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Project Title: Breed Scab Resistant and Low DON Hard Winter Wheat Varieties for the Northern Plains

PROJECT 1 ABSTRACT

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Our goal is to develop hard winter wheat cultivars that are resistant to Fusarium head blight and that accumulate reduced levels of DON following infection. Specifically, we will address the following objectives and associated research activities:

1. *Increase efficiency of individual breeding programs by developing phenotypic and genomic selection models through coordinated efforts of pyramiding major and minor genes leading to the development and release FHB resistant varieties with lower levels of DON,*
2. *Characterize genotype x fungicide "specific" treatment responses for enhancing FHB resistance and the reduction of DON so information can be given to the MGMT group, and*
3. *Enhance communication and end-user education/outreach relating to resistant varieties and effective management practices.*

Our plan is to make crosses among lines with minor and major genes for FHB tolerance and low DON accumulation (identified in our and the regional FHB nurseries), and integrate improved FHB phenotyping by cooperating with Dr. Anne McKendry to evaluate the preliminary yield trial (270 new lines) with our current field and greenhouse based FHB screens to greatly improve and validate our selection protocols. We intend to expand our ability to screen/select lines through molecular markers, genome wide association studies, and genomic selection. Currently we genotype using genotyping-by-sequencing the preliminary observation trial (~1700 lines) and screen for FHB tolerance and DON in our advanced and elite trials (~460 lines). Using our molecular marker data and replicated multi-location screening nurseries, we hope to develop genomic selection models that will facilitate identifying FHB tolerance and low DON more efficiently in our germplasm. Little effort will be placed on the *in vitro* detached leaf assay as it may work for winter wheat, but did not work for spring wheat.

This information will be validated in our field and greenhouse FHB tests. Because we know genetic improvement may not be sufficient in severe FHB epidemics, we now screen our elite trial with and without fungicides so we can determine the effect of disease (including FHB) on grain yield and DON. This information will be shared with the MGMT Group as they optimize genotype by fungicide treatments to lessen DON in the supply chain. Finally all of this research will be communicated to our growers, millers, bakers, and consumers through our extension/outreach efforts.

This outreach activity will allow growers to choose the best cultivars and apply the best fungicides in the most efficacious manner to reduce DON