High-Throughput Phenotyping for Disease and Drought Stress Selection in Groundnut (Arachis hypogea L.)

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The ability to accurately select for drought tolerance, disease resistance and variety performance is important across breeding environments. However, assessment traits of interest like plant biomass is resource intensive and often subjective, hence the quality of data is compromised. High-throughput phenotyping (HTP) using hand held tools was proposed to alleviate the phenotyping challenge in groundnut (*Arachis hypogaea* L.) breeding. The study was aimed at identifying 1) HTP tools for groundnut selection for tolerance to drought and diseases (groundnut rosette disease caused by satellite RNA, groundnut rosette virus, and groundnut rosette assistor virus and late leaf spot disease caused by *Phaeoisariopsis personata* (Berk & Curt) and yield performance and 2) plant physiological parameters that can predict pod yield to focus on during selection in breeding programs. Sixteen genotypes were grown under rainfed conditions in Serere (1°30'00.0"N, 33°33'00.0"E), Uganda, and evaluated over the 2019-2020 growing season. Data was collected using traditional phenotyping (visual scores and direct measurement) and HTP tools (red-blue-green, RGB camera; thermal camera; and GreenSeeker) on plant emergence and vigor, canopy height, leaf color, and disease severity on a weekly basis over a period of five weeks during plant growth. At harvest, measurements on plant biomass and pod weight were taken.

Results show that groundnut phenotyping can be successfully conducted with the less time consuming HTP tools to provide results that are still comparable with those obtained using the traditional phenotyping methods. In some cases, parameters derived with HTP tools were more accurate predictors of final whole plant dry weight and pod dry weight. The results generally indicate that there is potential to focus on measurement of a few plant traits and still accurately predict final groundnut yield using HTP tools. As already shown for other crops, the findings from this study highlight the potential of HTP tools in speeding up groundnut breeding programs that often have to work with numerous breeding lines.