

Projecting changes in crop production as air temperatures increase due to climate change

June 12 2014, by Ann Perry



Warming temperatures linked with global climate change may mean that growers will need to use more pesticides to hold off pests and maintain soybean production levels, according to new ARS research.

Findings from research at the U.S. Department of Agriculture (USDA) by conducted by Agricultural Research Service (ARS) plant physiologist Lewis Ziska and published today in the scientific journal *PLOS ONE* project changes in crop production as air temperatures increase due to climate change. ARS is USDA's chief intramural scientific research

agency, and the research supports the USDA priority of responding to climate change.

In the study published today, researchers observed one of the effects that agricultural producers may see as air temperatures increase is a corresponding increase of insects, weeds and fungal pests because of milder winter temperatures. One possible result is growers may need to increase their pesticide use to respond to these pests and maintain soybean production levels.

"One of our most crucial challenges is finding ways to maintain and increase crop production levels in the face of [climate change](#)," said ARS Administrator Chavonda Jacobs-Young. "These studies underscore the importance of conducting research that helps us confront these challenges and facilitates the development of cost-effective options for the environmentally sustainable production of food, feed, and fiber."

In temperate regions, the distribution and survival of agricultural pests is often kept in check by low winter temperatures. Ziska, who works at the ARS Crop Systems and Global Change Laboratory in Beltsville, Maryland, examined average [pesticide applications](#) since 1999 for commercial soybean grown over a 1,300-mile longitudinal transect from Minnesota to Louisiana. Minimum daily temperatures in this study area ranged from -20 degrees Fahrenheit to 23 degrees Fahrenheit.

Although soybean yields per acre did not vary by state, increases in total pesticide applications were positively correlated with increases in minimum winter temperature. This suggested that rising minimum temperatures could be a good proxy for increased pesticide use.

Ziska determined that from 1977 through 2013, minimum [winter temperatures](#) were increasing throughout the transect, although the rate of increase was greater for northern states like Minnesota than for

southern states like Louisiana. This observation is consistent with the Intergovernmental Panel on Climate Change projections regarding enhanced warming with increasing latitude.

Using these findings to project future pesticide use, Ziska determined that if these [temperature](#) trends continue, soybean pesticide use by region in the next 10 years may also change, with herbicide use increasing in the north and insecticide and fungicide use increasing in the south. Overall, according to Ziska, these results indicate that increases in pesticide application rates may be a means to maintain soybean production in response to potential increases in pest pressures associated with rising minimum daily temperatures and climate change.

More information: "Increasing Minimum Daily Temperatures Are Associated with Enhanced Pesticide Use in Cultivated Soybean along a Latitudinal Gradient in the Mid-Western United States." Lewis H. Ziska. Research Article | published 11 Jun 2014 | *PLOS ONE*.
10.1371/journal.pone.0098516

Provided by Agricultural Research Service

Citation: Projecting changes in crop production as air temperatures increase due to climate change (2014, June 12) retrieved 25 April 2024 from <https://phys.org/news/2014-06-crop-production-air-temperatures-due.html>

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