Study indicates rising temperatures will increase yield risk, crop insurance premium rates

In a different approach, agricultural economists use ‘cause of loss’ crop insurance data

MANHATTAN, Kan. – Kansas State University agricultural economists have taken a different approach than most to determine the risk farmers face in growing crops under increasingly higher average temperatures.

The results indicate that yield risk will increase in response to warmer weather, with a 1 degree Celsius increase associated with yield risk increasing by approximately 32% for corn and 11% for soybeans.

K-State economists Edward Perry, Jesse Tack, and Jisang Yu conducted the analysis using roughly 30,000 county-by-year observations from a relatively untapped source of information included in “cause of loss,” or COL data. That information is part of insurance indemnity payment data.

COL data is publicly available and maintained by the USDA Risk Management Agency. The economists investigated data from 1989 to 2014. The research has been published in Nature Communications.

“We find that warming temperatures on average are associated with higher risk, and our results suggest that the cost of insurance per unit of liability – the premium rate – will increase as a result,” said Tack, who is an associate professor in the K-State Department of Agricultural Economics.

He said that warming weather is expected to reduce average yields for many of the major dryland corn and soybean production regions in the United States. What is less clear is if the variability around lower average yields will change. That’s important for several reasons, including that unexpected yield shortfalls can dramatically affect producers’ well-being, especially if they are deep or stack up over multiple years.
Federally subsidized crop insurance can provide some protection, Tack said, but producers must pay a portion of the premium and premiums are based on how risky production is. Perry noted that their estimates indicate that rising temperatures will have different effects in different parts of the country. In some northern regions, higher temperatures will actually reduce downside risk.

“One implication of the heterogeneity in warming impacts is that producer adjustments to warming temperatures will differ depending on where you are located,” Perry said.

The team also found that the increase in production losses linked to drought are larger than those linked to heat, and that the combined heat/drought increases are larger than the combined excess moisture/cold decreases on average across U.S. dryland counties, Yu said.

“This is a unique finding that comes from (using) the cause of loss data. This difference in losses across different causes matters to farms in terms of how they can adjust to and mitigate weather impacts on their crops,” he added.

The analysis highlights the important role of heat and drought stress in increasing yield risk. Both are associated with increased risk when temperatures rise, even if rainfall levels are normal, Yu said.

At the farm level, producers make annual decisions on input expenditures such as seed and fertilizer, based on the distribution of potential outcomes, Tack said. “When those outcomes are riskier, producers may devote fewer inputs into the production process, or increase their use of risk-reducing inputs in the same way investors shy away from risky stocks.”

More information is available in the Nature Communications article, including details about methodology for the study. Information about climate change and temperatures is available on the National Oceanic and Atmospheric Administration website.

FOR PRINT PUBLICATIONS: Links used in this article
Nature Communications article, https://www.nature.com/articles/s41467-020-17707-2

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