

# Climate change threatens corn crops

February 28 2013, by Tom Marshall

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A warming world is putting crops at risk, according to scientists who studied how the weather affects French maize yields.

If climate-change projections are right, we'll need to improve yields per acre by as much as 12 per cent between 2016 and 2035 just to maintain today's total production.

The results reveal a real threat to our food supply in the coming decades. It turns out that maize yields drop significantly for every day when temperatures climb over around 32°C, and that [heat stress](#) has been as important an influence on maize yield as variation in rainfall since the turn of the century.

Over the past 50 years, the average number of days over this dangerous threshold has already risen from around three per year to more than five,

and it is predicted to grow to around ten a year over the next two decades. In some major maize-growing regions it could be as much as 15 days per year above this damaging threshold.

'It's a serious risk to food security,' says Dr Ed Hawkins of NERC's National Centre for [Atmospheric Science](#) and the University of Reading, who led the study. '[Crop yields](#) increased fourfold since the 1960s, largely due to better technology such as pesticides and [fertilisers](#), but this improvement has slowed in recent decades and the current rate of increase in technology may not be enough to maintain current production levels.' Better [farming methods](#) and new [crop varieties](#) will help, but there's no guarantee we can meet the target.

The team analysed of the influence on maize yields of rainfall and [high temperatures](#) over the last half-century, combining historical crop data with [climate model simulations](#). They then used projections of future daily maximum temperatures to predict the effects of heat stress on yields in the future, assuming that the historical relationship between climate and yield variations continues to hold, and tested these predictions against historical data to make sure they represent the world accurately.

The findings show that extremes of temperature have gained in importance relative to variability in rainfall since the 1960s. Hawkins says this is probably because French farmers have greatly increased their use of irrigation, so that dry spells don't do so much harm to their crops. But irrigation gives no protection against extreme heat; during the 2003 heatwave, the nation's [maize yields](#) fell by around 20 per cent compared to the year before. Things may be a little different in other countries, but the basic picture is likely to be similar.

'Predicting rainfall is very difficult compared to predicting temperatures, but we think it will change much less than temperature over the next

couple of decades,' says Hawkins. Climate models predict strong temperature increases over the twenty-first century with relative confidence, due to continued growth in greenhouse gas emissions, whereas rainfall changes are less certain.

The falloff in rates of yield improvement since the heady days of the so-called 'green revolution' may be partly due to the temperature rise we've already had. But it may also be because the obvious steps to boost yields with steps like breeding better seeds, greater use of machinery and heavier use of fertilisers and pesticides have already been taken, and that future improvements will be much harder to achieve. The 12 per cent figure is a worst-case scenario that includes a margin for error; if we could manage that, we could be very confident of at least maintaining current production. Hawkins says it's possible that a lower figure would be enough, provided the warming that happens is towards the lower end of expectations.

Different crops have varying tolerance for heat, but all have a threshold above which they suffer damage. Techniques like genetic modification or more efficient selective breeding may be able to help farmers develop new varieties that can handle hotter conditions, but it's not certain how far this process can go. If climate change continues unabated, farmers might need to start switching to entirely new crops that are currently grown in hotter parts of the world.

Hawkins says the group now hopes to extend the study, applying the same methods beyond France and to a wider range of crops.

The paper appears in *Global Change Biology*.

**More information:** Hawkins, E., Fricker, T. E., Challinor, A. J., Ferro, C. A. T., Ho, C. K. and Osborne, T. M. (2013), Increasing influence of heat stress on French maize yields from the 1960s to the

2030s. *Global Change Biology*, 19: 937-947. [doi: 10.1111/gcb.12069](https://doi.org/10.1111/gcb.12069)

*This story is republished courtesy of [Planet Earth online](#), a free, companion website to the award-winning magazine *Planet Earth* published and funded by the Natural Environment Research Council (NERC).*

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Citation: Climate change threatens corn crops (2013, February 28) retrieved 25 April 2024 from <https://phys.org/news/2013-02-climate-threatens-corn-crops.html>

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