Building a better fluorescence estimation of electron transport in plants

Scientific Achievement

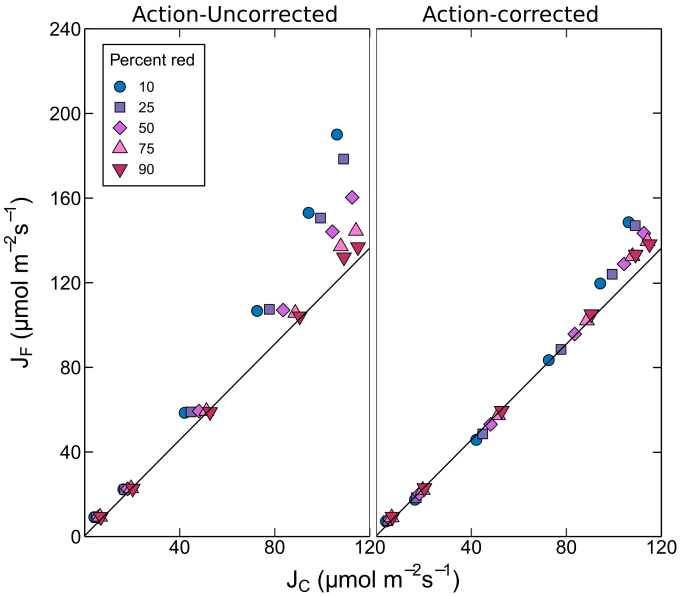
A correction for non-photosynthetic absorption of light in calculations of electron transport.

Significance and Impact

Fluorescence measurements of electron transport help determine crop productivity. This correction addresses overestimations of photosynthetic quantum yield that distort the calculation. This correction is important for models of carbon assimilation, CO_2 diffusivity through the leaf, and nitrogen assimilation, indicators of photosynthetic productivity and crop yield.

Research Details

- There is variation in quantum yield of carbon by wavelength, described by an action spectrum. The action spectrum by McCree (1970) was used as justification for eliminating far-red and ultraviolet light as photosynthetically active – the plant absorbs somewhat at these wavelengths, but it does not drive photosynthesis.
- Plants absorb more blue light than red light, but blue light is less effective at driving photosynthesis due in part to absorption by non-photosynthetic pigments.
- Correcting fluorescent measurements of electron transport (J_F) for this discrepancy (see figure) improves linearity between J_F and the calculated electron usage for carbon metabolism (J_C).
- Action-corrected data will be important for methods requiring accurate electron transport measurements, including estimations of mesophyll conductance and nitrogen assimilation.



Correcting fluorescent measurements of electron transport (J_F) for this discrepancy (above) improves linearity between J_F and the calculated electron usage for carbon metabolism (J_C).

Alan M. McClain and Thomas D. Sharkey. New Phytologist; October, 2019 (Read here)

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