



NAPPN Annual Conference Abstract:

**Limitations of Solar-Induced Chlorophyll Fluorescence (SIF) for Estimating
Photosynthesis Under Stress**

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High-throughput measurements of photosynthesis of plants grown under various conditions may provide important insights into the plasticity of the photosynthetic performance of plants. Remote sensing of photosynthetic activity [i.e., solar-induced chlorophyll fluorescence (SIF)] and its derivatives are the next generation of remote techniques, enabling high-throughput photosynthesis measurements under field conditions. We hypothesized that by measuring SIF simultaneously with measurements of whole-plant water relations in a standardized controlled drought experiment, we would be able to quantify photosynthetic activity and to detect water stress at an early stage. A functional-phenotyping platform was used to apply the controlled drought treatment and to monitor the growth and water balance of tomato introgression lines (ILs). A new SIF-derived index, electron transport rate (RS-ETR_i), was found to be negatively correlated with whole-plant stomatal conductance (G_{sc}) under non-stressed conditions; whereas a positive correlation was observed between those factors under drought stress. No significant relationships were found between SIF and plant biomass or G_{sc}. SIF 687 responded to drought earlier than any of the other measured vegetation indices (VIs). SIF parameters could not differentiate between IL lines; whereas differences between ILs were clearly identified by the gravimetric water-relations measurements. We concluded that SIF did not provide any advantage over commonly used methods for detecting physiological differences between the ILs. Overall, although SIF plays a significant role in photosynthesis, the relationship between SIF and photosynthesis is complex and we believe it would be an oversimplification to use SIF to quantify photosynthetic activity.