Evaluation of Average Leaf Inclination Angle Quantified by Indirect Optical Instruments in Crop Fields

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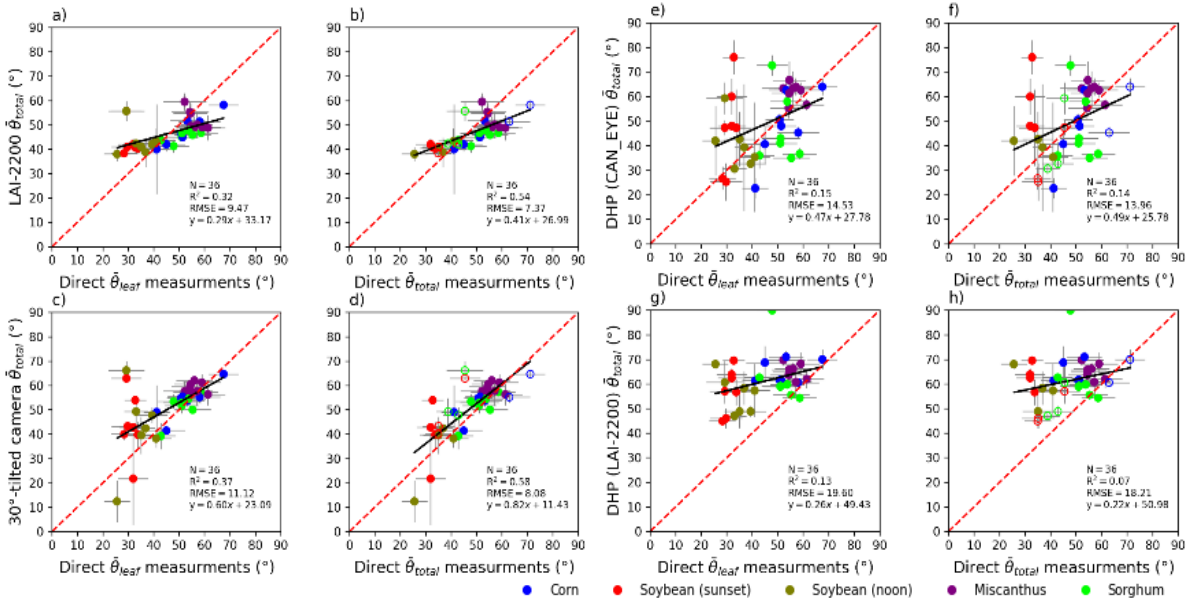
Background/Objective

- Leaf inclination angle (θ_L) is critical to accurately assess biofuel crop productivity, as it influences the energy balance and mass exchange between the atmosphere and terrestrial ecosystems.
- The lack of accurate and cost-effective measurement hinders its applications, and its representation in physical models is generally over-simplified.
- Manual measurement of θ_L is tedious, and error associated with indirect measurement methods remains unquantified.
- This study evaluates the performance of three indirect optical measurements of θ_L in various crops.

Approach

Researchers evaluated and compared the performance of three indirect optical measurements of θ_L : LAI-2200, 30˚ tilted camera, and digital hemispherical photography (DHP) in fields of miscanthus, corn, sorghum, and soybean over a growing season and benchmarked with direct measurements.



Comparison of θ_{total} results obtained from different indirect sensors with direct θ_{total} and θ_{leaf} measurements. Vertical error bar represents the spatial variation and horizontal error bar represents the 95% CI.

Results

LAI-2200 and 30°-tilted cameras had the highest correlation with direct measurements indicating reliable accuracy for continuous canopy monitoring. DHP exhibited lower accuracy, suggesting it may be less suitable in row crop fields.

Significance/Impacts

Low-cost 30°-tilted cameras may provide a promising solution for continuous canopy structure monitoring in various ecosystems.

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