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Abstract

Improving Light Use Efficiency in C_4 Plants by Increasing Electron Transport Rate †

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Abstract: C_4 plants play a key role in world agriculture and strategies to manipulate and enhance C_4 photosynthesis have the potential for major agricultural impacts. The C_4 photosynthetic pathway is a biochemical CO_2 concentrating mechanism that requires the coordinated functioning of mesophyll and bundle sheath cells of leaves. Chloroplast electron transport in C_4 plants is shared between the two cell types; it provides resources for CO_2 fixation therefore underpinning the efficiency of photosynthesis. Using the model monocot C_4 species *Setaria viridis* (green foxtail millet) we demonstrated that the Cytochrome (Cyt) b_6f complex regulates the electron transport capacity and thus the rate of CO_2 assimilation at high light and saturating CO_2. Overexpression of the Cyt b_6f in both mesophyll and bundle sheath cells results in a higher electron throughput and allows better light conversion efficiency in both photosystems. Importantly, increased Cyt b_6f abundance in leaves provides higher rates of C_4 photosynthesis without marked changes in Rubisco or chlorophyll content. Our results demonstrate that increasing the rate of electron transport is a viable strategy for improving the light conversion efficiency in C_4 crop species like maize and sorghum.

Keywords: C_4 photosynthesis; electron transport; biotechnology; light harvesting

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