

# Elevated carbon dioxide in atmosphere trims wheat, sorghum moisture needs

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Plenty has been written about concerns over elevated levels of carbon dioxide in the earth's atmosphere, but a Kansas State University researcher has found an upside to the higher CO<sub>2</sub> levels. And it's been particularly relevant in light of drought that overspread the area in recent months.

"Our experiments have shown that the elevated carbon dioxide that we now have is mitigating the effect that drought has on winter wheat and sorghum and allowing more [efficient use](#) of water," said K-State [agronomy](#) professor Mary Beth Kirkham.

Kirkham, who has written a book on the subject, "Elevated Carbon Dioxide: Impacts on Soil and Plant Water Relations," used data going back to 1958. That's when the first accurate measurements of [atmospheric carbon dioxide](#) were made, she said.

"Between 1958 and 2011 (the last year for which scientists have complete data), the carbon dioxide concentration has increased from 316 parts per million to 390 ppm," she said. "Our experiments showed that higher carbon dioxide compensated for reductions in growth of winter wheat due to drought. Wheat that grew under elevated carbon dioxide (2.4 times ambient) and drought yielded as well as wheat that grew under the ambient level carbon dioxide and well-watered conditions."

The research showed that sorghum and [winter wheat](#) used water more efficiently as a result of the increased levels of carbon dioxide in the

atmosphere, Kirkham said. Because elevated carbon dioxide closes stomata (pores on the leaves through which water escapes), less water is used when carbon dioxide levels are elevated. [Evapotranspiration](#) is decreased.

Studies done subsequent to the early work confirmed the findings.

Over the past few months, the researcher said she's heard people comparing the dry summer of 2012 with the Dust Bowl years of the 1930s and the drought of the mid-1950s in Kansas.

The first [accurate measurements](#) of [CO2 levels](#) were made in 1958, so while scientists do not know what the concentration of CO2 was in the 1930s, Kirkham said, she used the data that she and her students collected to calculate how much the water use efficiency of sorghum has increased since 1958, which was about the time of the middle of 1950s drought.

"Due to the increased [carbon dioxide concentration](#) in the atmosphere, it now takes 55 milliliters (mL) less water to produce a gram of sorghum grain than it did in 1958," she said. "Fifty-five mL is equal to about one-fourth of a cup of water. This may not seem like a lot of water savings, but spread over the large acreage of sorghum grown in Kansas, the more efficient use of water now compared to 1958 should have a large impact.

"The elevated carbon dioxide in the atmosphere in 2012 ameliorated the drought compared to the drought that occurred in the mid-1950s."

At the basis of Kirkham's book are experiments that she and other researchers conducted in the Evapotranspiration Laboratory at K-State from 1984-1991.

"They were the first experiments done in the field in a semi-arid region

with elevated carbon dioxide," Kirkham said. The lab no longer exists, but the work continues.

**More information:** More information about Kirkham's research is available at [www.agronomy.ksu.edu/MBKirkham](http://www.agronomy.ksu.edu/MBKirkham)

Provided by Kansas State University

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