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Crop yield stability and climate

Tom Osborne (1,2)

(1) NCAS-Climate, University of Reading, Reading, UK (t.m.osborne@reading.ac.uk), (2) Walker Institute, University of Reading, Reading, UK

The stability of crop yield is an important characteristic of cropping systems. Low variation in output from year to year is desirable for many reasons including reduced income risk, reduced cost of price support mechanisms and reduced volatility of prices. Only a handful of studies have examined crop yield data for changes in variability over time. Results vary by crop, location and by method. However in general, maize yield stability was found to have decreased, rice stability increased, and wheat stability remained unchanged during the later part of the 20th century. Hypotheses for changes in stability focus on changes to the production system associated with the Green Revolution. The importance of climate in determining crop yield fluctuations is recognized, but the possibility that climate itself is non-stationary and, consequently, may cause changes in yield stability is not considered. This study examines this possibility by analysing both crop yield and climate data for changes in variability through time.

Country–level crop yield data for the period 1961-2002 from the UN Food and Agriculture Organisation and observed precipitation and temperature datasets (averaged over growing area and growing season months) were analysed to (i) detect changes in variability of each variable over the time period, and (ii) establish relationships between climatic and crop yield variability. Decadal variations in climate variability were shown to be important in explaining decadal changes in crop yield stability casting doubt on explanations relating to technology. Importantly, non-stationarity in the crop-climate relationship for several crop-country combinations was found over the 40-year time period analysed, raising concern regarding their use in climate change impacts on crops and the long-term suitability of index-based crop insurance.