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Leibniz Centre for Agricultural Landscape Research (ZALF)

A model for better harvest forecasts:

Many factors lead to crop failures

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A study led by the Leibniz Centre for Agricultural Landscape Research (ZALF) shows that crop failures in agriculture can result from many different extreme and not even not so extreme weather events such as drought, heat, heavy rain or unseasonal temperatures. While large-scale crop failures are mainly caused by drought, regionally occurring crop failures can be the result of a combination of different weather phenomena that can differ between years. The study “No perfect storm for crop yield failure in Germany” was published in the *Environmental Research Letters* magazine in July 2020. It contributes to a better understanding of the complexity of these interactions and helps to make more accurate forecasts for crop failures in the future.

Extreme weather phenomena such as record heat waves, prolonged drought and heavy rainfall are increasingly leading to crop failures. Yield failures not only pose financial challenges for farmers, but in extreme cases, can also contribute to food prices spikes or supply shortages. Most recently, in 2018 and 2019, high temperatures and drought in parts of Germany led to record poor harvests. However, not all yield losses can be explained by such extreme weather events.

A study led by ZALF and involving the universities of Potsdam, Bonn and ETH Zurich shows that crop losses can be caused by a range of extreme weather events and in some cases an unfortunate combination of unfavorable but not particularly extreme weather phenomena. For example, a summer drought has a particularly strong effect when the plants have already been stressed by unfavorable weather conditions in winter. ZALF’s research results help to model the complex interplay of these factors with the aim to generate knowledge to better protect farmers from crop failures and the resulting financial losses through the use of forecasts and adapted cultivation methods or plant breeding.

Climate change is causing erratic weather patterns

Against the background of climate change, the authors of the study assume that extreme weather events will occur more frequently, but that there will also be an increase in unusual combinations of weather phenomena occurring locally. In critical growth phases, even a few unusually hot days or long periods of drought can lead to yield losses. A lot of rain in a short period of time can wash nutrients out of the soil, favor the spread of plant diseases and delay field work. However, weather phenomena that are not extreme, but rather unusual in their combination and that occur regionally can also have a severe impact on yields. As an example, the authors cite the poor wheat harvest in France in 2016, which can be attributed to an excessively warm fall combined with an excessively wet spring.

A model to predict the harvest supports agriculture

The effects of unusual weather patterns in combination with individual extreme weather events have not yet been sufficiently researched. The present study contributes to illustrating that crop yield failures can be triggered by a number of extreme weather combinations that must be considered in assessing the risk of yield failures. In the long term, adapted cultivation methods, targeted plant breeding, diversification of cropping and farming systems, as well as novel insurance products for agriculture will be needed for farmers if they are to avoid serious losses of income.

About the study

The study "No perfect storm for crop yield failure in Germany" was published in the Environmental Research Letters magazine in July 2020. It examines the causes of regional differences in the yields of the four most important arable crops in Germany (winter rape, winter wheat, winter barley, silage maize) over the past 20 years.

Project Partners:

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- Institute of Crop Science and Resource Conservation, University of Bonn, Bonn, Germany (Frank Ewert, Thomas Gaiser)

Further information:

<https://iopscience.iop.org/article/10.1088/1748-9326/aba2a4>



While large-scale crop failures are mainly caused by drought, regionally occurring crop failures are often the result of a combination of different weather phenomena: This is shown in a recent study conducted by ZALF. | The image is released for editorial reporting purposes. An image source does not have to be given. | Image source in color and print quality: <http://www.zalf.de/de/aktuelles>

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About the Leibniz Centre for Agricultural Landscape Research (ZALF) in Muencheberg, one of the institutes of the Leibniz Association:

Mission of ZALF is to deliver solutions for an economically, environmentally and socially sustainable agriculture –together with society.

As a contribution to overcoming global challenges such as climate change, food security, biodiversity conservation and resource scarcity, we develop and design crop systems, integrated in their landscape contexts that combine food security with sustainability. Therefore we process complex landscape data with a unique set of experimental methods, new technologies and models as well as socio-economic approaches.

ZALF research is integrated systems research: starting from processes in soils and plants to causal relationships on the field and landscape level up to global impacts and complex interactions between landscapes, society and economy.
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