Dual function of overexpressing plasma membrane H^+-ATPase in balancing carbon-water use

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Stomata respond slowly to changes in light when compared with photosynthesis, undermining plant water-use efficiency (WUE). We know much about stomatal mechanics, yet efforts to accelerate stomatal responsiveness have been limited despite the breadth of potential targets for manipulation. Here, we use mechanistic modeling to establish a hierarchy of putative targets affecting stomatal kinetics. Counterintuitively, modeling predicted that overexpressing plasma membrane H^+-ATPases could speed stomata and enhance WUE under fluctuating light, even though overexpressed H^+-ATPases is known to promote stomatal opening and reduce WUE in the steady state. Experiments validated the prediction, implicating an unexpected role of the H^+-ATPases in improving WUE under fluctuating light. It suggests that H^+-ATPases have a dual function, acting as a facilitator of carbon assimilation and water use, depending on the light conditions. These findings highlight the importance of integrating in silico modeling with experiments in future efforts toward enhancing stomatal function.

Biography

Yizhou Wang received his PhD from the University of Glasgow, UK, and completed postdoctoral training at both the University of Glasgow and Washington University in St. Louis, USA. He currently serves as the director of the Institute of Crop Science at Zhejiang University, China. With over 40 publications in reputable peer-reviewed journals, he also contributes as an editorial board member for five distinguished academic journals.

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