WGRF

Advancing Agriculture through Research

RESEARCH REVIEW

Table of Contents

WGRF

Investing and impacting agriculture in Western Canada

$240M

INVESTED IN RESEARCH SINCE 1981

WGRF invests on average

$12M

in funding per year

$32M

to accelerate and expand crop research

$24M

invested in infrastructure, equipment and facilities to increase research capacity across Western Canada.

170-250

current projects

Search

15

crops

$8M

to establish Research Chairs at the Universities of Alberta, Saskatchewan and Manitoba

$2M

in Graduate Student Scholarships since 2011 to develop the next generation of researchers

For a complete list of recipients: wgrf.ca/special-initiatives/graduate-scholarship/

Messages from the Chair and Executive Director

Making a big impact on advancing Prairie agriculture

WGRF is a unique farmer-directed organization focused on funding research that will benefit farmers in Western Canada. As the largest producer-based funder of crop research in Canada, WGRF invests on average $12 million annually in projects across 15 different crops, supported through a dedicated team of staff, Board members and the research community.

Laura Reiter
WGRF Chair

An impressive collaboration

I have always been impressed by the research that happens here on the Prairies. As the new Chair of the WGRF Board, I am seeing firsthand the impressive scope of work that's funded through WGRF and the well-earned respect that exists for the organization across Western Canada.

Since WGRF began in 1981, the organization has delivered more than $240 million in field crop research. That level of investment requires a tremendous amount of collaboration at every level – around the boardroom table, among the research community and the WGRF staff overseeing every research project. That collaboration is key throughout the research process. Whether it's working with other commodity organizations, funding groups or researchers, WGRF plays a critical role to make it all happen. I have tremendous respect for the WGRF staff that manage and coordinate all the projects, including the relationships throughout the research community.

Throughout this edition of WGRF's Research Review, you'll see some of the farmer-funded, farmer-directed work that is happening across the Prairies. At the heart of each project is how it can make an impact on the farm, whether it's staying ahead of resistant weeds or getting the most from water and nutrients.

Over the past few months, I have visited a number of WGRF-funded research locations – including research plots and new facilities – I've seen the impact producer dollars are making in the research community across the Prairies. There is a visible excitement from researchers about what this funding helps them accomplish. Then there is the critical link in bringing their results back to the farm. The knowledge transfer part of research is so valuable, and technology is helping make that happen so much quicker.

As I look back on my first year as WGRF Chair, I'm really impressed at how the WGRF Board works together. There are a lot of experienced farmers from across Western Canada around the table, making for a very diverse group when it comes to ideas and issues. But when we talk about project funding, everyone's goal is the same – getting the best research done for Prairie farmers.

Our vision

Profitable and sustainable western Canadian grain farmers.

Our mission

Producers directing investments into crop research to benefit western Canadian grain farmers.

Wayne Thompson
WGRF Executive Director

The passionate pursuit of relevant research

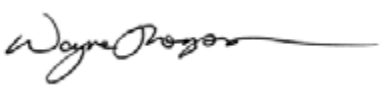
My first year as Executive Director at WGRF marks a return to the organization. Several years ago, I was a research program manager with WGRF. Coming back has been a fantastic experience as I reflect on what's changed and what has not. The importance of funding varietal development and agronomy research remains constant, as does WGRF's steadfast goal to fund research that benefits farmers. Some of the changes reflect the need to look at the response to weather variability and climate change, and how research can provide new technology and practices for on-farm use.

Over the past summer, I met with scientists and technicians working on research funded by WGRF and have been reminded about the passion and excitement they have for helping improve the profitability of farmers through their work. I am particularly proud of what WGRF is able to accomplish by supporting the great research community we have in Canada.

WGRF has a steady path for the research we support. We are committed to investing in research that helps farmers make decisions that will have a positive impact on their farm. We know farmers adopt technology very quickly when there is a fit for their operation, so we take the time to ensure the research we fund will deliver on-farm benefits.

Questions about good crop rotation and the influence of pest management remain top of mind for farmers and scientists. The development of new tools to manage inputs brings the need for more information on how to best use tools and technology on the farm. At the same time, WGRF continues to focus on the need for tools that farmers can use to accurately monitor and forecast crop pests to make timely management decisions. WGRF continues to support projects like the Prairie Pest Monitoring Network, Prairie Crop Disease Monitoring Network and extension activities including Field Heroes.

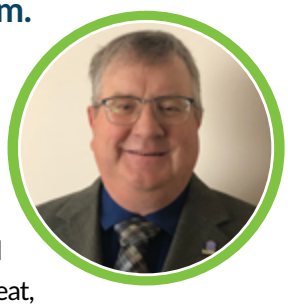
I am looking forward to seeing the completion of research projects over the next year. Thank you to the Board and staff for another successful year of working to fund research and infrastructure projects, and share results with farmers. Thank you also to the diverse and dynamic research community in Western Canada that helps WGRF deliver on its mission and vision.



View from the farm

WGRF Board directs relevant research

As a farmer-funded, farmer-directed organization, WGRF relies on the involvement, insight and ideas of farmers across Western Canada. Meet two of our Board members who help drive WGRF's grassroots approach to ensuring research projects provide relevance right back to the farm.



Greg Sundquist
Watrous, SK

Greg Sundquist and his wife Jo-anne seed about 2,000 acres – a combination of wheat, canola, flax and peas – plus about 800 acres of hay. They also have about 300 acres of their operation certified for organic production.

"The fact that WGRF directors are involved in directing research is really important for me and our farm," says Sundquist, who's been on the WGRF Board for about six years and sits on the Research Committee.

He's seen the impact of WGRF-funded research on his operation. "When I started farming, we used to think 24-30 bu./ac. was a really good yield on wheat," says Sundquist, who took over the family farm after a career with Farm Credit Canada. "Now, if I don't get 40-50 bu./ac. I'm a little disappointed. And that has to do with varietal development and agronomy that's based on research from organizations like WGRF."

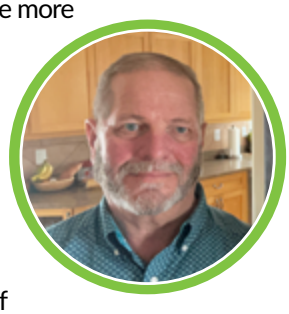
As a member of the WGRF Research Committee, Sundquist has the opportunity to see the research proposals and provide direction on projects that have also included supporting infrastructure investments for building and equipment.

