NAPPN Annual Conference Abstract: High throughput phenotyping of field excavated roots for diverse maize lines under different N conditions

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Maize (*Zea mays* ssp. *Mays*) is one of the most essential cereal crops in the world. As climate changes, breeding for high nitrogen-use efficiency maize genetic materials without sacrificing the yield becomes more urgent than anytime before. Image-based high-throughput phenotyping, functioning as a key element in plant breeding efforts, is critically important and has the potential to relieve difficulties in phenotypic scoring on breeding pipelines. Numberless studies using RGB images related to biomass and agronomically important traits have mostly focused on above-ground traits. The belowground root-related traits, however, have not been intensively studied. The objective of this study is to investigate the root architecture and phenotypic properties (number of aerial roots, stem diameter, internode length, and fresh root weight) of roots of the hybrid and inbred maize lines grown under low and high nitrogen conditions. In this study, a collection of BGEM lines (n = 304 inbred and n = 197 hybrids) were planted on the field in low and high nitrogen conditions. The root samples of n = 2,100 plants were collected, and the soil around the roots was washed out for automated image-based phenotyping. The roots were imaged with the completely automated conveyor belt LemnaTec system. A high variation in root structure, stem diameter, number of aerial roots, and internode length was observed among the genotypes. Our root phenotyping pipeline and traits extracted from these images will enhance root biology and facilitate breeding for below-ground root traits.