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NAPPN Annual Conference Abstract: Temporal analysis of maize plant height and growth rate using UAV captured imagery

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Keywords: unoccupied aerial vehicles (UAV), maize, plant height, growth rate, genome-wide association study (GWAS), canopy cover, environment, genotype-by-environment interaction

Body Text: Plant height is used in many breeding programs for assessing plant health, predicting yield, or monitoring growth rates which can be used in identifying superior hybrids or evaluating abiotic stress factors. This has often been measured at a single time point when plants have reached their terminal height for the season. Collection of plant height using unoccupied aerial vehicles (UAVs) is faster, allowing for measurements throughout the growing season which could facilitate a better understanding of plant-environment interaction and responses. Plant height data was collected weekly for a panel of ~500 diverse lines over four growing seasons. The variation in plant height throughout the season was found to be explained by genotype, year, and genotype by year interactions. However, the relative contributions of these different sources of variation fluctuated throughout development. Genome-wide association studies of plant height and growth rate revealed many significant SNPs associated with plant height and growth rate at different parts of the growing season that would not be identified by terminal height alone. When comparing growth rates from plant height to growth rates estimated from another morphological characteristic, canopy cover, we found that canopy cover appears to be more affected by environment than plant height. This potentially makes canopy cover more useful for understanding environmental modulation of overall plant growth and plant height better for understanding genotypic modulation of overall plant growth.