> **"This is an organization that actually has an impact on your farm. WGRF is money well spent and research well worth doing."**

"It always impresses me that we have an equal number of farmers and researchers on the Research Committee," says Sundquist. "We look at research proposals from completely different points of view but usually come to the same conclusion, looking for the impact of the research on farm and the probability of success."

Sundquist says being on the WGRF Board has been a great learning experience – how the research process happens, the opportunity to interact with a lot of interesting, innovative farmers and be part of an organization that has an impact on the farm.

"I think the work that WGRF does is really important and I would love to see more producers get involved with the organization," says Sundquist.



Jeff Nielsen
Olds, AB

Jeff Nielsen farms 1,200 acres of wheat, barley and canola together with his husband Tim Hollman. They farm on land that's been in Jeff's family for close to 100 years.

"I have always had a strong interest in agricultural policy," says Nielsen, who's been on the WGRF Board about six years and sits on the Research Committee with Sundquist. "That's why I've been involved in many agricultural groups to ensure farmers have a strong voice."

Nielsen sees a big part of his role on the WGRF Board to support grassroots research that will help deliver positive changes on farm. "It's not like other boards I have been involved in. We are there to give input on key research projects for WGRF to fund," says Nielsen.

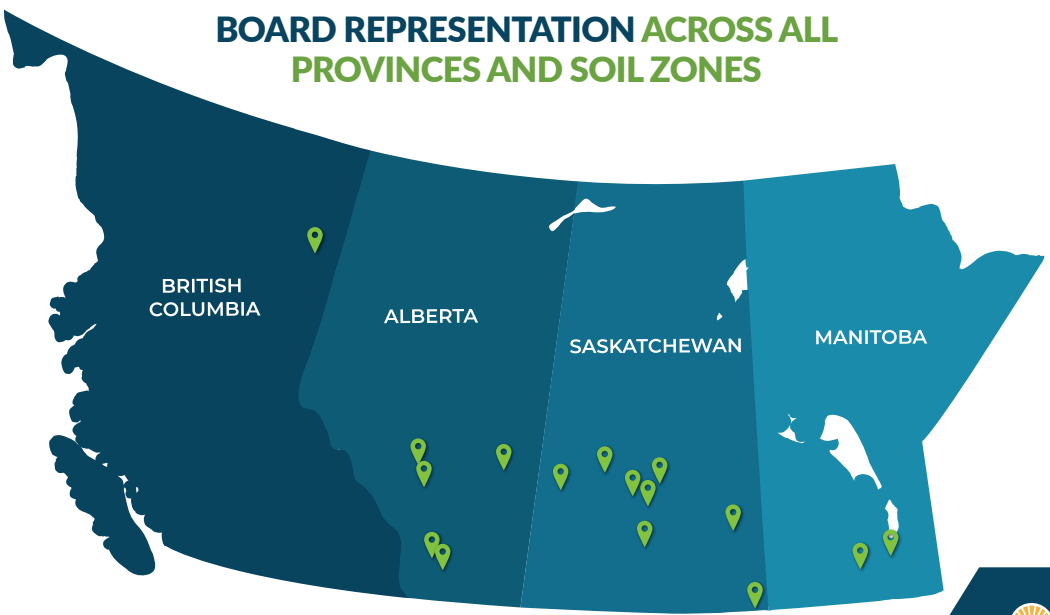
"We are trying to maximize the ability of researchers to develop products and crops that will bring better returns for producers, in a relatively short period of time," says Nielsen. "It's great to have WGRF fund research as well as access to the equipment researchers need, like smaller plot combines, to do the work."

> **We are trying to maximize the ability of researchers to develop products and crops that will bring better returns for producers.**

Nielsen also points to changes in technology, like gene editing, that bring the ability to make faster advances in crop research and the opportunity to implement new knowledge on farm. "Producers know it takes a while to breed a new variety but with new technology we can speed up the process," he says.

WGRF research also helps support Canada's reputation for top quality crop production. "We are keeping a focus on funding research that invests in Canadian crops," says Nielsen. "The money WGRF invests on behalf of farmers will help deliver a better bottom line return."

BOARD REPRESENTATION ACROSS ALL PROVINCES AND SOIL ZONES



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Malcolm Odermatt,
WGRF Research Committee Chair

Photo credit: Malcolm Odermatt

> The best part of this process is that WGRF gives producers a voice about the agricultural research that's funded.

A closer look

The WGRF project funding process

Over more than four decades, WGRF has invested $240 million in research to advance crop production in Western Canada. The process and people involved in reviewing each project proposal ensures WGRF-funded research checks the best boxes for having an actionable, on-farm impact.

Malcolm Odermatt has chaired WGRF's Research Committee – the group tasked with evaluating research proposals – for the past three years. He's a third-generation farmer, growing wheat, barley, canola, oats and peas with his father Martin in northwest BC.

"The best part of WGRF's process is that it gives producers a voice about the agricultural research that's funded," says Odermatt. "Canadian farmers continue to strive to become more efficient and sustainable, while facing numerous challenges, and research is a way we can help make that happen."

Making an impact

WGRF's Research Committee includes farmers and outside experts, a unique mix that's designed to work collaboratively to ensure the projects that will have the greatest overall impact on grain and oilseed producers in Western Canada are funded.

Here's how the process happens.

1. **Letters of intent.** Researchers across Canada are invited to submit letters of intent (LOI) through provincial calls in British Columbia, Alberta, Saskatchewan and Manitoba with an overview of the research they'd like to pursue. At this stage, the project includes objectives, budget and expected benefit to the industry. WGRF's Research Committee reviews these LOIs to see if the research aligns with WGRF's research priorities.
2. **Full research proposals.** LOIs that are approved go to the next stage and researchers provide a much more detailed proposal.
3. **Project scoring.** This is the big part of WGRF's Research Committee work each year, reviewing and scoring each project proposal on scientific merit, potential impact and likelihood of success.
4. **Presentation and approval.** After the Research Committee has scored all projects, the recommended list for funding is presented to the full WGRF Board for review and final approval.

WGRF also works with other organizations to fund research to ensure we are supporting beneficial research and not duplicating efforts .

A shared passion

As a young farmer, Odermatt knows the importance and value of the range of research WGRF funds that will have an impact on how he farms. And as the Chair of the Research Committee, he sees the passion for agriculture around the Board table.

"WGRF is a driving force for crop research in Western Canada," he says. "And we have a Board that includes farmers from BC to Manitoba to give us a wide background and perspective on crops, climate and soil types."

