



Advancing Agriculture through Research

RESEARCH REVIEW



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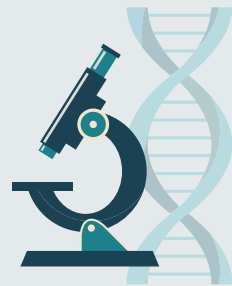


Advancing Agriculture through Research

Investing and impacting agriculture in Western Canada

\$226M

INVESTED IN RESEARCH SINCE 1981



\$24M

in infrastructure and tools to help organizations conduct research



\$8M



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

\$1.4M



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/

WGRF MEMBER ORGANIZATIONS

Agricultural Producers Association of Saskatchewan

Alberta Barley

Alberta Federation of Agriculture

Alberta Wheat Commission

BC Grain Producers Association

Canadian Canola Growers Association

Canadian Seed Growers' Association

Keystone Agricultural Producers

Manitoba Crop Alliance

National Farmers Union

Prairie Oat Growers Association

Saskatchewan Barley Development Commission

Saskatchewan Flax Development Commission

Saskatchewan Wheat Development Commission

Western Barley Growers Association

Western Canadian Wheat Growers Association

Western Pulse Growers

Western Winter Cereal Producers

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Messages from the Chair and Executive Director

Focus forward on research innovation for prairie agriculture

WGRF is a unique farmer-directed organization focused solely on funding research that will benefit farmers in Western Canada. In fact, over the 42-year history of the organization, WGRF has grown to become the largest producer-based funder of crop research in Canada. Our annual investment has nearly tripled over the last two decades, to \$12.8 million, supported through a dedicated team of staff, Board members and the research community we serve.

Farmer-funded. Farmer-directed.

Around the Board table, WGRF directors bring a wealth of farming experience and a commitment to research that continues to be a tremendous asset for WGRF. Our number one goal as a Board continues to be focused on funding crop research to benefit grain farmers in Western Canada by providing project and capacity funding in our key priority areas.

So, what does farmer-funded, farmer-directed research mean? For WGRF, it means delivering more than \$226 million in field crop research since we began in 1981. It's part of our long-term commitment to fund innovative and relevant research that will make a difference for producers across the Prairies now, and into the future.

Over the last five years, we've watched our \$32 million capacity initiative put equipment, buildings and people in place across Western Canada. These investments will pay dividends for decades. And we'll continue to make announcements throughout 2023 as additional agreements are finalized.



Dr. Keith Degenhardt

To support the next generation of crop researchers, we've expanded our graduate scholarships to include the University of Lethbridge and The University of British Columbia for \$15,000/year at each institution, and we expect the first recipients to be awarded this year. The scholarships are available to students pursuing a graduate degree in any of WGRF's priority research areas. Read more about this on page 10. These new scholarships build on those established in 2011 at the Universities of Alberta, Manitoba and Saskatchewan that award \$300,000 each year, combined.

As we start a new year, I'd like to acknowledge two individuals within the WGRF organization – our retiring Executive Director Garth Patterson and our incoming Executive Director Wayne Thompson. Garth has played a key role guiding WGRF over the past 11 years and we are thankful for his vision and leadership. Garth and his team have been instrumental in securing a collaborative approach to research funding that is benefitting all Prairie producers, and helping to maximize the investments we, as producers, are making. We welcome Wayne to his new role and look forward to his insights and knowledge on improving Prairie agriculture research.

A handwritten signature in black ink that reads "Dr. Keith J. Degenhardt". The signature is written in a cursive, flowing style.

Dr. Keith Degenhardt PhD
Board Chair, WGRF



Our vision

Profitable and sustainable western Canadian grain farmers.



Our mission

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

Collaboration creates robust research



WGRF is a driving force in crop research for the Canadian Prairies with a scope that covers 15 different field crops.

WGRF has played a leadership role in transforming provincially-based crop research to a

collaborative, Prairie-wide effort – a testament to the interconnectedness of our industry. I believe this approach brings better decision making, more efficient use of resources and strengthens the relationships between organizations. Our investments are all designed to support adoption of new technologies and knowledge that maintains and builds profitability for producers. We know how critical technology transfer is for ensuring research results are clearly communicated to agronomists and farmers. We have developed new tools for programs including Field Heroes, Canadian Agronomist and the Prairie Crop Disease Monitoring Network (story on page 18). And we continue to explore new ways to enhance our technology transfer tools.

