

# Elevated Ozone Concentration Reduces Photosynthetic Carbon Gain but Does Not Alter Leaf Structural Traits, Nutrient Composition or Biomass in Switchgrass

## Background/objective

Elevated tropospheric ozone ( $O_3$ ) concentration threatens the stability of crop production and negatively influences the growth, development, production and yield of  $C_3$  plants. However, less is known about the impacts of elevated  $O_3$  on photosynthesis and performance of  $C_4$  species. The effects of elevated  $O_3$  on leaf photosynthesis, nutrient composition and structural traits were studied in switchgrass, a promising  $C_4$  bioenergy crop.

## Approach

- ❖ Using Free Air Concentration Enrichment (FACE) technology, the impacts of elevated  $O_3$  on leaf gas exchange, leaf structural traits, and growth of switchgrass were studied.
- ❖ Three plots (20 m dia) were exposed to ambient  $O_3$  concentration (30-50  $nmol\ mol^{-1}$ ), and three plots were fumigated with elevated  $O_3$  ( $\sim 100\ nmol\ mol^{-1}$ ).

## Results

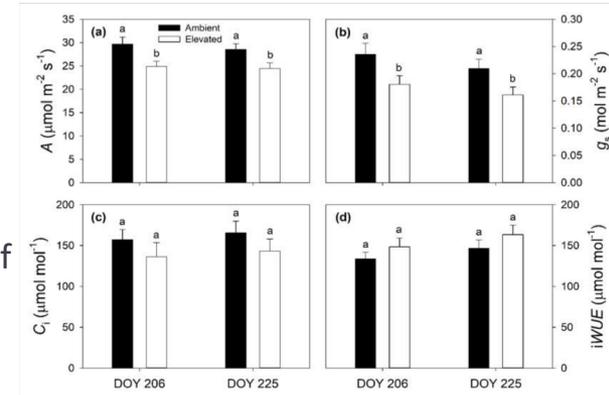
- ❖ Elevated  $O_3$  concentration reduced net  $CO_2$  assimilation rate ( $A$ ), stomatal conductance ( $g_s$ ), and maximum  $CO_2$  saturated photosynthetic capacity ( $V_{max}$ ).
- ❖ Other functional and structural traits in switchgrass and the macro- and micronutrient content of leaves (except potassium) were not affected

## Significance

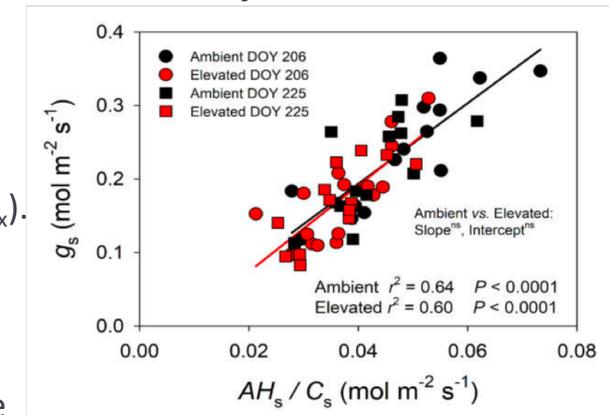
- ❖ The study provides evidence that switchgrass exhibits a greater  $O_3$  tolerance than maize, and suggests that  $C_4$  bioenergy crops differ in  $O_3$  tolerance.
- ❖ Understanding variation in  $C_4$  bioenergy feedstock responses to elevated  $O_3$  could be used to better place specific feedstocks on a dynamic landscape.

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Average values of: net  $CO_2$  assimilation rate ( $A$ ) (a); stomatal conductance ( $g_s$ ) (b); intercellular  $CO_2$  concentration ( $C_i$ ) (c); and instantaneous water use efficiency (iWUE) (d) of switchgrass grown at ambient or elevated  $O_3$  concentrations



Relationship between stomatal conductance ( $g_s$ ) and  $AH_s/C_s$  for switchgrass grown under ambient and elevated  $O_3$  concentrations