He credits the Research Committee for the important investment of time and energy required each year to review proposals. "We encourage discussion at the Research Committee meetings to hear different insights that everyone brings to the table," says Odermatt. "We come to consensus as a group on each project before putting projects forward for funding – this is sometimes a challenge but also what makes the process so strong."

Odermatt is also quick to recognize the critical role that WGRF Research Program Managers and staff play in the funding process – doing much of the heavy lifting required to fully evaluate, budget and follow each funded project.

At the end of the day, he's really excited about the vantage point he has about emerging research in Canada. "I get to connect with a lot of producers who are interested in research and sustainability, and I have some great insight into agricultural research in Canada and that feeds my curiosity."

The results of WGRF research funding

$240M

INVESTED IN RESEARCH SINCE 1981

More than **700** WGRF-funded research projects (searchable at **wgrf.ca**)

Search

Established funding priorities that have included consultation with more than

300 farmers, agronomists, scientists and WGRF members

WGRF invests in both **single crop** and **cross-cutting crop** research in the priority areas of variety development and production.

Projects cover 15 different field crops

Prairie power

Research Chairs advance production practices and knowledge

WGRF has committed more than $8 million to help establish Research Chairs in Western Canada. Here are highlights on the research they are focused on.

Mario Tenuta, PhD
Industrial Research Chair
in 4R Nutrient Stewardship
University of Manitoba

Mario Tenuta loves to tell the story of optimism about the use and management of nitrogen fertilizer by farmers in Western Canada. He turned that passion into a unique research position that's funded through the Canadian Fertilizer Institute, WGRF, NSERC and the University of Manitoba. "We know that by changing and adapting our practices to reduce greenhouse gas emissions, we can keep productivity high and reduce nitrogen losses," says Tenuta.

He's particularly interested in how the 4Rs – using fertilizer at the right source, rate, time and placement – could drive sustainable crop production by reducing nitrous oxide (N_20) emissions without compromising crop yield and productivity. "It's a very fortunate time for us to be doing this work as there is a lot of interest from industry, farmers and government," he says.

Tenuta and his team have a big list of objectives for this five-year project that wraps up in 2025. All the projects fit into three areas:

1. Filling gaps in the information and practices around the 4Rs
2. Building tools to estimate N_20 reductions that are possible using 4Rs
3. Forecasting what can be achieved using 4Rs to reduce N_20 emissions

Another part of Tenuta's role – and one he clearly enjoys – is sharing research information and making it relatable to whoever he is talking to. "I love helping farmers wade through fertilizer options and use our field results to show them where and when these products can be used, and the results they can expect," says Tenuta. "I want our research to show very positive activities that farmers can do to reduce N_20 emissions that don't necessitate a drastic cut in nitrogen fertilizer use."

Maryse Bourgault, PhD
WGRF Research Chair
in Integrated Agronomy
University of Saskatchewan

Maryse Bourgault began her new seven-year position at the start of the pandemic which meant she couldn't start where she'd hoped to – talking to farmers about what integrated agronomy means to them.

"It's an interesting term and I find it's sometimes easier to talk about systems," says Bourgault. "I am looking at approaches for integrating different crops that will improve resilience, sustainability and profitability for grain production in Western Canada." Those approaches include winter cropping, livestock grazing, intercropping and cover crops.

"We've had some success with winter camelina," says Bourgault. "We're planting it in the fall at different seeding dates and plant densities to see if it helps plants withstand some winter kill and have a good stand in the spring."

On the livestock grazing front, Bourgault is incorporating annual and perennial forages to determine how intensely livestock can be part of this system. For intercropping options, Bourgault has found intercropping peas and canola is very productive and makes it possible to use less nitrogen fertilizer and increase yields in both crops, compared to growing them separately.

Maryse Bourgault adjusting the rate on custom-made deep fertilizer bander.

Photo credit: Mark Halliday

She's also working with researchers at the University of Manitoba and University of Alberta to look at cover crops as an approach to provide erosion control and generally improve soil health.

With a few years of results in hand, Bourgault isn't ready to give on-farm recommendations about integrated agronomy. "I'm still at the point where I want to hear feedback from farmers about the approaches we're working on," she says. "Farmers have great innovative ideas and can be more nimble with on-farm changes than researchers."

Linda Gorim, PhD
WGRF Research Chair in Cropping Systems
University of Alberta

Linda Gorim knows there's no substitute for firsthand experience, from the new undergraduate courses she developed to the grassroots research she conducts. "I look at this position as being WGRF's ears on the ground to address the need for high quality personnel for the industry, and find out what farmers are struggling with to guide my research projects."

One of the first tasks in her 10-year position was developing two new agronomy courses to boost content and knowledge at the university. "I am all about experiential learning," says Gorim. "And what I saw was that students were learning agronomy in lectures, books and video, but graduating without experiencing agronomy."

The first course is field-trip based where students experience agronomy around the province, touring university test plots, meeting with farmers and trying their hand at identifying real-time cropping issues in the field.

The second course takes a collaborative, work-term approach so students experience much more than agronomy as they prepare for a career in agriculture. Students spend a little time in class then intern with agricultural companies for the bulk of the semester. "We want to give students the opportunity to practice all these skills to give them a healthy start when they enter the workforce," she says.

Gorim takes a similar approach with her research. "All my research projects are based on a need I have heard directly from farmers – relevant issues that farmers and the industry are facing." Her research projects fall under two main categories – agronomic research and sustainable agriculture research.

"What really drives me is finding solutions for producers and building trust," says Gorim.

Linda Gorim in field with her research crew seeding cover crops into canola and wheat.

Photo credit: Dr. Linda Gorim

Kaylie Krys operating a drone at the University of Saskatchewan demonstration day

Photo credit: Kaylie Krys.

Up in the air

Drones show promise for timely canola scouting

On a weekend course as an undergrad, Kaylie Krys got her first taste of the opportunities for drones in digital agriculture with scalable options to fit the size of farm. A few years later, she put those ideas into action as a graduate student at the University of Saskatchewan using unoccupied aerial vehicles (UAV) or drones to provide early-season plant counts for canola farmers.

Kaylie Krys
University of Saskatchewan

"My project was designed to see how using drones could assist agronomists by generating accurate plant counts to help with timely in-season decisions," says Krys, who is finishing up her Masters' degree that was partially funded by WGRF as part of its Graduate Student Scholarship program.

Accurate plant counts are generally done manually by agronomists to identify areas with emergence variability – information that could trigger replanting and/or influence variability maps and other activities throughout the growing season.