I would like to thank the Board for the privilege of serving them and Prairie farmers over the past 11 years. The team of WGRF staff are creative and committed to doing their best for farmers. It has been a pleasure working with you. Thank you so much! I believe WGRF has a bright future and will continue to provide value for Prairie farmers.

Garth Patterson M.Sc., PAg
WGRF Executive Director, retiring



WGRF welcomes Wayne Thompson

I'm excited about the opportunities in front of WGRF in my new role as Executive Director. WGRF is an important organization for western Canadian producers.

I look forward to the work ahead on more sustainable cropping systems, implementing phase two of agronomy research capacity funding, continued growth in our communication capacity and working on WGRF's new strategic plan.

Wayne Thompson
WGRF Executive Director, incoming

Powering changes for Prairie agriculture

Farmers making research decisions for farmers

Every year, 18 WGRF directors work to manage and invest, on average, more than \$12 million in field crop research that will benefit producers across the Prairies. Board members bring a variety of expertise and experiences to the table, collectively growing more than 31 field crops across a variety of soil zones throughout Western Canada.

Laura Reiter

As a second generation WGRF Board member, Laura Reiter of Radisson, SK has a deep appreciation for the investments the organization has made in crop research over the years. And, as a new Board member, she's looking forward to lending her time and experience to support new research for growers across the Prairies.

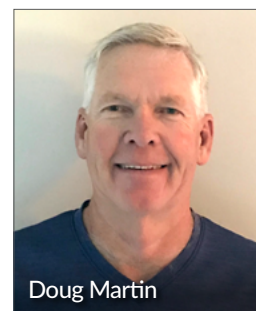


"WGRF can invest in research that isn't just crop specific with projects that mirror what's going on at the farm level that encompass a variety of crop systems and rotations," she says. A member of the Research Committee and the Saskatchewan representative on the Executive Committee, Reiter is proud of the unique role WGRF serves, funding research on behalf of her fellow producers. "Practical application and the ability to implement the research we fund is just as important too," says Reiter, noting the knowledge transfer and ability to share research results are also fundamental aspects of the work WGRF conducts for the industry.

Reiter farms with her family, growing spring wheat, canola, yellow peas and barley.

Doug Martin

When Doug Martin joined the WGRF Board in 2021, he was immediately impressed by the quantity and breadth of the research projects the organization invests in. "I didn't realize the diversity and how extensive WGRF was involved in research that spans the Prairie provinces," says Martin. "The average producer doesn't realize how much money is invested and how much work is conducted on their behalf through this organization."

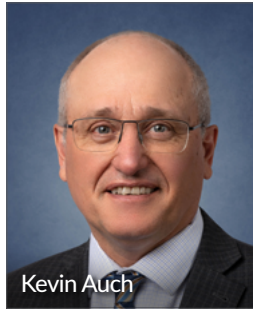


Martin appreciates WGRF's cross-research priorities and the organization's ability to adapt to changes in the industry. WGRF's investment in projects that support climate change and sustainable crop development research are examples of the organization's forward-thinking approach to issues facing Canadian agriculture. Currently in his second term on the Board, Martin is a member of the Investment Committee responsible for the management of the investment funds.

Martin farms with his wife, along with his cousin and his wife, in East Selkirk, MB. A mixed farm, the family has a 1,200 farrow to wean operation and crops 3,900 acres of winter wheat, spring wheat, corn, soybeans, oats and canola.

Kevin Auch

"I've always been interested in improving the way we can do things in farming, and I understand how important the research funded by WGRF is to Canadian farmers," says Kevin Auch, a WGRF Board member who has focused his farming career on exploring new methods to preserve and improve productivity. Auch operates a grain farm in Carmangay, AB with his wife and employees.



It's all about farmers' money being invested for the benefit of the farmers who provide those funds.

