This paper analyses the impacts of extreme weather events on wheat yields reported in the German Farm Accountancy Data Network (FADN). The FADN-sample has continuously encompassed about 11,500 farms each year since 1995/96. While the average of farm yields within a county correspond to the official average county yield, farm yields show higher annual fluctuations over time.

In order to assess the impacts of extreme weather events on wheat yields, the farm data is spatially joined with data on local natural site conditions on the municipality level. Soil data such as the field capacity is taken from soil maps and altitude above sea level from digital terrain maps. The variables are averaged over the arable land in the municipalities using GIS. Meteorological data observed at weather observation stations of the German Weather Service such as temperature (minimum, average, maximum), precipitation, and potential evaporation are interpolated on a 1x1km grid and aggregated to municipalities. Various indicators reflecting extreme weather events such as the number of days with extreme frost, freeze-thaw cycles, drought and heat during the vegetation period and enduring rain and wet soil at harvest are derived on the basis of the soil and daily weather data. Multivariate regression analyses are applied for clustered homogenous soil-climate-regions to elicit the impacts of defined extreme climate events on wheat yields.

First results reflect the regionally different exposure to extreme weather events in Germany. While farmers in the northern regions suffered rather from enduring rain and soil moisture at harvest, drought caused major problems on sandy soils in the eastern regions. Of course, due to the focus on weather extremes, a substantial part of weather-induced yield fluctuation remains unexplained. Nevertheless, the results provide valuable information regarding risk management for farms.

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* Corresponding author. Tel.: +49-531-596-5513; fax: +49-531-596-5599.
E-mail address: horst.goemann@ti.bund.de

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