Activity 18

Developing Weed-suppressive No-till Wheat Systems with Reduced Glyphosate Use

Lead Researcher
Charles Geddes, research scientist with Agriculture and Agri-Food Canada at the Lethbridge Research and Development Centre

This research activity, led by Charles Geddes of Agriculture and Agri-Food Canada in Lethbridge, AB., is addressing the growing threat of herbicide-resistant weeds in wheat production. Herbicide-resistant weeds cost prairie farmers about $530 million each year in reduced crop yield, lower grain quality, and increased use of crop protection products. By developing more-sustainable and competitive wheat production systems this research will reduce the negative impact of weeds on wheat yield while also slowing the evolution and spread of herbicide-resistant weeds. This research will also help limit overuse of glyphosate, thereby sustaining its effectiveness in no-till agriculture systems.

Weeds are the greatest biotic threat to crop yields. Uncontrolled weeds in spring and winter wheat can contribute to yield loss of 19.5 per cent and 23.4 per cent, respectively. This is a potential loss of $700 million each year for Canadian wheat farmers. Herbicides have effectively controlled most weeds in wheat production systems for decades, however, the evolution and spread of herbicide-resistant weeds and public scrutiny of chemical use in agriculture threaten current approaches to weed control. In the Canadian Prairies, the proportion of fields where herbicide-resistant weeds have been found has increased since the 1990s, posing a great threat to the sustainability of wheat-based cropping systems. Observations by researchers suggest that some farmers are returning to more tillage-intensive systems to manage problematic herbicide-resistant weeds. However, the increased use of tillage for weed control can increase soil erosion, limit carbon sequestration, increase greenhouse gas emissions, and decrease moisture storage. While glyphosate essentially replaced tillage for pre-plant weed control in conservation tillage systems, public scrutiny of this active ingredient and the evolution of glyphosate-resistant weeds certainly threaten the longevity of no-till agriculture.

This research aims to improve our understanding of sustainable integrated weed management

KEY TAKEAWAYS

- **This research aims to improve our understanding of sustainable integrated weed management in wheat production through the strategic use of non-chemical cultural practices that can reduce herbicide use while also managing problematic weeds like kochia, wild oat, green foxtail, and wild buckwheat**
- **A comprehensive assessment of residual weed populations in 120 wheat fields is happening to identify the benefits and challenges of winter wheat, ultra-early seeded spring wheat, and typical spring wheat, for weed management in a real-world farming scenario**
- **There are two field experiments to assess how to make alternative wheat production systems more competitive with problematic weeds with limited glyphosate use but maintaining the benefits of conservation tillage**
  - The first experiment will test the combination of wheat production system herbicide layering and seeding rate on weed management and wheat productivity
  - The second experiment focuses on how alternative wheat production systems can be used to target the growth stage timing of kochia seed production, reducing kochia seedbank replenishment and overall populations

in wheat production through the strategic use of non-chemical cultural practices that can reduce herbicide use while also managing problematic weeds like kochia, wild oat, green foxtail, and wild buckwheat. Weed-suppressive no-till wheat systems will be designed by integrating alternative wheat seeding systems like winter wheat or ultra-early spring wheat with higher crop seeding rates and strategic use of residual herbicides. Winter wheat (seeded in the fall) and ultra-early seeded spring wheat (seeded in the winter/spring at zero to 2°C soil temperature) allow for early crop establishment making it more competitive with summer-annual weeds while also forgoing the spring pre-plant burndown herbicide application. Further to this, a comprehensive assessment of residual weed populations in 120 wheat fields in the Canadian Prairies will be done to identify the benefits and challenges of winter wheat, ultra-early seeded spring wheat, and typical spring wheat (seeded at eight to 10°C soil temperature) with respect to on-farm weed management. These assessments will identify how weed communities adapt to different wheat planting dates and the associated timing of weed control practices.

This research also includes two different field experiments that assess how to make alternative wheat production systems more competitive with problematic weeds like wild oat, green foxtail, kochia, and wild buckwheat with limited glyphosate use but maintaining the benefits of conservation tillage. The first experiment will be done near Lethbridge with Geddes and Brian Beres; and Lacombe, AB. with Breanne Tidemann and Hiroshi Kubota; Swift Current, SK. with Kui Liu; and Carman, MB. with Dilshan Benaragama with the University of Manitoba; for three years at each. This experiment will assess the combination of wheat production system (winter wheat versus ultra-early spring wheat versus typical spring wheat), herbicide layering (weedy control versus post-emergence herbicide versus layering residual pre-emergence with a post-emergence herbicide), and seeding rate (standard versus double) on weed management and wheat productivity.

The second experiment focuses on how alternative wheat production systems, like winter wheat or ultra-early spring wheat, can be used to target the growth stage timing of kochia seed production, thereby reducing kochia seedbank replenishment

Charles Geddes looking at wheat plots that have wild oat in them at one of the experiments for the Developing Weed-suppressive No-till Wheat Systems with Reduced Glyphosate Use research activity at Lethbridge, AB. PHOTO: CHARLES GEDDES

and reducing overall populations of this multiple herbicide-resistant weed. This experiment will be done at Lethbridge with Geddes and Carman with Benaragama, for two years.

Together this research will provide farmers with greater knowledge of how wheat production can be changed to make wheat more competitive with weeds, while also maintaining the benefits of conservation tillage systems in the Canadian Prairies.

In 2024, a farmer survey comparing uncontrolled weeds present in winter wheat (16 fields seeded in the fall) versus ultra-early spring wheat (19 fields seeded before April 15) and (a large number of) spring wheat fields planted at the typically planting date were done in Saskatchewan. The investigators also conducted small-plot experiments comparing the impact of these wheat seeding systems on the timing of kochia seed production at Lethbridge and Carman. Another small-plot experiment was conducted at Lethbridge, Lacombe, Swift Current and Carman to understand how integrating alternative wheat seeding systems, increased seeding rates, and a residual preemergence herbicide affect problematic weeds in no-till wheat production systems. Over the winter, they plan to process the grain and weed seed samples collected during the summer, collect and compile data sets, and conduct a preliminary analysis of their data from 2024.