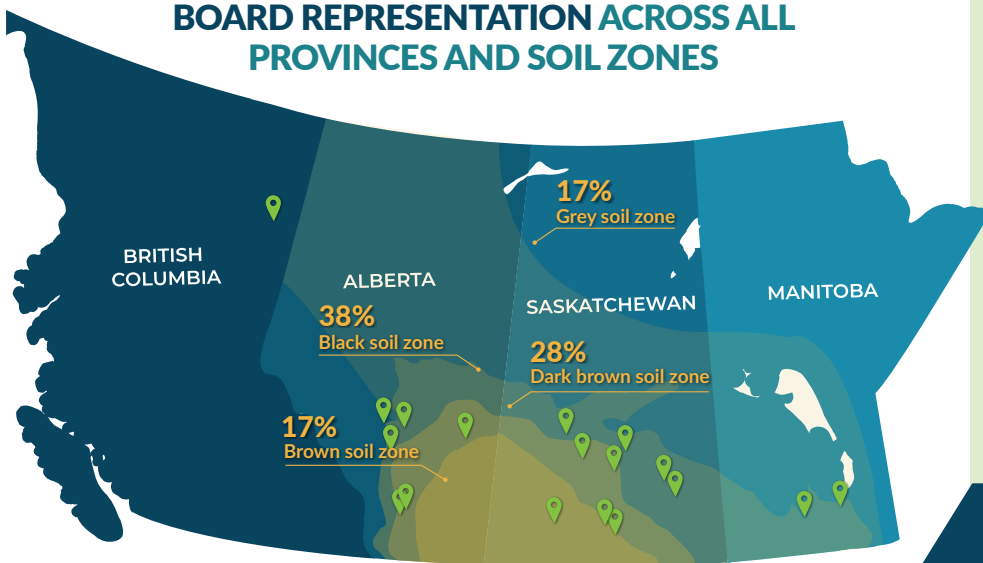
- Kevin Auch, WGRF Board Vice-Chair



As Vice-Chair of the WGRF Board, Auch is committed to investing in the interests of western Canadian growers. He says much of what growers already know about agronomy, fighting diseases, weeds and insects is a direct result of years of research investment. "While we have made huge productivity and profitability gains in an increasingly competitive world, continued investment will be vital to ensure our competitiveness and profitability in the future," says Auch.

Auch is proud of the organization's work, leveraging the WGRF funds to directly help farmers without the need to provide a profit margin for other parts of the value chain. "It's all about farmers' money being invested for the benefit of the farmers who provide those funds," Auch explains.

BOARD REPRESENTATION ACROSS ALL PROVINCES AND SOIL ZONES



2022 BOARD OF DIRECTORS

Dr. Keith Degenhardt, Chair
Hughenden, AB

Kevin Auch, Vice-Chair
Carmangay, AB

Adam Littman
Saltcoats, SK

Bill Prybylski
Willowbrook, SK

Dave Bishop
Barons, AB

Dick Wymenga
Leslieville, AB

Doug Martin
East Selkirk, MB

Greg Sundquist
Watrous, SK

Glenn Wright
Vanscoy, SK

Jeff Nielsen
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Jill Verwey
Portage la Prairie, MB

Kenton Possberg
Humboldt, SK

Laura Reiter
Radisson, SK

Malcolm Odermatt
Fort St. John, BC

Mark Akins
Hearne, SK

Mike Ammeter
Sylvan Lake, AB

Stewart Wells
Swift Current, SK

Wade Hainstock
Moose Jaw, SK



From simple to systems

Building a regional road map for better crop rotations

Wheat and canola form the backbone of crop rotations on the Prairies. It's a simple rotation that has "worked" for decades, but more and more research points to the benefits of diversifying crop rotations for long-term sustainability whether you measure it by yield, soil health or resilience to biotic and abiotic stresses.

In an ideal world, producers would farm in four-year crop rotation cycles as an effective way to balance the varied needs of the crop and soil, manage pest pressures and maintain vital biodiversity.

