GENOMIC STRATEGIES TO ENHANCE WINTER FIELD SURVIVAL AND STABILIZED YIELD IN FALL SEEDED CEREALS.

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Summary

The three Prairie Provinces account for 84% of the arable land in Canada, where wheat is one of the major crops, with annual production of 25-30 million metric tons bringing about $5 billion in export revenue. Spring wheat is the dominant type grown on the Prairies (~ 93%), whereas fall-seeded winter wheat is relatively low (<5%). Fall seeded winter cereals provide soil cover in the autumn and nesting grounds for wild life in the early spring, supporting the natural Prairie habitat. Early emergence of fall seeded winter cereals efficiently use spring moisture, grow vigorously outcompeting weeds, mature earlier and yield 20 - 40% more in years with low winter kill. The major challenge for winter wheat production on the Prairies is the survival of the very harsh prairie winters with extreme low temperatures (= -30oC). Improving low temperature (LT) tolerance and winter field survival in fall-seeded crops is urgently needed for producers to include the environmentally friendly winter cereals in a sustainable crop production system. During fall, exposure to non-freezing low temperature, winter cereals cold acclimate to gain LT tolerance that is influenced by environmental factors (day length, light quality and temperature) and seedling growth characteristics (final leaf number, prostrate growth habit and anthocyanin production), that are controlled by several genes.

We recently identified several regions on the wheat and rye genomes associated with the developmental traits, LT tolerance and winter field survival. Combining the characterized wheat genomic regions resulted in 26 winter wheat recombinant inbred lines (RIL) with enhanced LT tolerance and improved winter field survival. The identified wheat RIL will be genotyped by sequencing and use the recently sequenced wheat and rye genomes to characterize candidate genes responsible for enhanced LT tolerance and winter field survival. The introgression of the characterized genes into elite winter wheat genotypes will accelerate the development of 'Climate Resilient Winter Wheat' for the benefit of Canadian producers to incorporate in the sustainable crop production portfolios, while opening up new international markets.