Increased Drought Portends Lower Future Midwest Crop Yields

For Immediate Release

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Release Date: 05.01.14
Filed under Releases

Increasingly harsh drought conditions in the U.S. Midwest ' s Corn Belt may take a serious toll on corn and soybean yields over the next half-century, according to research published today in the journal *Science*.

Corn yields could drop by 15 to 30 percent, according to the paper ' s estimates; soybean yield losses would be less severe.

North Carolina State University ' s Roderick Rejesus, associate professor of agricultural and resource economics and a co-author of the *Science* paper, says that corn and soybean yields show increasing sensitivity to drought, with yields struggling in dry conditions in Iowa, Illinois and Indiana during the 1995 to 2012 study period.

" Yield increases are getting smaller in bad conditions, " Rejesus said. " Agronomic and genetic crop improvements over the years help a lot when growing conditions are good, but have little effect when growing conditions are poor, like during droughts. "

U.S. corn and soybeans account for approximately 40 and 35 percent of global production, respectively, making the results important to the world ' s food supply.

Using field data over an 18-year period, the researchers point to the effects of vapor pressure deficit (VPD) on corn and soybean yields. VPD includes temperature and humidity measures; extremes at either end of this variable signify drought or too much water for crops. Akin to the sweet spot on a baseball bat, the best VPD condition is a value in its middle range.

Some 29 climate estimates modeled in the paper suggest that VPD will rise significantly over the next 40 years, bringing on more severe drought conditions.

The researchers ran the same tests using the Palmer Drought Severity Index, another widely used measure capturing nationwide temperature and humidity, and reported similar results. They also ran the same tests for a broader group of Corn Belt states to include South Dakota, Nebraska and Kansas. Those tests confirmed the results found in Iowa, Illinois and Indiana.

Rejesus adds that crop densities may be one reason for the problem. When plants are placed closer together, he says, it ' s easier for bad conditions to affect more plants. Crop simulations conducted in the study supported this notion.

Rejesus says that research into more drought-resistant seeds or other ways of combating sensitivity

to drought is necessary because the findings have strong implications throughout the food chain.

“There are a number of risk management implications for farmers,” he said. “Should farmers – 80 percent of whom already purchase crop insurance – buy even higher levels of crop insurance? What kinds of safety nets should be in place for farmers, if any? What happens to meat prices when corn yields diminish? There are lots of tradeoffs involved in this issue.”

Lead author of the paper is David Lobell of Stanford University. The research was funded by the National Science Foundation and the National Oceanic and Atmospheric Administration.

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Note to editors: An abstract of the paper follows.

“Greater Sensitivity to Drought Accompanies Maize Yield Increase in the U.S. Midwest”

Authors: David Lobell, Stanford University; Michael Roberts, University of Hawaii at Manoa; Wolfram Schlenker, Columbia University; Noah Braun and Roderick Rejesus, North Carolina State University; Bertis Little, Tarleton State University; Graeme Hammer, University of Queensland

Published: May 2, 2014, in *Science*

DOI: 10.1026/science.1251423

Abstract: A key question for climate change adaptation is whether existing cropping systems can become less sensitive to climate variations. We use a field-level data set on maize and soybean yields in the central United States for 1995 through 2012 to examine changes in drought sensitivity. Although yields have increased in absolute value under all levels of stress for both crops, the sensitivity of maize yields to drought stress associated with high vapor pressure deficits has increased. The greater sensitivity has occurred despite cultivar improvements and increased carbon dioxide and reflects the agronomic trend toward higher sowing densities. The results suggest that agronomic changes tend to translate improved drought tolerance of plants to higher average yields but not to decreasing drought sensitivity of yields at the field scale.