Assisting with field level activity

A key component of Krys' research used drones to generate plant counts in canola fields from the cotyledon to two leaf stage, and provide the information to agronomists and farmers in a timely way so they could make decisions based on the results, if needed.

"In the world of precision agriculture, there is a lot of data collected throughout the growing season, but the emergence

stage was a bit of a gap and there wasn't much information being applied digitally to help farmers, so that's where this project fills in a piece of the puzzle with precision ag," says Krys.

Krys recruited five farmers across central Saskatchewan who provided approximately 45 canola fields over two years where she collected point-sample drone images. These images were used to assemble plant counts and ground cover data, and calculate approximate weed density of the field.

"We used plant counts as a starting point to see what a drone could do in the field and if we could follow a similar scouting pattern to what agronomists would do on foot to be able to replicate their survey activities," says Krys.

The drone-generated plant counts were fed into a computer program – developed in collaboration with a computer science Masters' student at University of Saskatchewan – to provide near real-time information for farmers and agronomists.

"We are trying to make plant counts more timely and more accurate, and helping with areas of the field that might be harder to reach or give a more in depth look at certain parts of the field."

Farm scale feasibility

Another part of the project was to conduct drone-based research in a more accessible way. "A lot of drone research is done with expensive, high-tech equipment and cameras, but we were able to use a smaller, more widely available drone that costs about $2,500, including the camera," she says.

Farmers often get a good look at their fields later in the season on the sprayer or swather, but drone technology offers the chance to get into the field to see what's going on at a time that could influence field activities throughout the growing season.

Kaylie Krys used a drone to generate canola plant counts as part of her Masters' degree at the University of Saskatchewan.

Photo credit: Kaylie Krys

"We really want to provide a tool to assist with an existing field practice that can be more efficient and more accurate," says Krys. In addition to plant counts, they also looked at ground cover to get a picture of weed density in the field that could help with spray timing.

While the weather can be a limiting factor for drones, it is also a benefit. You can't use a drone in high winds, but you could walk the field. And when the fields are too wet to walk, you can send out a drone without damaging the crop.

Promising applicability

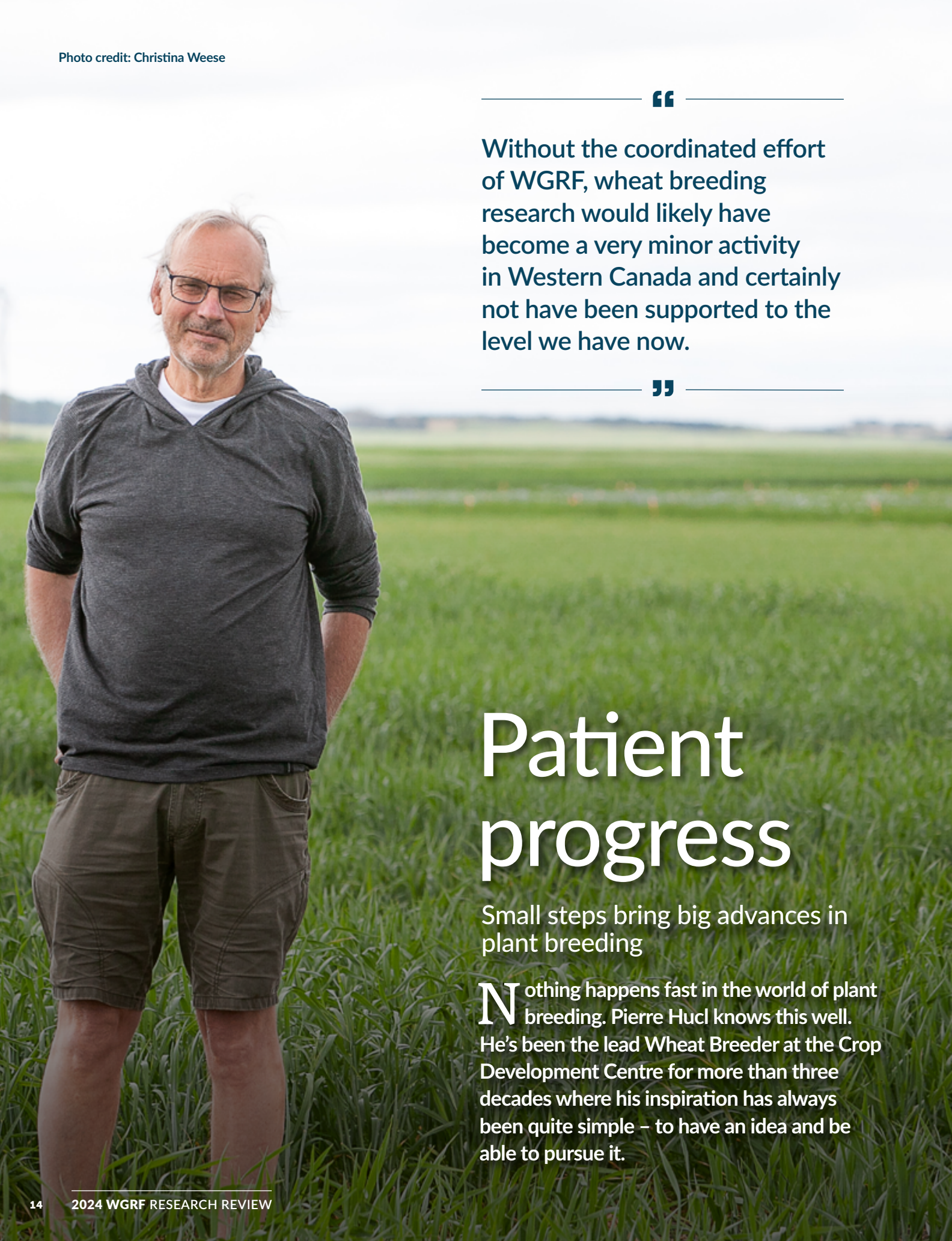
Krys is finalizing her project and her thesis, but says there are some very promising, preliminary results about the possibilities with drones to provide a new tool that delivers timely and relevant information at a farm level for a small investment.

"By using drones, we found current practices for the number of manual collections typically done (25 samples per quarter section) may not be enough sampling to accurately represent a field," says Krys. "We're hoping the use of drones can increase the sample size to provide a better representation of a field in the spring and provide better recommendations for canola planting densities."

She stresses that drones can assist, not replace, agronomists with field counts and scouting. The same methods Krys used with drones could be used to assess herbicide, disease or insect damage.

