Leaf Hyperspectral Data and Different Regression Models Used to Estimate Photosynthetic Parameters in Peanut and Soybean

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One of the keys to improving crop yield under different stresses is studying is photosynthesis. Photosynthetic parameters, such as the maximum rate of carboxylation of RuBP (Vcmax), and the maximum rate of electron transport driving RuBP regeneration (Jmax) vary in response to climate conditions and have been identified as target for improvement. However, the techniques used to measure these physiological parameters are very time consuming. On the other hand, spatial and temporal variation in plant photosynthesis can be estimated using remote sensing-derived field spectrometer vegetation indices. In this study, we developed and assessed estimates of Vcmax and Jmax through four different advanced regression models: PLS, BR, ARDR and LASSO based on leaf reflectance metrics measured with an ASD FieldSpec4 Hi-RES of different crops under different environmental conditions such as: (1) peanut under water stress (2) soybean under high [CO2] and high temperature. Both phenotypic variability and varying levels of stress were employed with each crop to ensure adequate ranges of responses. Model sensitivities were assessed for each crop and treatment separately and in combination in order to better understand the strengths and weaknesses of each model in all the different conditions. The models suggest a robust prediction of Vcmax around R2:0.67 and the same for the Jmax R2: 0.55 for the combination of three species. Field spectrometer remote sensing brings light to this challenge and shows promising results for predicting photosynthetic capacity based on more detailed leaf optical properties.