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PROJECT 1 ABSTRACT
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Fusarium head blight (FHB), caused chiefly by the fungal pathogen *Fusarium graminearum*, is a widespread and devastating disease of small grain cereals. In addition to reducing both the yield and quality of the crop, *F. graminearum*, also produces mycotoxins such as deoxynivalenol (DON) that contaminate the grain, making it unsuitable for various end uses by industry. FHB is very difficult to manage completely. It is best to use an integrated strategy that includes cultural practices, the application of fungicides, and deployment of resistant varieties. With respect to the latter component, many cereal improvement programs across the country now dedicate a significant portion of their overall effort on breeding for resistance to FHB. Phenotyping breeding materials for resistance to FHB and the accumulation of DON in wheat and barley is time-consuming, labor-intensive, and expensive using conventional protocols. Non-contact sensing technology, mainly color imaging, is a promising technology for the high-throughput phenotyping (HTP) of plants. In addition, hyperspectral imaging (HSI) based field high-throughput phenotyping (FHTP), can provide insights about the internal processes of plants as well as tissue structure, leaf pigments, and water content. Thus, image analysis involving color imaging and hyperspectral imaging holds great promise for the accurate assessment of FHB on small grain cereals and FHTP can greatly reduce or eliminate nearly all of the problems associated with visual assessments. Moreover, these imaging technologies are amenable to automation and can handle many more samples at a much faster rate than is possible with visual assessments.

To increase the accuracy, efficiency, and cost-effectiveness of FHB phenotyping in the field, our specific objectives for this 2018/19 technology proposal are to:

1) develop an efficient pipeline for assessing FHB severity on wheat and barley in the field based on image processing;
2) compare the efficiency and cost-effectiveness of this FHTP system to conventional visual assessment protocols in the field;
3) investigate the feasibility of hyperspectral imaging for assessing DON content in wheat and barley grain under controlled laboratory conditions and
4) design and make a field pheno-cart platform for efficient data collection.

The knowledge and technology generated from this study will lead to greater efficiencies in the development of wheat and barley cultivars with FHB resistance and low DON accumulation. This, in turn, will enhance food safety and supply by reducing the impact of FHB for producers, processors, and consumers.