Rising temperatures hinder Indian wheat production

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Geographers at the University of Southampton have found a link between increasing average temperatures in India and a reduction in wheat production.

Researchers Dr John Duncan, Dr Jadu Dash and Professor Pete Atkinson have shown that recent warmer temperatures in the country's major wheat belt are having a negative effect on crop yield. More specifically, they found a rise in nighttime temperatures is having the most impact.

Dr Jadu Dash comments: "Our findings highlight the vulnerability of India's wheat production system to temperature rise, which is predicted to continue in the coming decades as a consequence of climate change. We are sounding an early warning to the problem, which could have serious implications in the future and so needs further investigation."

The researchers used satellite images taken at weekly intervals from 2002 to 2007 of the wheat growing seasons to measure 'vegetation greenness' of the crop – acting as an indicator of crop yield. The satellite imagery, of the north west Indo-Gangetic plains, was taken at a resolution of 500m squared – high enough to capture variations in local agricultural practices. The data was then compared with climate and temperature information for the area to examine the effect on growth and development of the crop.

The study, published in the journal *Global Change Biology*, found that:

- warmer temperature events have reduced crop yield
- in particular, warmer temperatures during the reproductive and grain-filling (ripening) periods had a significant negative impact on productivity
- warmer minimum daily temperatures (nighttime temperatures) had the most significant impact on yield

In some areas of the Indian wheat belt, growers have been bringing forward their growing season in order to align the most sensitive point of the crop growth cycle with a cooler period. However, the researchers have also shown that in the long-term this will not be an effective way of combating the problem, because of the high level of average temperature rise predicted for the future.

Dr Dash comments: "Our study shows that, over the longer period, farmers are going to have to think seriously about changing their wheat to more heat tolerant varieties in order to prevent temperature-induced yield losses.

"Currently in India, 213 million people are food insecure and over 100 million are reliant on the national food welfare system, which uses huge quantities of wheat. This underlines how crucial it is to consider what types of wheat need to be grown in the coming decades to secure production.

"We hope that soon, we will be able to examine agricultural practices in even greater detail – with the launch of the European Space Agency's Sentinel satellites which will provide regular data at even higher spatial resolution."

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