WGRF invests $330,000 annually in graduate scholarships, administered by the Universities of Alberta, British Columbia, Lethbridge, Manitoba and Saskatchewan to attract and support the best minds in crop research to generate improved technology and productivity for farmers in Western Canada.

Photo credit: Christina Weese



> Without the coordinated effort of WGRF, wheat breeding research would likely have become a very minor activity in Western Canada and certainly not have been supported to the level we have now.

Patient progress

Small steps bring big advances in plant breeding

Nothing happens fast in the world of plant breeding. Pierre Hucl knows this well. He's been the lead Wheat Breeder at the Crop Development Centre for more than three decades where his inspiration has always been quite simple – to have an idea and be able to pursue it.

"With biology, there are no wonder solutions," explains Hucl, Professor and Plant Breeder in the Department of Plant Sciences and Crop Development Centre (CDC) in the College of Agriculture and Bioresources at the University of Saskatchewan. "You make progress but it's in baby steps. There's no quick easy route, but you work at something long enough to hopefully see ideas get to market."

Hucl now has the vantage point of looking back on the work he's done with the satisfaction that it has made a difference for farmers in Western Canada. "I'm always hoping that the work I do will lead to something producers can use."

Producer funded, practical approach

The applied approach has worked well for Hucl. When he first started at the CDC in 1990, he looked for areas of research emphasis that were different from other wheat breeding programs. Judging by the significant increases in wheat yields in Western Canada over the past years – and the more than 40 new crop varieties he's developed – Hucl's approach has made tremendous, lasting contributions to western Canadian agriculture.

He credits the strength of the breeding research community to the long-standing support of WGRF, a group he's been involved with throughout his career.

Hucl has deep roots with WGRF. He was part of the initial discussions around using check-offs to invest in research, has been the recipient of funding that's been very important to the breeding program at CDC, and he was on the WGRF Wheat Technical Advisory Committee for a number of years.

"The research check-off from producer groups has been critical to fund practical research and create a critical mass for this type of research," says Hucl. "Without the coordinated effort of WGRF, wheat breeding research would likely have become a very minor activity in Western Canada and certainly not have been supported to the level we have now."

Wheat and more

Hucl spent the first 10 years at CDC focused on leaf spotting fungal diseases in wheat. Then when the west moved into a drought cycle, these diseases that preferred cool, wet conditions were no longer a big issue. Research attention then turned to Fusarium head blight that was becoming a big problem in Western Canada.

The biggest changes Hucl has seen in wheat breeding have happened in the last decade. "Prior to the mid 1980s, the approach to wheat breeding was to not mess with the variety quality which left a narrow window for improvements as a breeder," he says. When regulations were loosened in 2007, it opened new opportunities. "Those changes gave us the ability to change the genetic background, that was an important time to make progress."

Hucl has taken a special interest throughout his career in canaryseed – looking for new opportunities for the small, premium crop that's still mostly used in bird seed blends. "There was virtually no research on canaryseed when I started at CDC so whatever questions we had about the crop we had to answer ourselves." A lot of ground has been covered on the crop, studying disease resistance, herbicide tolerance, grain quality and possibilities for human consumption.

The pace of technology

As Hucl steps back a little – he started working part time in July 2023 – he reflects on the opportunities now at the hands of the next generation of wheat breeders. "We've had changes in the kinds of problems facing the industry – Fusarium, wheat midge, climate change and new unpredictable issues – but the tools that plant breeders have at their disposal are very different from when I started."

Automation and prediction tools mean breeders can make faster progress. "There is a limited time every year to analyze and test all the material we collected during the growing season so we have results in time for planting the next season. The faster you can do that, the more material you can process in a shorter period of time," he says.

Photo credit: Maggie MacDonald

By wing or by foot

Researchers measure how pea leaf weevils go the distance

Field peas and faba beans around the world are vulnerable to the pea leaf weevil, an invasive pest that can cause economic damage by feeding on the root nodules and leaves of plants. Weevils have expanded their range across much of Alberta in recent years, causing significant economic risk to crops.

Now, efforts are underway to develop a provincewide monitoring system that would allow producers to make more informed decisions about when to plant chemically-treated seed. But to monitor effectively, researchers need a crucial piece of the pea leaf weevil's story: just how far do they travel?

Drs. Maya Evenden and Asha Wijerathna, of the University of Alberta's College of Natural and Applied Sciences, are working to determine flight capacity and dispersal ability of the pea leaf weevil. With this information, they hope to be able to more accurately place field traps to gain a clearer picture of pest populations at key points in the growing season.

Temperature and conditions

Pea leaf weevils are known to travel by walking and flying, but how they move – and how far – depends on the season and environmental conditions.

"We know that weevils that emerge from overwintering sites in the spring move longer distances at a higher speed than weevils that leave crops in the fall," says Wijerathna. "We have been trying for a long time to determine how far they travel."

Weevils typically begin feeding when springtime temperatures reach 12° to 13°C. They can feed on any legume plant before entering field pea and faba bean fields to reproduce. They feed more actively when temperatures reach 20°C. Around 2010, populations in Alberta were mainly found in the southern part of the province.

"It seemed like once they jumped over Highway 1, they were off to the races," says Evenden. "Adult weevils can feed on any wild or cultivated legume plant, but they have to find field peas and faba beans to reproduce."

Feeding rate differs

Adult weevils and larvae are difficult to spot with the naked eye, but damage from adults is easily identified by the telltale notches they leave behind on foliage. Larvae cause the more significant damage because they feed on the root nodules that contain nitrogen-fixing bacteria. Larval feeding damage can result in poor growth, reduced seed yield and damage to roots.

> **Trapping in the spring should be done over a broad area because we know they are feeding while they overwinter, and they fly some distance.**

Spring monitoring over a broad area

Wijerathna says understanding springtime activity is a crucial piece of the monitoring puzzle. To study dispersal capacity, the researchers are using both lab and field-based approaches.

"Trapping in the spring should be done over a broad area because we know they are feeding while they overwinter, and they fly some distance," says Wijerathna. "In the spring, weevils are reproductively active. In the fall they are moving away from the crop to find any legume for their overwintering habitat, and they walk shorter distances more slowly."

In the lab, the researchers conducted walking bioassays, tests to track weevil movement using a video tracking software that allowed them to measure walking parameters such as distance and speed.

Legume plants affect weevil walking capacity, but these effects varied with the dispersal period, Wijerathna notes.

Next steps

Evenden and Wijerathna will continue to work with data from their lab assays and field studies to gain a better understanding of dispersal capacity for this invasive species.

