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Foliar nitrogen content and carbon isotope composition are correlated with growth and moisture stress in soybean

*Miles Ingwers**, Center for Applied Genetic Technologies, University of Georgia, Georgia, USA

Clinton Steketee, Institute of Plant Breeding, Genetics and Genomics, University of Georgia, Georgia, USA

Zenglu Li, Institute of Plant Breeding, Genetics and Genomics, University of Georgia, Georgia, USA

Interactions between carbon isotope composition ($\delta^{13}\text{C}$), foliar nitrogen content and above-ground biomass accumulation (growth) merit further investigation in soybean as these metrics may be valuable for assessing moisture stress and for the screening of drought tolerant varieties. To this end we examined the response of six soybean genotypes to soil moisture stress in a greenhouse study. Of the six genotypes, three were pre-determined to be drought resistant and three were predetermined to be drought sensitive. Two treatments were imposed: low soil moisture (~5-10 % VWC) and high soil moisture (~30-38 % VWC). Growth, foliar nitrogen content and $\delta^{13}\text{C}$ were measured at the end of the experiment (growth stages V5 to R2). All the measurements were affected by soil moisture stress. Significant positive correlations were found between $\delta^{13}\text{C}$ and biomass accumulation. The R^2 value for the relationship between $\delta^{13}\text{C}$ and biomass accumulation was much higher in the high soil moisture treatment than in the low soil moisture treatment. Foliar nitrogen content was significantly correlated to growth under high soil moisture conditions, but not under low soil moisture conditions. The data suggest that selection for genotypes with higher $\delta^{13}\text{C}$ values would result in greater biomass accumulation in low-soil moisture conditions, while selection for greater percent foliar nitrogen content and $\delta^{13}\text{C}$ may result in greater biomass accumulation under high soil moisture conditions. The relationship between $\delta^{13}\text{C}$ and foliar nitrogen content could be a very informative metric to help understand the effects of moisture stress. This relationship between $\delta^{13}\text{C}$ and foliar nitrogen content may further indicate which of the two more limiting (water versus nitrogen acquisition) are in a specific environment, which may allow for breeding selection.