While it's a lofty goal, a group of researchers across Western Canada are working on ways to bring biodiversity back into crop rotations. They are part of Resilient Rotations, a project of the Integrated Crop Agronomy Cluster led by the Western Grains Research Foundation that's evaluating practical options for more productive, sustainable and resilient cropping systems. By comparing different crop rotations – measuring drawbacks and benefits – the goal is to ultimately help farmers make decisions that are the best fit for their operation.

Dr. Kui Liu, Research Scientist with Agriculture and Agri-Food Canada, is leading the five-year project with a team as diverse as the crop rotation options they are evaluating for western Canadian farmers. There are agronomists, weed scientists, pathologists, economists, meteorologists and soil health experts – a testament to the diversity of factors that impact an effective, sustainable and productive approach to crop rotation.

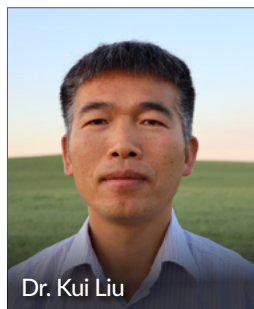


Photo credit: Michael Liu

"We are approaching crop rotation using a systems approach – all the elements that impact crop rotation from yield, soil health and economics to local growing conditions," says Liu. It's a more holistic way to look at crop rotation and one they hope will provide new insights and options for farmers in a more customized, prescriptive type of approach.

A slow switch

The team is evaluating six different crop rotations at eight field sites across the Prairies to provide relevant recommendations based on local growing conditions. There are three sites in Alberta, three in Saskatchewan and two in Manitoba. Data from the four-year rotations are being evaluated by region based on yield, resource use efficiency, soil health, pest pressure, economics, carbon footprint and resilience.

They are under no illusion that there is a single solution, but rather a slow switch from a simplified two-crop rotation to a rotation that takes a systems approach – considering all the factors that impact the performance of cropping systems. "We don't want producers making

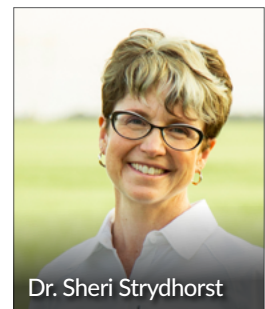


Photo credit: Alberta Wheat Commission

one year rotation decisions,” says Dr. Sheri Strydhorst, Principal with Sheri’s Ag Consulting, and part of the Resilient Rotations team. “It should be a long-term process that considers the local field and farm conditions, and the many factors that impact crop performance and farm economics.”

Spreading the news

“We are producing factsheets with regional results on how each of the six rotations performed based on the evaluation criteria,” says Strydhorst, who also leads extension for the Resilient Rotations project. “Rainfall and yield are key issues on producers’ minds and the first two factsheets will provide timely and relevant information to help with 2023 planning decisions.” Other factsheets will follow on nutrient use efficiency and economic returns.

Regional recommendations

One thing is clear from the four years of field data under their belt. “There is no single cropping system that’s suitable for a large region like Western Canada,” says

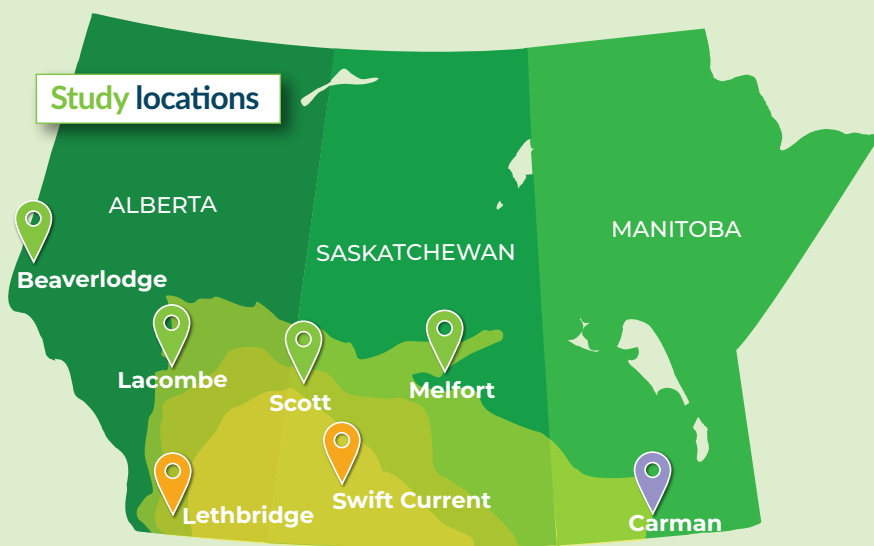
Liu. “We need site specific cropping systems based on local conditions.”

