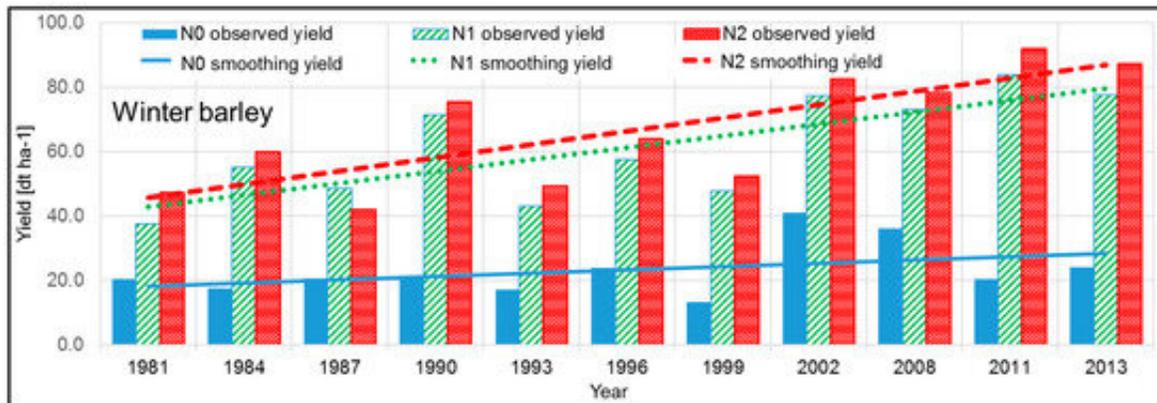


# Winter important for cereal yield

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Credit: DOI: 10.3390/cli9070112

The weather conditions in the winter and during the transitional phases from fall to winter and winter to spring have a significant influence on the yield level of key cereal crops, such as winter barley and winter wheat. These were the findings of a research team of scientists at the Chair of Plant Nutrition at the Technical University of Munich (TUM).

Global [climate change](#) is predicted to increase temperatures and change the distribution of precipitation. It remains uncertain as to how climate change will affect regions and what level of intensity they will have, though.

Scientists at the Chair of Plant Nutrition at TUM have recently investigated the effects of various weather parameters on the long-term

yields of [winter](#) barley, and evaluated the parameters that have a decisive impact on plant development throughout the year and during specific growth phases.

## **Weather is more than temperature and precipitation during the growing season**

"Our continuous field trials in Dürnast near Freising (Bavaria) have provided a very comprehensive archive of data for studying the relationships between climate change and yields," explains first author, Dr. Kurt Heil. The soil available here consists of very fertile Pleistocene Loess.

Previous studies on the influence of the [weather conditions](#) on agricultural yields have focused almost exclusively on the influence of the water supply (drought stress) and temperature (heat) during the [growing season](#). In their study, Dr. Kurt Heil and his team at the Chair of Plant Nutrition have looked at the weather parameters outside the growing season—a topic to have received less attention to date.

## **Consider frost change days, temperature thresholds and the intensity of precipitation**

"Late frosts can sometimes occur in our area as late as May," explains Heil. As winter periods end earlier nowadays on a perennial average, late frosts of this kind have a significant impact on plant health, as the plant already begins to grow at a temperature of a few plus degrees, so the young shoots are damaged by late frosts.

With higher rates of nitrogen fertilization, however, weather patterns become increasingly significant during growing seasons, which has also caused [plants](#) to become more sensitive to extreme weather conditions.

When more fertilizer is used, plants grow more strongly, which means they consume more water and in the absence of precipitation are hit harder by drought than they are when they grow less strongly.

"Temperature and precipitation are of importance with all calculations in all variants, but to a lesser extent when they are considered as totals or averages. Specific indices such as frost change days, temperature thresholds, the precipitation intensity, rain-free days, the early or late frost index and the drought index are of greater relevance in this context," explains Urs Schmidhalter, Professor of Plant Nutrition at TUM.

## **The effects of climate change on high-yield locations**

In the study, the annual variations in crop yields were largely determined by the prevailing climatic conditions in the winter as well as by the transition periods from the warmer season to the winter and vice versa. According to the study, indices such as temperature thresholds, frost change days and precipitation intensity are particularly important in the winter. During the main growing seasons, it was only the intensity of the rainfall that was of considerable importance.

"These results can be attributed to the high availability of the available field water capacity at this location, which significantly reduces the need for summer [precipitation](#) when the stores of groundwater are replenished in the winter," says Heil.

Overall, the results expand the range of the potential effects of climate change and are transferable to high-yield locations in Western Europe, which are among the world's most fertile and high-yield places of cultivation and therefore predestined and important for food production. The continuation of long-term experiments also suggests essential insights and predictions concerning the effects of climate change in the

future.

**More information:** Kurt Heil et al, Sensitivity of Winter Barley Yield to Climate Variability in a Pleistocene Loess Area, *Climate* (2021). [DOI: 10.3390/cli9070112](https://doi.org/10.3390/cli9070112)

Kurt Heil et al, Influence of Climate Conditions on the Temporal Development of Wheat Yields in a Long-Term Experiment in an Area with Pleistocene Loess, *Climate* (2020). [DOI: 10.3390/cli8090100](https://doi.org/10.3390/cli8090100)

Provided by Technical University Munich

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