

# More frequent extreme and adverse weather conditions threaten Europe's wheat production

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European wheat production areas have to prepare for greater harvest losses in the future when global warming will lead to increased drought and heat waves in southern Europe, and wet and cool conditions in the north, especially at the time of sowing. More frequent extreme weather conditions in Europe also threaten global food security since it produces almost a third of the world's wheat.

Of particular concern is the finding that the probability of multiple adverse events occurring within one season is projected to increase sharply by mid-century. This poses particular challenges to plant breeders and crop scientists.

Wheat harvests will suffer in the future, for example, from more frequent hot days, drought, late spring frost and harsh winters. On the other hand, cool and wet weather conditions can increase plant disease pressure and the lodging of the crop, making the crop difficult to harvest, as well as complicating the management of soils.

"The results are very alarming, given the fact that Europe produces 29 per cent of the world's wheat. In recent years we have witnessed extraordinary and [extreme weather events](#) that have impacted grain production in key agricultural areas. These phenomena have been among the main reasons for the growing food shortage and food price spikes," says Reimund Rötter, a research professor at MTT Agrifood Research

Finland.

## **Effects of extreme and adverse events difficult to assess**

Rötter and his colleagues have studied the risks to crops caused by [climate change](#) in the ongoing CropM / FACCE MACSUR project. Based on methodology developed for a detailed climatic risk analysis at national level in Finland, the indicator approach of agro-climatic conditions was now further elaborated and tailored to wheat in Europe.

The novel method helps to reveal the implications of various climatic and agronomic risks, such as frost, water logging, drought and high temperature stress for crops. Applied in combination with crop simulation models, it is also possible to evaluate local adaptation strategies as successfully shown in an earlier study for barley in Finland.

"Most crop yield simulation models currently in use are not yet suitable for the impact assessment of the various adverse weather conditions or extreme events. In addition, the information and data available are usually too scarce for large area applications of crop simulation models," says professor Rötter.

## **New diverse varieties needed for future environments**

Higher frequency of extreme [weather conditions](#) makes it more difficult not only to predict harvests but also to breed crop plants that can better cope with future climate.

"Drastic regional variations in climatic conditions also require regional strategies to climate change adaptation. In some areas, we need to be able to cultivate varieties that are resistant to heat; elsewhere, both better

tolerance of drought and heat will be required. In other areas the varieties mainly have to survive low temperatures and water logging.

"Thus research and agricultural policy should support and invest in advanced breeding and modelling approaches and their integration for accelerating delivery of new diverse varieties of wheat for the different 'future environments'," argues Reimund Rötter.

## **Similar risks apply to other crops as well**

The FACCE MACSUR project runs regional pilot studies throughout Europe on the effects of climate change and adaptation of farming practices on future crop production and food supply. In addition to wheat, the novel indicator method will be applied to the risk assessment of other crops as well. The Finnish regional pilot study is run in northern Savo.

"Although our results highlight the potential of adverse impacts of changing climate on wheat, similar risks apply to other crops as well, for their growing times and sensitive periods partially overlap with wheat," adds Reimund Rötter.

**More information:** Trnka, M., Rötter, R.P., Ruiz-Ramos, M. et al. (2014). "Adverse weather conditions for European wheat production will become more frequent with climate change." [DOI: 10.1038/NCLIMATE2242](https://doi.org/10.1038/NCLIMATE2242) . Abstract available: [www.nature.com/nclimate/journal/article/2/11/nclimate2242.html](http://www.nature.com/nclimate/journal/article/2/11/nclimate2242.html)

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