It’s too early for even regional recommendations. But the research team expects to provide a road map or decision tree of information for producers to consider for future crop rotation decisions. “A geographic decision tree could be the ultimate tool for producers from this work,” says Strydhorst. “Producers would start by their region, and identify their top concern – nutrient use efficiency, weed control, economics, etc. – and look to that “branch” for recommendations for their farm.”

As the current five-year project wraps up, Liu has applied for continued funding through the next Integrated Crop Agronomy Cluster. “We really need two to three cycles of studying various crop rotation data to be able to make solid recommendations to producers,” he says. “And it’s important for producers to realize that the benefits of a diversified cropping system may not be realized in the first four years, but gradually, and sustainably, over time.”

More information is available at wgrf.ca/resilient-rotations-factsheet

THE RESILIENT ROTATIONS PROJECT



The Resilient Rotations project is evaluating six crop rotations across the Prairies:

Control: historically recommended, four-year crop rotation

Intensified: oilseed intensified in the northern Prairies or pulse crop intensified in the southern Prairies

Diversified: multiple crop types, diversified rotations

Market driven: crop types selected based on annual commodity prices

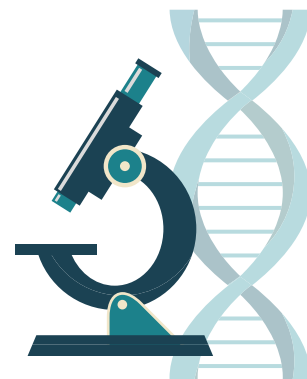
High risk: introduce new crop types that may not be adapted for the geographic region

Soil health: include green manures and intercrops to improve soil health

■ Northern Prairies ■ Southern Prairies ■ Red River Valley

Resilient Rotations is supported by funding from WGRF, Alberta Wheat Commission, Saskatchewan Wheat Development Commission, Alberta Pulse Growers, Saskatchewan Canola Development Commission, Manitoba Crop Alliance, and Agriculture and Agri-Food Canada through the Canadian Agricultural Partnership – a provincial-federal-territorial initiative.

Investing in the next generation

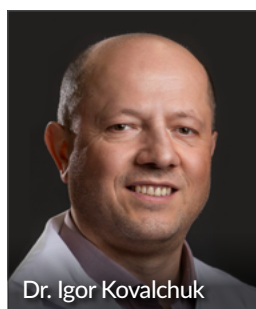


New scholarships strengthen crop research capacity

WGRF recently expanded its scholarship program, adding the University of Lethbridge and The University of British Columbia to the list of universities it supports across Western Canada. Each of the two new universities will receive \$15,000 per year to fund a graduate scholarship, available to master or doctoral students working on WGRF priority research areas.

University of Lethbridge

At the University of Lethbridge, the new annual scholarship will support students studying in the agricultural biotechnology and agricultural studies graduate program. These programs contribute to research with a direct impact on local agricultural practices, building on strong ties with institutions such as Agriculture and Agri-Food Canada, as well as local community and industry groups.



Dr. Igor Kovalchuk

For students planning to pursue grains research as a career path, getting through graduate studies can be a financial drain. Dr. Igor Kovalchuk, Head of the Plant Biotechnology Laboratory at the University of Lethbridge, says he fields as many as 30

calls per week from prospective students asking about scholarship opportunities. Too often, he sends them away empty-handed – until now.

“Any scholarship is a big deal for the student and the university,” says Kovalchuk. “It makes the life of the student easier and allows them to focus on research

instead of working. It is an incentive for the best researchers, including international students, who pay double tuition rates in Canada.”

Kovalchuk says without a scholarship, graduate students typically find work as teaching assistants, but the pay is low, the hours are long. Part-time work occupies a lot of time that a student could otherwise devote to their research, and to completing their degree faster.

