Leaf to grains: predicting multiple morpho-physiological leaf to grain yield traits in sorghum from leaf-level hyperspectral reflectance

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Abstract

Enhancing photosynthesis for increased sorghum grain yield has become a key focus in sorghum breeding efforts. Phenotyping, involving the measurement of various morpho-physiological and physical traits associated with photosynthesis and grain yield, is a time-intensive process. However, the potential of non-invasive leaf-level hyperspectral imaging to swiftly detect plant performance, optimizing photosynthesis and grain yield, is promising. This study aimed to evaluate the feasibility of utilizing hyperspectral reflectance in the 350–950 nm range for the rapid estimation of these traits in intact sorghum leaves. Multiple machine learning regression algorithms were developed using leaf-level hyperspectral reflectance data from nearly 400 sorghum accessions within an association panel. The best-performing prediction models were then considered as potential methods for constructing a prediction model targeting multiple other physiological and yield traits in sorghum accessions. The results indicate that this approach enables the early detection of leaf photosynthetic and yield traits through leaf-level hyperspectral reflectance without the need for a full-range, high-cost leaf spectrometer.

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