Science Societies

Improvements in grain yield performance prediction for maize hybrids

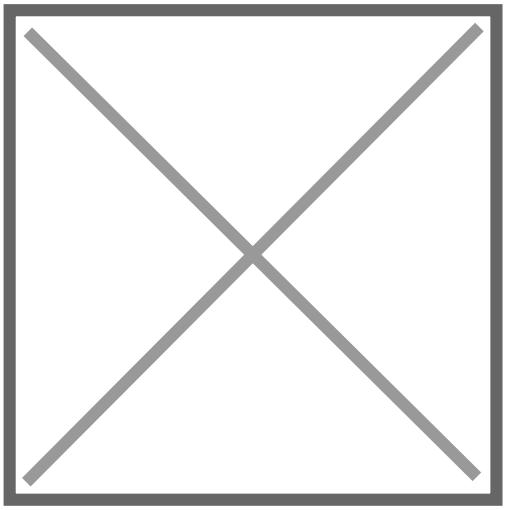
September 23, 2025

Texas A&M's maize field early in the growing season (College Station, TX). Photo courtesy of Fat

Texas A&M's maize field early in the growing season (College Station, TX). Photo courtesy of Fatma Ozair.

Improving maize grain yield is a primary goal of breeders to uphold economic gains and strengthen the grain supply for a growing population. Grain yield is a complex trait influenced by genetics (G), environment (E), and their interactions (GxE). Unfortunately, GxE effects are often overlooked when predicting the performance of hybrid lines due to limited multi-environment data and the computational costs of traditional modeling techniques. However, collaborative research initiatives like the maize Genomes to Fields (G2F) project have given U.S. researchers access to nationwide yield and environmental data for shared sets of testcrossed maize hybrids.

To dissect the genetic basis of grain yield and stability over environments, a team of researchers used a novel modeling technique, reducing the dimensionality of GxE parameters needed to accurately predict performance for hybrid populations across diverse environments. The model incorporated weather information to index 29 environments and subsequently provided biologically relevant GxE parameters, quantifying grain yield stability of each hybrid. This model substantially reduced computational time while maintaining or exceeding the predictive performance for grain yield.



Graduate student and first author on the paper, Fatma Ozair, helping pollinate maize lines within Texas A&M's corn breeding program (College Station, TX). Photo courtesy of Fatma Ozair.

The methods from these findings can help breeding programs identify and select maize hybrids widely adapted across different environments, discover hybrids that are well-suited to a specific region, and identify key biological weather parameters without requiring high-performance computing resources.

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Ozair, F., Adak, A., Murray, S. C., Alpers, R. T., Aviles, A. C., Lima, D. C., ... & Xu, W. (2025). Phenotypic plasticity in maize grain yield: Genetic and environmental insights of response to environmental gradients. *The Plant Genome*, *18*,

e70078. https://doi.org/10.1002/tpg2.70078

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