

Characterization of teff lodging tolerance via image analysis

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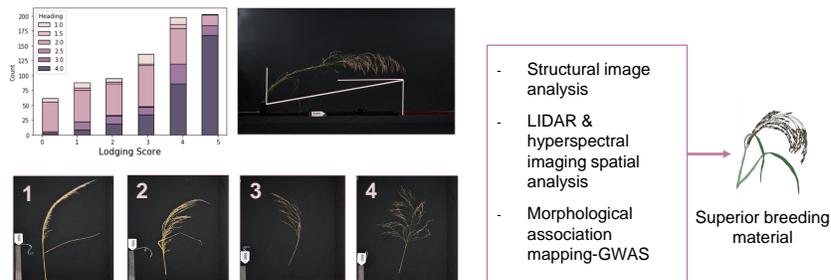
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Abstract

Teff (*Eragrostis tef*) is an underutilized cereal grown primarily by small-scale farmers in Ethiopia, where it thrives under arid conditions unsuitable for other grain crops. Incomplete selection of classic domestication traits such as lodging, panicle architecture, and seed density contribute to the low yields observed in teff compared to leading cereals. To investigate the phenotypic basis of lodging tolerance in teff, we surveyed domestication related traits across a diversity panel of 265 teff wild relatives, landraces, and cultivars in Michigan. Panicle architecture and lodging score were collected in the field. To strengthen ground truth data and identify spectral signatures of plant height and subsequent lodging, LIDAR and hyperspectral images were collected with an unmanned aerial vehicle. A tiller imaging box was designed to maintain plant architecture from the field in a controlled lab environment. Morphological features including panicle height, panicle width, spikelet density, panicle angle, and tiller angle will be calculated using PlantCV and ImageJ. Feature evaluation via Pearson's correlation and analysis of variance will be conducted for structural and morphological traits. This data will be used in a genome wide association study to identify phenotypes underlying lodging tolerance, and superior breeding material will be isolated for future studies.

How can we evaluate lodging tolerance in teff?



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Teff (*Eragrostis tef*) is an underutilized cereal grown primarily by small-scale farmers in Ethiopia, where it thrives under arid conditions unsuitable for other grain crops. Incomplete selection of many traits we associate with domestication such as lodging, panicle architecture, and seed density contribute to the low yields we see in teff compared to other staple cereals. This year, a diverse panel of 265 teff wild relatives, landraces, and cultivars were planted at Michigan State University. A tiller imaging box was designed to maintain plant architecture from the field in a controlled lab environment. Panicle architecture and lodging score were collected in the field, and morphological features including panicle height, panicle width, spikelet density, panicle angle, and tiller angle will be calculated using PlantCV and ImageJ. Feature evaluation via Pearson's correlation and analysis of variance will be conducted for structural and morphological traits. With the development of this image analysis pipeline, teff lodging tolerance will be characterized, and superior breeding material will be isolated for future studies.