*BRC Science Highlight*
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# Bioenergy Sorghum Maintains Photosynthetic Capacity in Elevated Ozone Concentrations

## Background/objective

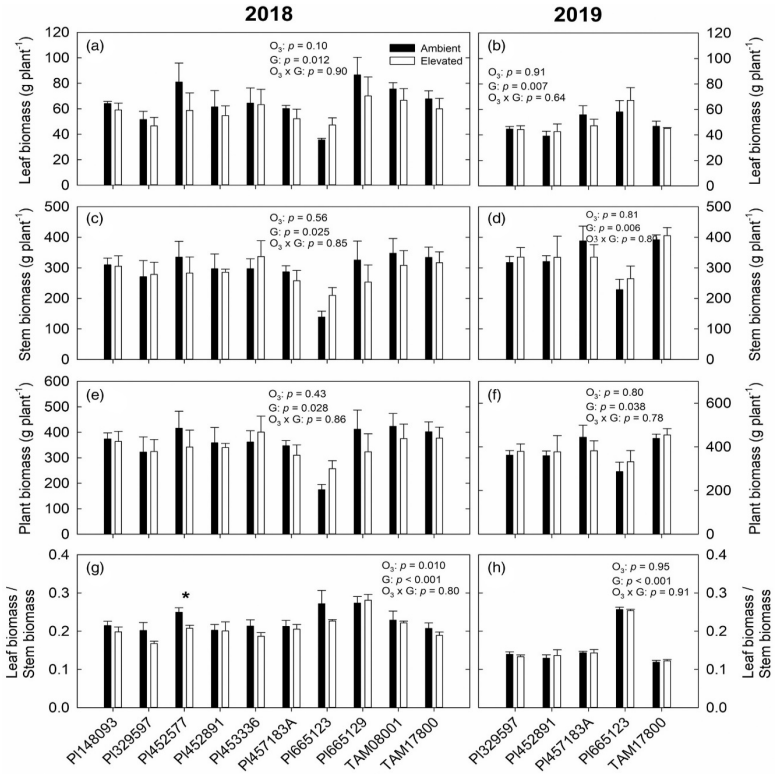
Tropospheric ozone ($O_3$) is a major secondary air pollutant with a deleterious impact on plant growth and development. Elevated $O_3$ significantly reduces photosynthesis and productivity in several $C_4$ crops, such as maize, switchgrass, and sugarcane. However, less is known about how it affects sorghum, an emerging $C_4$ bioenergy crop that is well-adapted to marginal environments and produces high biomass. This study investigated how elevated $O_3$ affects photosynthesis, biomass, and nutrient composition of a number of sorghum genotypes. Tests were also conducted to see if elevated $O_3$ altered the relationship between stomatal conductance and environmental conditions.

## Approach

- Studies were conducted under fully open-air field conditions using free-air concentration enrichment (FACE) technology, which allows for long-term, continuous exposure to elevated $O_3$ and monitoring of plant traits under natural conditions with little or no perturbation of other environmental factors.
- To further test the effects of elevated $O_3$ on photosynthetic traits of sorghum lines under controlled environmental conditions, a growth chamber experiment was performed using four genotypes.

## Results

- Sorghum genotypes showed significant variability in plant functional traits, including photosynthetic capacity, leaf N content and specific leaf area, but responded similarly to $O_3$.
- At FACE, elevated $O_3$ did not alter net $CO_2$ assimilation (*A*), stomatal conductance ($g_s$), stomatal sensitivity to the environment, chlorophyll fluorescence and plant biomass, but led to reductions in the maximum carboxylation capacity of phosphoenolpyruvate and increased stomatal limitation to *A*.




**Leaf biomass (a,b), stem biomass (c,d), plant biomass (e,f) and the ratio of leaf biomass to stem biomass (g,h) measured in sorghum genotypes grown at ambient and elevated $O_3$ in 2018 (a,c,e,g) and 2019 (b,d,f,h).**

## Significance

To our knowledge, this is the first study to examine how elevated $O_3$ affects photosynthesis and biomass in bioenergy sorghum genotypes, and it provides important information for exploring $O_3$ sensitivity among $C_4$ species and identifying $O_3$ resistant bioenergy feedstocks. The results of this study suggest that bioenergy sorghum is tolerant to $O_3$ and could be used to enhance biomass productivity in $O_3$ polluted regions, and thus can provide abundant and sustainable energy under future climate scenarios.

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