## Activity 5

# The Role of Wheat Growth Habit in Reducing GHG emissions and Fostering Climate Resiliency Without Compromising Yield, Quality and 4R Principles

**Lead Researcher**
**Brian Beres, senior research scientist in agronomy with Agriculture and Agri-Food Canada at the Lethbridge Research and Development Centre**

This research activity led by Brian Beres, a senior research scientist with Agriculture and Agri-Food Canada (AAFC) in Lethbridge, AB., is investigating the responses of Canada Western Red Spring (CWRS) wheat to different nitrogen (N) management strategies and planting strategies across Western Canada.

Wheat production in Western Canada is dominated by spring wheat. Although spring wheat yield has increased gradually since the 1990s, a gap still exists between the maximum yield potential and on-farm yield. Preliminary research has shown that yields can be economically increased until approximately 80 per cent of the maximum yield potential, depending on the cropping system. Further to this, the inverse negative relationship between yield and grain protein concentration means that yield gap closure could compromise industry protein targets for CWRS.

As wheat management practices continue to intensify in order to increase yield and profitability, new fertilizer additives and products to enhance N fertilizer use efficiency (NUE), such as nitrification inhibitors, urease inhibitors, and controlled-release N products are becoming more attractive to farmers. To improve NUE, the International Plant Nutrition Institute (IPNI) proposed 4R Nutrient Stewardship. The core strategies of 4R Nutrient Stewardship are to use the Right Source at the

## KEY TAKEAWAYS

- **The research will determine if Nitrogen (N) stabilizer enhanced efficiency fertilizer (EEF) can decrease N losses to the environment that are often associated with fertilizer applications, and what, if any, responses are attributed to wheat growth habit**
- **New science-based knowledge will be generated on net GHG emissions (specifically nitrous oxide and carbon dioxide) related to the N fertilization in a CWRS wheat cropping system will be provided through this research**
- **A CWRS variety (AAC Brandon and AAC Westking), planted at a conventional calendar date and planted using an ultra-early seeding system, will be compared to conventionally planted Canada Western Red Winter (CWRW; AAC Wildfire)**
  - They will be monitored for crop and soil responses to the addition of urea plus a nitrogen stabilizer, eNtrench® or SuperU™, and a urea application on its own
- **An exploratory study was started in Lethbridge to develop and refine N labelling techniques to the EEF eNtrench® in April, 2024**
- **Winter wheat plots were established at all five sites in August and September, 2024**
  - Chambers that measure GHG were installed

Right Rate and to apply fertilizer at the Right Time and in the Right Place.

There have been few Western Canadian Prairie-wide studies that have combined enhanced efficiency fertilizer (EEF) sources with wheat growth habit or timing of seeding factors. Information remains lacking on how fertilizer best management practices impacts both crop N use and greenhouse gas (GHG) emissions. This information is crucial to sustain soil resources, provide a healthy economy and adapt to climate change. In addition to protecting the environment, the dilemma that remains for farmers and agronomists is to determine if EEF products increase yield and whether the added cost of using them provides a consistent economic return.

The primary objective of this research is to determine if N stabilizer EEFs can decrease N losses to the environment that are often associated with fertilizer applications, particularly with practices that increase N loss in spring wheat systems. The information generated from this research will assist farmers and agronomists to decide if N stabilizers are a good investment. This research will also provide new science-based knowledge on net greenhouse gas emissions (specifically nitrous oxide and carbon dioxide) related to the N fertilization in a CWRS wheat cropping system.

This research is designed to compare a CWRS variety (AAC Brandon and AAC Westking), planted at a conventional calendar date and planted using an ultra-early seeding system based on soil temperature triggers instead of a calendar date, which will be compared to conventionally planted Canada Western Red Winter (CWRW; AAC Wildfire). These wheat cropping systems will be monitored for crop and soil responses to the addition of urea plus a nitrogen stabilizer, eNtrench® or SuperU™, and a urea application on its own.

This research activity is being conducted at five locations across Western Canada including the Lethbridge, AB. with Ben Ellert, Vice Hao, Austin Huculak, Harwinder Sidhu; Lacombe, AB. with Hiroshi Kubota, Larry Michielsen, Liz Sroka and Guillermo Hernandez-Ramirez; Swift Current, SK. with Kui Liu, Mervin St. Luce and Lee Poppy; and Brandon, MB. with Ramona Mohr, Steve Crittenden, Aaron Glenn and Santosh Kumar; AAFC Research and Development Centres, and at the University of Manitoba's research farm in Carman, MB. with Mario Tenuta. These sites have diverse growing conditions that also represent the three major soil zones across the Prairies.

**An experimental plot for treatments used in the role of wheat growth habit in reducing GHG emissions and fostering climate resiliency without compromising yield, quality and 4R principles research activity.** PHOTO CREDIT: BRIAN BERES

In April, 2024 an exploratory study was initiated in Lethbridge to develop and refine N labelling techniques to the EEF eNtrench®. This will allow the researchers to trace N through the soil and plant to yield. In August and September winter wheat plots were established at all five sites and chambers that measure GHG were installed in the field experiments. Next, 'ultra-early' CWRS plots will be seeded at all five sites and GHG measuring chambers will be installed. The ultra-early planting date is determined when the top 5 cm of the soil is consistently above 0°C. In similar research projects this has been as early as February 9 in Lethbridge. Observations and notes on crop growth and development, soil nutrient levels, and GHG data will be collected and analyzed in laboratories. There are no results from this research to report yet, but the researchers are enthusiastic and confident these field experiments will provide valuable information to agronomists and farmers across Western Canada.