

Activity 10

Integrated Approaches to Develop Climate Resilient High Yielding Spring Wheat Cultivars for Western Canada



Lead Researcher

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This research activity, led by Harpinder Randhawa of Agriculture and Agri-Food Canada (AAFC) aims to develop new wheat varieties with high yield, enhanced agronomic performance, improved stress tolerance, and better end use quality.

The overarching goal of this research, which is a continuation of research conducted under the previous Canadian Agricultural Partnership, is to develop new wheat varieties that will have a lower environmental impact through decreased crop protection input use. This will improve net farm

income, slow the development of pest resistance to crop protection products and ultimately improve the production efficiency and return on investment for farmers.

AAFC has a well-established and successful Canadian Prairie Spring Red (CPSR) wheat breeding program which focuses on developing high yielding varieties with improved agronomic performance, tolerance to biotic and abiotic stress, and desired end-use quality. In 2023, approximately 80 per cent of CPSR wheat seeded in Canada was developed by AAFC with AAC Penhold holding the lead.

The current research activity builds onto this impressive program by integrating conventional and modern breeding approaches. High yielding early generation wheat varieties have been developed and are making their way through more testing in

KEY TAKEAWAYS

- **This research is meant to develop new wheat varieties that will have a lower environmental impact through decreased crop protection input use**
 - Farmers will get improved net farm income, slow the development of pest resistance to crop protection products, and improve the production efficiency and return on investment
- **New breeding material with improved agronomic performance and resistance to various biotic and abiotic stresses are in the pipeline**
- **Better understanding of wheat and wheat pest responses to a changed and changing climate**
- **High yielding early generation wheat varieties have been developed and are currently being tested**
- **There have been new genetic sources of improved tolerance to biotic stresses incorporated into existing wheat breeding lines**
- **Seed has been sent to New Zealand to be increased, tested for yield and other important agronomic traits**
- **Data summarization has been done for registration trials, with results submitted to the Prairie Recommending Committee for Wheat, Rye and Triticale**



Wheat breeding plots that are used for agronomic evaluation in 2024. PHOTO: HARPINDER RANDHAWA

their breeding pipeline and will ultimately contribute to the economic strength and sustainability of CPSR wheat production in Canada.

Canadian wheat production faces ongoing and emerging yield-limiting issues driven by climate change, presenting new challenges for farmers and plant breeders. For example, the emergence of new diseases (e.g., rust), disease adaptation to warmer temperatures resulting in greater disease severity and prevalence (e.g., yellow rust and Fusarium head blight), an increase in insect infestations (e.g., wheat midge and sawfly) or behaviour (e.g., increased insect feeding) and abiotic stresses (e.g., drought and heat).

Further to this, changing weather patterns like precipitation before farmers can harvest also affect wheat end use quality and grade because of pre-harvest sprouting. Developing wheat varieties that are better adapted to a changing climate is an important tool for Canadian farmers. This will help improve the environmental, agronomic, and economic sustainability on their farm.

This research leverages scientific expertise and innovative agricultural research stations across the Canadian Prairies. The main site for this research is at AAFC's Lethbridge Research and Development

Centre (RDC) in Alberta where Randhawa is based out of. This research is also being done at AAFC RDCs in Swift Current, SK. with Richard Cuthbert and Jatinder Sangha, Morden, MB., with Maria Antonia Henriquez and Brent McCallum, Brandon, MB., with Santosh Kumar, and Saskatoon, SK. with Tyler Wist, as well as at the Department of Plant Science at the University of Manitoba with Curt McCartney.

To date, this research has incorporated new genetic sources of improved tolerance to biotic stresses into existing wheat breeding lines. Early generations of wheat varieties were increased to be further tested across Canada and selection work in the nursery and field experiments for all breeding generations were completed. Agronomic data was collected in all field trials and selections were made in the early generation nurseries.

Seed samples from the field trials were analyzed in the laboratory for important seed quality metrics, and some of this material has been sent to a seed quality laboratory for further analysis. Seed was also sent to New Zealand to be increased, tested for yield and other important agronomic traits, and Randhawa made further selections there. Data summarization was completed for registration trials, and these were submitted to the Prairie Recommending Committee for Wheat, Rye and Triticale (PRCWRT).