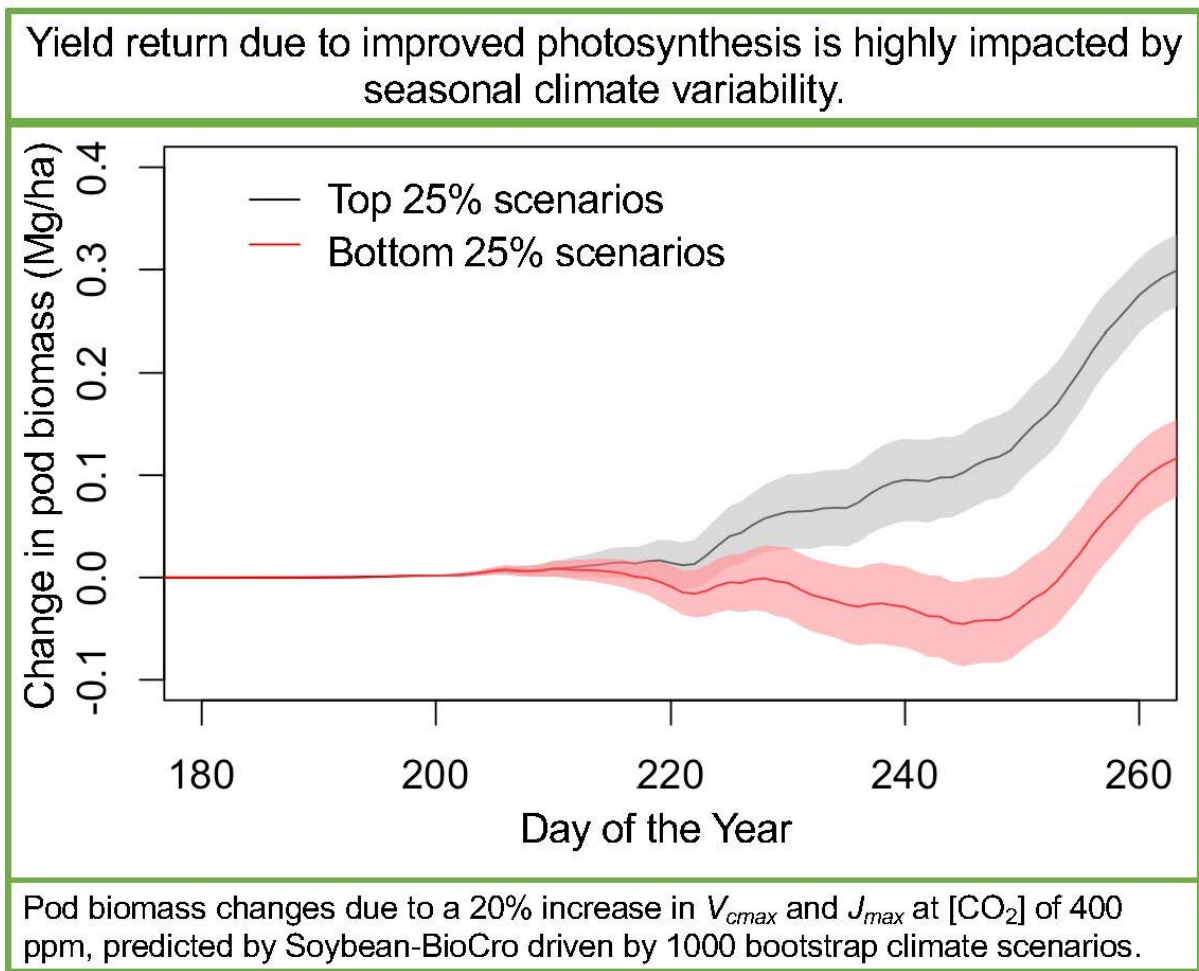


# Researchers model 'link' between improved photosynthesis and increased yield

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Pod biomass changes due to a 20% increase in  $V_{cmax}$  and  $J_{max}$  at  $[CO_2]$  of 400 ppm, predicted by Soybean-BioCro driven by 1000 bootstrap climate scenarios.

Credit: Yufeng He, RIPE Project

A team from the University of Illinois has modeled improving photosynthesis through enzyme modification and simulated soybean growth with realistic climate conditions, determining to what extent the improvements in photosynthesis could result in increased yields.

"There's a complex relationship between photosynthesis improvement and actual yield, having higher photosynthesis doesn't necessarily mean you have higher yield. The yield return is highly impacted by seasonal [climate conditions](#)" said Yufeng He, a postdoctoral researcher at Illinois, who led this work for a research project called Realizing Increased Photosynthetic Efficiency (RIPE). "This study has created a bridge that links the missing part between photosynthesis improvements and higher yields at field scale."

He and his colleagues in the Matthews Research Group used the BioCro modeling framework to simulate soybeans in Illinois fields under normal and elevated CO<sub>2</sub> conditions, paying specific attention to two important parameters that affect the plant canopy's photosynthetic process; J<sub>max</sub> and V<sub>cmax</sub>. They wanted to determine the effect of boosting these photosynthetic processes at the canopy level, rather than just at the leaf level, and determine if the effects could lead to higher yields under a range of climate conditions.

The team found that the overall returns in plant photosynthesis and pod biomass (yields) were affected when plants were simulated in a high CO<sub>2</sub> environment. They also found that correlations between increased photosynthesis and increased yield were dependent on the climate conditions at different stages of soybean growth. Their findings were recently published in *Field Crops Research*.

"There has been evidence showing that photosynthesis can be improved by modifying certain enzymes, but most of these studies were either done only looking at the leaf-scale impacts or the impacts from a limited

number of field trials and seasonal climate conditions," said Megan Matthews, Assistant Professor in the Department of Civil and Environmental Engineering at Illinois and Principal Investigator on the research.

"We studied the impacts of seasonal climate conditions at the field level on the improvements of [photosynthesis](#). Using realistic climate inputs to run our models and show how those improvements would vary with different climates."

The next steps for the researchers involve adding specific data from African plant cultivars and [environmental conditions](#) and incorporating more detailed mechanistic models to apply the findings to crop growth in Sub-Saharan Africa.

**More information:** Yufeng He et al, Seasonal climate conditions impact the effectiveness of improving photosynthesis to increase soybean yield, *Field Crops Research* (2023). [DOI: 10.1016/j.fcr.2023.108907](#)

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