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Leaf spectra can predict hybrid vigor in maize

September 22, 2025

Dr. Deniz Istipliler, a researcher at Ege University in Turkey, collecting leaves for hyperspectral imaging in Lincoln, NE as part of a collaborative project with the Nebraska-based Schnable and Yang labs. Photo courtesy of the Schnable Lab, University of Nebraska—Lincoln.

The light that a maize leaf reflects can capture the genetic and environmental influences of crop performance. A team of researchers collected hyperspectral reflectance data from the leaves of inbred and hybrid maize plants growing under high and low nitrogen conditions. As expected, nitrogen availability had substantial impacts on reflectance patterns, particularly in spectral bands associated with photosynthetic pigments. However, the team also identified spectral “hotspots” where reflectance displayed hybrid vigor—instances where the hybrids exhibited better performance when compared with their inbred parents. Machine learned models trained on hyperspectral leaf reflectance data were able to distinguish inbreds from hybrids. This suggested that reflectance carries information about hybrid vigor.

This work is important because it moves beyond using hyperspectral data solely as a proxy for hand-measured traits, instead treating the spectral signals themselves as heritable and/or environmentally responsive phenotypes. Incorporating hyperspectral phenotyping in breeding programs could work as a faster tool for quantifying responses to stress under field conditions. In addition, it may be possible to employ hyperspectral phenotyping as a way to study or estimate hybrid vigor although additional work will be necessary to determine if the magnitude of hybrid vigor for hyperspectral phenotypes is predictive of the magnitude of hybrid vigor for other

desirable traits, such as grain yield.

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Istipliler, D., Tross, M. C., Bouwens, B., Jin, H., Ge, Y., Yang, J., Mural, R. V., & Schnable, J. C. (2025). Heritability, heterosis, and hybrid/inbred classification ability of maize leaf hyperspectral signals under changing soil nitrogen. *Crop Science*, *65*, e70073. https://doi.org/10.1002/csc2.70073

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