"A measure of dispersal capacity is the missing link that will allow us to develop a provincewide pheromone-based monitoring system for pea leaf weevil, because it will help us accurately predict the abundance of this invasive species," says Wijerathna. "With that information we can give growers a tool to make year-to-year decisions about chemically-treated seed."

In addition to WGRF, this project was co-funded by the Alberta Pulse Growers Commission and Results Driven Agriculture Research.

Dr. Meghan Vankosky monitors a canola field as part of the Prairie Pest Monitoring Network.

Photo credit: Meghan Vankosky

Thinking in systems

Integrated Crop Agronomy Cluster (ICAC) delivers practical insights through unique multi-crop approach

From 2018 to 2023, the Integrated Crop Agronomy Cluster (ICAC) conducted a broad range of research projects, tackling timely agronomic issues from a whole-farm, multi-crop angle. The insights gained, and tools and resources developed as a result, are providing farmers in Western Canada with ideas and options that are designed to make an on-farm difference.

ICAC took a unique approach to crop research, looking at agronomic issues that cut across multiple crops for a more whole-farm perspective. Projects covered soil health, herbicide resistance, climate change adaptations, crop insect and disease monitoring, managing spray drift, a risk model for Fusarium head blight, as well as developing productive and resilient crop rotations. Here are highlights from a few of the ICAC projects.

Building resilient rotations

Farming in four-year crop rotation cycles is an effective way to balance the varied needs of the crop and soil, manage pest pressures and maintain vital biodiversity. Resilient Rotations – a group of ICAC researchers across Western Canada – is working on ways to bring biodiversity back into crop rotations.

They evaluated six different crop rotations across the Prairies measuring drawbacks and benefits, to help farmers make decisions for their operations that will create more productive, sustainable and resilient cropping systems.

"There is no single cropping system that is suitable for a large region like Western Canada," says Dr. Kui Liu, Research Scientist with Agriculture and Agri-Food Canada at the Swift Current Research and Development Centre, SK who led the project team. "We need to think about cropping systems that are designed for a specific region or area that is based on local climate and soil conditions."

A series of factsheets with regional results on how the crop rotations performed have been produced and are available at **wgrf.ca/resilient-rotations-factsheet**.

New tools and resources

With a focus on providing timely, relevant information, many of the cluster projects produced new tools and resources for crop farmers.

Prairiepest.ca

More than 20 years of Prairie-wide insect surveillance powers the Prairie Pest Monitoring Network (PPMN) – a collective hub that tracks the population and distribution of seven key insect pests across Manitoba, Saskatchewan, Alberta and the Peace River region in British Columbia.

"Our overall goal with the network is to provide as much timely information as we can about insects to the people who need it to make insect management decisions," says Dr. Meghan Vankosky, PPMN Co-Chair and Field Crop Entomologist with Agriculture and Agri-Food Canada at the Saskatoon Research and Development Centre.

For more information, or to subscribe to the PPMN weekly updates, visit **prairiepest.ca.**

Prairie Crop Disease Monitoring Network

The Prairie Crop Disease Monitoring Network (PCDMN) was established to foster a more cohesive, collaborative approach to field crop disease monitoring for Alberta, Saskatchewan and Manitoba, by providing timely, coordinated information for producers.

"The Prairie region has a long history of working together on insect monitoring in the Prairie Pest Management Network, so we had an excellent example on which we could base our network," says Kelly Turkington, Research Scientist at Agriculture and Agri-Food Canada, based at the Lacombe Research and Development Centre, AB.

The network uses a blog, social media and factsheets to share information, and also launched the PCDMN quick disease reporter tool, accessed as an app or website form. Sign up for free email updates at prairiecropdisease.blogspot.com and follow on X @pcdmn.

Finding new FHB solutions

Fusarium head blight (FHB) continues to rank as one of the most severe crop diseases in Canada. ICAC researchers looked at ways for producers to manage FHB including building regional models to better predict the risk.

"We set out to create a homegrown, Prairie-wide risk assessment tool that would predict when a severe FHB outbreak is expected or when it is not," says Paul Bullock, an Agrometeorologist at the University of Manitoba. "There are benefits for producers both ways as they make agronomic and economic decisions for their farm."

The new FHB risk mapping tool will allow users to choose the crop, specific variety and FHB risk to be measured, to generate a map with colour-coded risk levels from very high to low, showing an entire region or zooming in to a specific area.

Read the full ICAC Summary Report at **wgrf.ca/research-programming/integrated-crop-agronomy-cluster.**

Paul Bullock checks portable weather stations that collects local data to power FHB risk models.

Photo credit: Paul Bullock

Integrated Crop Agronomy Cluster

A whole-farm approach to agronomic research

Canadian farmers face agronomic challenges that cut across multiple crops. The Integrated Crop Agronomy Cluster addresses gaps in multi-crop and systems approaches to agronomic research.

$9M
invested from 2018-2023

$6.3M
from Agriculture and Agri-Food Canada, under the Canadian Agricultural Partnership

$1.1M
from industry partners

$1.6M
from Western Grains Research Foundation

Industry funders include: Alberta Pulse Growers, Alberta Wheat Commission, Brewing and Malting Barley Research Institute, Manitoba Canola Growers Association, Manitoba Crop Alliance, Manitoba Pulse and Soybean Growers, Prairie Oat Growers Association, Saskatchewan Canola Development Commission, Saskatchewan Pulse Growers, and Saskatchewan Wheat Development Commission.

A sharper eye on traits

New technology to boost crop breeding programs

Researchers at Agriculture and Agri-Food Canada (AAFC) are evaluating a promising new technology designed to help accelerate advances in crop breeding in Western Canada, provide new, more resilient varieties for producers and drive continued competitiveness for the sector.

The three-year pilot project is using made-in-Canada autonomous robots to increase the efficiency for identifying desirable traits in plot trials that bring new crop varieties to market. The University of Saskatchewan Field Phenotyping System (UFPS) or "UFPS carts" are part of a bigger AAFC initiative looking at digital transformation in agriculture including the way big data is collected, shared and utilized in crop research.

The UFPS cart is self-propelled, ground-based equipment that contains a number of advanced sensors or cameras to collect and record crop information as the unit rolls over a field. The technology contained within the unit's hardware provides a robust new way to identify desirable crop traits – specifically phenotypic or observable traits – that is more precise and cost effective.

AAFC, together with funding from WGRF, purchased six UFPS carts from the University of Saskatchewan where the equipment was first developed in 2016. The units are in place at AAFC research farm locations across the Prairies, and one in Ottawa, as part of a collaborative project to develop best practices for the technology moving forward.

