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Developing a high-throughput phenotyping methodology to assess temporal biomass accumulation in soybean

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Plant light interception and its conversion to biomass is a fundamental processes governing crop growth and yield. Biomass accumulation is a dynamic and complex process, which is influenced by many factors. Traditional breeding approaches try to explore biomass in an indirect way when selecting for yield. This however does not take the processes associated with biomass production and accumulation into account. Dissecting the genetic basis of such process requires genotyping and phenotyping of suitable populations, enabling quantitative trait loci discovery. However, phenotype biomass is expensive, labor and time demanding. In addition, its phenotyping is usually destructive and restricted to last period of growing season. High-throughput phenotyping (HTP) may have the potential to supplement traditional phenotyping techniques and overcome some limitations about precision, cost and time. Developing high-throughput methodologies to enable non-destructive biomass determination may have a great impact in breeding and physiological research on plant growth dynamics and yield. Therefore, our objectives are to develop a HTP methodology for biomass phenotyping; to compare biomass determination by ground-based and sensor-based, using various biometric methods; and to investigate genetic architecture of biomass through GWAS in a developmental phase-specific manner. A random subset of 32 families from the SoyNAM panel, resulting in 384 lines, was combined and planted at ACRE farm from Purdue University in this 2017 season. Weekly destructive biomass measurements will be taken, as well as unmanned aerial platform-based multi-spectral imaging of the field. Multispectral aerial images will be used to derive different reflectance vegetation indices and to perform a multivariate analysis to predict biomass accumulation. Combining the phenotypic data with the available genotypic data for SoyNAM we will perform GWAS for biomass accumulation overt time in soybean.