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Temporal field-based phenomics for evaluating transgenic maize under drought stress

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Climate change has increased the need for drought-resilient crops, yet traditional assessment methods are labor-intensive. This study utilized an unmanned aerial system (UAS) with RGB and multispectral sensors to monitor transgenic maize hybrids under irrigated and drought conditions. Machine learning models revealed strong correlations between vegetation indices and phenotypic traits, with RGB sensors outperforming multispectral sensors in trait prediction. Prediction accuracies ranged from 0.35 to 0.70 for traits like grain yield, days to anthesis, and plant height. Ridge regression and random forest models provided the best predictions. The vegetation indices NGRDI, VARI, and RCC effectively predicted and captured the plant response to drought. This study demonstrates the potential of UAS phenotyping as an efficient tool for assessing drought resilience in maize breeding programs.

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Ten years of Genomes to Fields: a collaborative corn breeding effort

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With the rapidly growing global population and changing climate, a critical challenge for agriculture is ensuring its sustainability to meet the food supply demands. Addressing this challenge requires the development of crop varieties capable of thriving in diverse environments. The Genomes to Fields (G2F) Initiative was launched over a decade ago to tackle this issue by studying the interactions between crop genomes, environments, and management practices and their effects on crop performance. To date, G2F has evaluated approximately 190,000 field plots, involving more than 6,000 corn hybrids across over 300 unique environments in North America. The initiative has generated publicly available datasets that include genotype, phenotype, soil, weather, and metadata, offering an unparalleled resource for identifying connections between genetic variation, environmental factors, and crop performance. Here, we summarize G2F's experimental designs, germplasms, testers, environments, the questions that have been investigated over the years, and the future research opportunities it presents, reinforcing its role in advancing a sustainable agricultural system.

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