"Without these carts, it is more labour intensive and subjective to collect this type of data on plant characteristics with the naked eye, a notebook and a ruler," explains François Eudes, Director of Research, Development and Technology for AAFC, based in Lethbridge. "There is also the improved accuracy of sensors gathering unbiased imaging and data."

Calibrating for consistency

Using six UFPS carts to gather the same information at various locations will help researchers standardize the technology and establish calibration parameters that will transform the images the sensor collects into extractable, measurable phenotypic insights needed to evaluate crop varieties.

"We're using the carts to compare spring wheat cultivar trials at six diverse locations for this pilot project, gathering information on different phenotypic traits throughout the growing season," says Keshav Singh, AAFC Research Scientist in Lethbridge focused on remote sensing, digital ag and phenomics, and the lead on the three-year project. "The UFPS cart-based smart sensors will be helpful in gathering a useful dataset to predict physical and physiological traits to evaluate cultivars," says Singh.

The short-term goals of the pilot project are two fold. Gather information and experience with the units across all locations to quantify basic agronomic traits like emergence, plant density, plant height, lodging, crop cover and canopy structure. This will "calibrate" the units to ensure they are performing consistently regardless of location or local environmental conditions. The second part is the tougher task – to develop standardized data management processes and best practices to streamline how data is stored and processed.

Best data practices

Eudes knows that collecting the images is the easy part. "The big challenge is in the volume of data collected," he says. That's where the data management piece of the project comes into

> We're using the UFPS carts to compare spring wheat cultivar trials at six diverse locations, gathering information on different phenotypic traits throughout the growing season.

Keshav Singh (centre with safety vest) and Francois Eudes (second from right) are leading AAFC's UFPS cart pilot project to calibrate and standardize data management and image analysis of the new crop breeding technology tool.

Photo credit: Keshav Singh

play – and how to manage the large volumes of data generated by the images captured by the UFPS cart, and how to process that into relatable, useable measures.

Standardizing data management as part of this project includes establishing best practices for how data is stored, shared, processed and analyzed. "That's another unique part of this project, to establish FAIR principles for the use of the information collected – findable, accessible, interpretable and reusable," explains Singh.

That's another reason for the six locations. "We will be able to standardize this work across all locations and research teams to help AAFC establish a good network of experts in plant phenotyping," says Eudes. "We want to be part of a larger team working on all aspects of data management that will help contribute to standardization across the industry."

> We will be able to standardize this work across all locations and research teams to help AAFC establish a good network of experts in phenotyping.

Beyond the pilot

The long goal for this new technology and its role in phenomics is to become a more precise, cost-effective way to collect data from research trials in AAFC crop breeding programs. "The work we are doing now to standardize the way information is collected and processed will mean that in the future, plant breeders could use the UFPS cart to drive over plots and instantly get data on specific phenotypic traits," says Eudes. "The algorithms we're developing will streamline the process for extracting insights from data collected with the phenocart," says Eudes.

The possibilities with the UFPS cart may rest mostly at the crop breeding level for now, but the ability to predict an aspect of crop performance or complex traits like grain yield or biomass, using a cart, are not out of the realm of future commercial applications for the new technology tool.

No quick fix

The possibilities for nitrogen fixation in non-legume crops

There's little debate that lowering the amount of nitrogen fertilizer in crop production is one strategy for reducing greenhouse gas emissions. The how is another story.

Diane Knight
University of Saskatchewan

University of Saskatchewan Soil Scientist Diane Knight has spent her career working on nitrogen fixation. Years ago, she heard a presentation by an Argentinian researcher about using "free-living" commercial inoculants in corn and soybeans to help the plants fix nitrogen. She was intrigued by the possibility and tucked the idea away.

Fast forward throughout her career to one of the last projects she completed before retiring in 2023. Knight, and colleague Richard Farrell, recently completed a three-year project to evaluate the ability of a new biological inoculant to fix nitrogen in non-legume crops in Western Canada. They worked with a UK manufacturer of a microbial inoculant (Envita™) that contains a free-living, nitrogen-fixing bacteria (*Gluconoacetobacter diazotophicus*), testing it on canola, wheat and soybeans.

"This was by far one of the most interesting and challenging projects to do," says Knight.

A different type of inoculant

Inoculants routinely used in Western Canada in soybeans, peas and lentil crops contain rhizobia bacteria that the plant needs to use to make nodules for fixing nitrogen. For legumes that are already equipped to fix their own nitrogen, the inoculants help them do it better and/or fix more nitrogen. These are symbiotic bacteria because they need the plant to work.

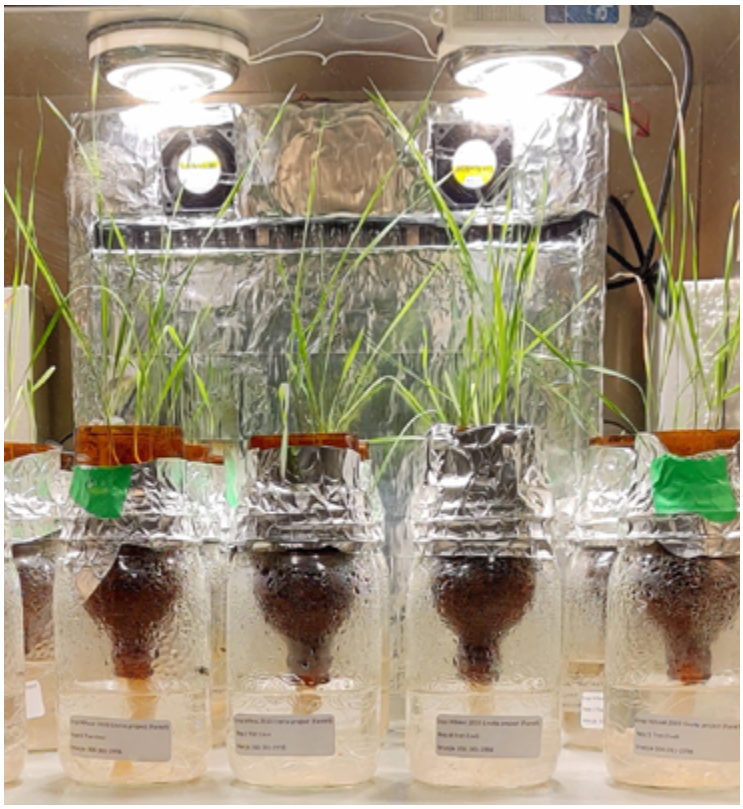
The free-living inoculant Knight and her team worked with is different. It contains bacteria that are already in the soil and can fix nitrogen, but not naturally present in high enough quantities to provide a benefit to the growing plant. The bacteria don't depend on the plant/crop to be able to fix nitrogen so the trick is how to get the bacteria inside the plant (the stem or roots) to do the job.

