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PROJECT 3 ABSTRACT

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Genomic selection (GS) is a relatively new molecular breeding strategy that applies to traits that are controlled by many genes of small effect. FHB resistance in soft winter wheat is primarily controlled by genes of small effects. There are two basic ways to apply GS. The first to called rapid cycling where the duration of a breeding cycle can be reduced to two generations by selecting individual plants based solely on their values predicted by GS. Rapid cycling GS can increase the genetic gain per year compared to phenotypic selection. This team has completed three cycles of GS for FHB resistance.

The second general application of GS is using GS to enhance selection from field trials and increase population size. In this application of GS, all lines entering field trials are genotyped. The phenotypic and genotypic data is used to build GS models to predict the value of every line in every trial. This can have significant benefits, particularly in the early stages of selection (stage 1 & 2). Stage1 & 2 trials have 100s (even 1,000s) of lines and are conducted at few locations, years, and reps. It is crucial to screen many lines in stage 1 & 2 trials but the number of lines tested is limited by the inability to phenotype large populations accurately and by funding. Selection from stage 1 & 2 trials is often based on phenotypes with low heritability that have not been repeated and this results in low gain from these trials. With GS we could predict the value of every line in a stage 1 & 2 trial in a current trial from data current and past trials conducted over multiple years, location, and with more reps. As genotyping can be less expensive than phenotyping then it may be possible to eliminate the stage 1 trials altogether and select "stage 1" lines based solely on their predicted value. Layering GS predictions onto the field trials can increase selection accuracy, reduce or eliminate some phenotyping, and enhance return on the investment in phenotyping.

Our objectives are:

1. Assess the phenotypes of lines from the past three cycles of GS and assess the effectiveness of rapid cycling GS
2. Assess the efficacy of using GS to enhance selection of stage 1 & 2 lines