Project Abstract

Project Title:	High fidelity/temporal measurement of FHB for improved detection and monitoring	
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Fusarium head blight (FHB), a devastating disease of wheat and barley, can markedly reduce yield and grain quality. Current disease mitigation strategies including cultural practices, fungicide application, and planting resistant varieties rely on accurate and efficient phenotyping of FHB severity. Most USWBSI projects that include field FHB screening utilize manual phenotyping methods, which do not provide adequate resolution for detecting small severity differences, is laborious, low throughput, and have rater bias and inter-rater variation. Increasing the throughput of FHB field assessment is necessary for continued improvement of varieties, efficacy of management practices, understanding disease development, and monitoring of FHB.

Previously, we deployed a sophisticated phenotyping rover developed by Mineral, a project of X which is a division of Alphabet Inc, the parent company of Google, for high temporal and fidelity FHB detection in wheat and barley. In this proposal, our aim is to continue using the rover to develop FHB disease models that improve detection, monitoring, and forecasting of FHB severity. The specific objectives of this proposal are:

1) Collaborate with Mineral to deploy the phenotyping rover to replicate, refine, and validate previously developed machine learning models for FHB severity in imaged wheat/barley plots.
2) Directly assess FHB incidence and severity for thousands of breeding, pathology, and disease management plots multiple times a week using developed and tested FHB models.
3) Combine unprecedented high temporal and accurate FHB monitoring with environmental variables to understand FHB progression and improve forecast models.

We will directly output FHB disease ratings for thousands of plots for breeders, pathologists, and disease management collaborators at the University of Minnesota. The throughput of the pipeline to obtain FHB ratings multiple times a week for disease development modeling and assessment of different wheat and barley genotypes for resistance and monitoring in-field FHB development across hundreds of lines at high frequency is unprecedented but achievable. Combining high temporal FHB monitoring with environmental variables will improve modeling of disease progression and forecasting. Improving the timing and reliability of these models is important for USWBSI researchers and growers to weigh the risks, costs, and benefits of management decisions. We envision eliminating field FHB phenotyping limitations faced by many researchers and foresee working with other USWBSI researchers across research areas to increase the phenotyping capabilities of their research programs for increased gains in their programs.