Comparing delivery routes

"One of the biggest challenges with any biological product is figuring out how to grow it, store it and then get it into a formulation that can get into the plant," says Knight.

Focusing on crops grown in Western Canada, they evaluated three inoculation methods – applying directly to the seed, a foliar application and soaking the seeds in the inoculant as they germinated – in canola, wheat and soybeans. "We included soybeans to see if we could get the plants to fix even more nitrogen with this different type of inoculant," says Knight.

Plants were all grown in a sealed chamber so they could accurately measure how much of the nitrogen added via the inoculant was getting into the plants. "We looked at different ways of inoculating, different times of inoculating, as well as different lengths of time that plants were exposed to the inoculant."



Wheat growing in a sterile, soil-less system to evaluate the uptake of a free-living inoculant to fix nitrogen.

Photo credit: Wenjie Chi

> **We didn't anticipate that getting the bacteria into the plant and fixing nitrogen was going to be as hard as it was.**

More questions than answers

"We didn't anticipate that getting the bacteria into the plant and fixing nitrogen was going to be as hard as it was," she says. "We had hoped to confirm the product could fix nitrogen in these crops and then look at the impact on greenhouse gas emissions."

They did find that soaking the seed during germination was the most successful in delivering the bacteria into the plant to colonize, but the least practical. The foliar application was also a successful delivery method, and applying directly to the seed was least effective.

"We would sporadically get confirmation that nitrogen fixation had occurred in the plants," explains Knight. "But we didn't know what we were doing right when it worked, or what we were doing wrong when it didn't work. The results were very random and hard to replicate."

Additional insights

When Knight connected with a researcher at the National Research Council who was using molecular tags to track inoculants inside the plant, she was able to gather some new insights on the project.

"We were able to confirm that in a lot of cases the bacteria was inside the plant, but just not necessarily fixing nitrogen," says Knight.

While the results weren't what they'd hoped, Knight doesn't mark it as a failed project. "We learned that it is hard to do and that's good info. We were able to get the bacteria to colonize in the plant. We just have to figure out how to turn the fixation on."

Although she isn't continuing this work, Knight wants producers to know that the possibility does exist for non-legumes to fix nitrogen, reducing fertilizer requirements and greenhouse gas emissions. There is just more work to be done.

Funding for this project was provided by WGRF and SaskCanola.

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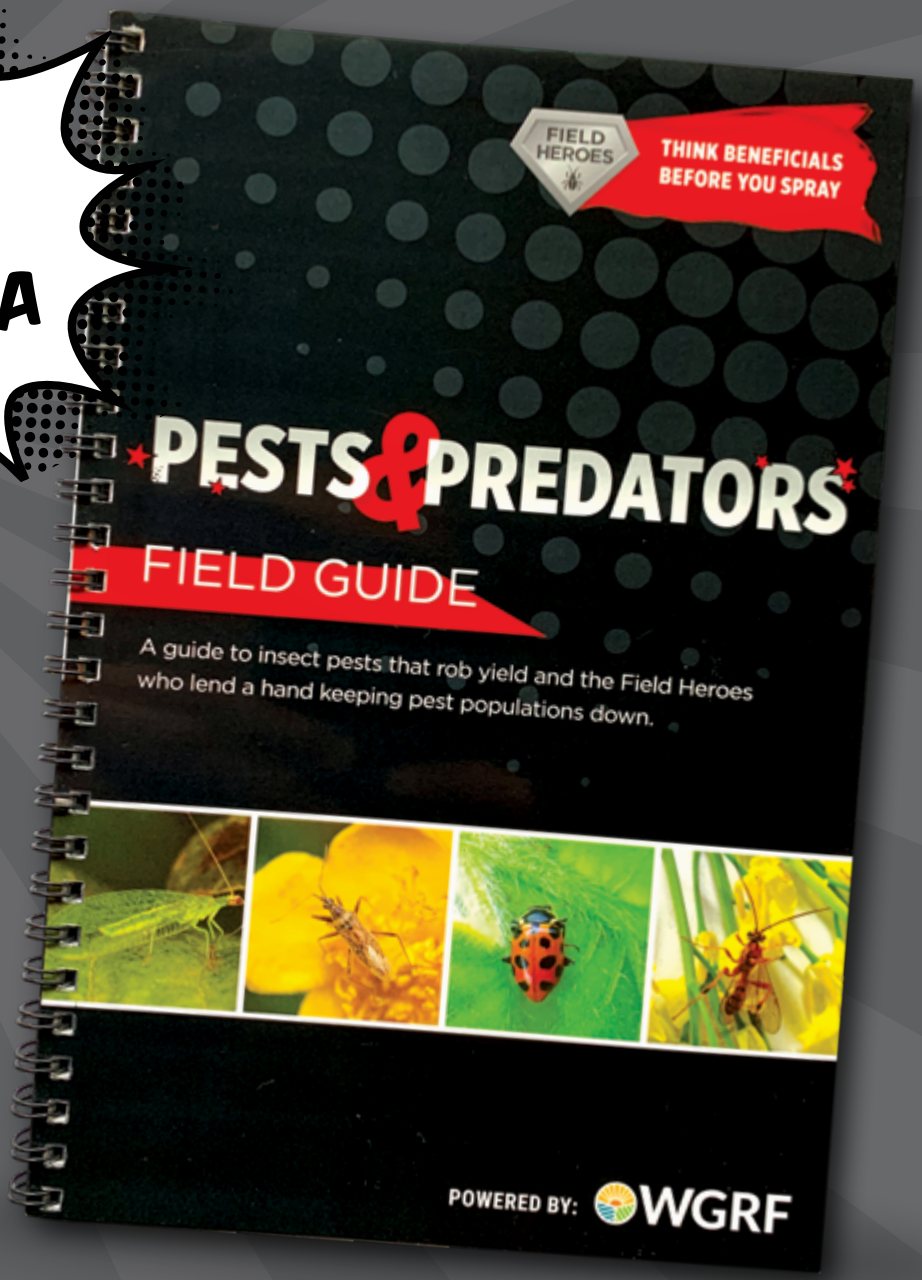

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