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Studies of root system architecture in soybean using stereo vision

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Root system architecture (RSA) studies are tedious, susceptible to introduced variation, measurements are time consuming and the extracted features may not translate to meaningful outcome, i.e., increase in yield or other important traits. With the advent of computer vision, there is a renewed interest in uncovering “the hidden half”, i.e., discovering trait correlations within and between genotypes and phenotypes. This study included 300 diverse soybean accessions from a wide geographical distribution and deployed 2-D (in controlled conditions) and stereo imaging platforms (field tests), processing and data analytic tools to deep phenotype for important RSA traits using in-house imaging software, ARIA. Both 2-D and stereo imaging platforms reveal tremendous genetic variability for RSA traits for root shape, length, mass, and angle. The stereo imaging platform developed for this study makes it possible to phenotype hundreds of genotypes and extract numerous root system traits. In addition, the 2-D platform developed is non-destructive, adding observations of seedling root growth and development.