“To increase research capacity that is relevant to local agricultural practices means investing in the students who will study in this region,” says Kovalchuk. “This funding also allows laboratories to stretch our research dollars farther. It means we can purchase equipment, or hire more staff to accelerate our efforts, and do research of better quality with our funding.”



Dr. Gurcharn Singh Brar

The University of British Columbia

Dr. Gurcharn Singh Brar, Faculty of Land and Food Systems at the University of British Columbia (UBC) echoes the importance of expanding graduate student investment beyond the biggest

Prairie universities. Brar leads the independent 'Crop Pathology and Genetics' Laboratory, which focuses on wheat and barley pre-breeding, genetics and pathology.

Brar completed both his master's degree and PhD in wheat genetics, pathology and breeding at the University of Saskatchewan, where he received many awards and scholarships. Immediately after completing his PhD, he was recruited by UBC in their Plant Science program.

"I was given the freedom to focus my research on whatever crop I wanted, and because my background and expertise was in cereal crops and mainly wheat – and I had good connections with the researchers and knowledge of industry in the Prairies – I decided to stay involved in wheat and barley research," says Brar.



Having a scholarship from WGRF gives our program credibility and demonstrates that producer groups see potential and have invested their trust in our research program.

- Gurcharn Singh Brar, UBC



Brar's work on genetics of disease resistance and other traits is important work, with research plots, greenhouse facilities, a laboratory with several staff members and many students (graduate and undergraduates) working on cereal crops research. When he made the move to BC, Brar advocated for WGRF to expand its scholarship reach to other graduate programs because he felt the students he supervised were at a disadvantage.

"Agriculture is important to BC, but many of the agricultural scholarships in our faculty targeted horticultural crops or livestock or wine," says Brar.

He says cereal crops often take a backseat to production that has more visibility in BC's Lower Mainland. Cereal crops tend to grow out-of-sight in northern BC or even in Lower Mainland where they are grown as forage. Although the province's acreage appears small compared to the Prairie provinces, he says it maintains a respectable pace alongside BC's other production.

The big numbers of WGRF scholarships

Since 2011, WGRF has invested in the next generation of young scientists with scholarships at universities across Western Canada.

5

UNIVERSITIES



\$1.4M

INVESTED TO DATE

28

RECIPIENTS

The first-ever WGRF graduate research scholarship at UBC was awarded to one of Brar's PhD graduate students in 2022.

"Having a scholarship from WGRF gives our program credibility and demonstrates that producer groups see potential and have invested their trust in our research program," says Brar. "Canada is a smaller community compared to the U.S., and we have an important opportunity to work closely with researchers and industry towards a more robust research network."

More information about WGRF scholarships and past recipients is available at wgrf.ca under the *Special Initiatives* section.

Building capacity

Specialized plot equipment supports innovative field research

Agriculture and Agri-Food Canada (AAFC) has a network of research locations across Canada that play a key role in accelerating innovative crop research, with results that are often particularly relevant for the region where the work is done. This research can be done at large and small scale, and the capacity to work with smaller plots allows for more research questions to be answered in a shorter amount of time. AAFC develops science-based, data-driven recommendations for farmers with plot-size, specialized equipment.



Dr. Stephen Crittenden

In 2022, WGRF announced funding to support equipment purchases at several of AAFC's stations and research farms across Western Canada. The \$3.0 million investment – with matching funds from AAFC – was designed to help enhance

and refresh field equipment. Two AAFC researchers benefitting from this program are Dr. Stephen Crittenden at AAFC Brandon and Dr. Myriam Fernandez at AAFC Swift Current.

Filling the knowledge gap on phosphorus

Stephen Crittenden has been a Soil Scientist with AAFC for about five years at its Brandon, MB research centre. His research focused on two key areas – soil health and nutrient management. On the soil health side, he's interested in the interactions of the physical, chemical and biological properties of soil, and the influence of management practices on those factors that ultimately impact crop yield and the environment. For nutrient management, he's focused on balancing agronomic and environmental performance.

As part of the WGRF funding, he received a plot seeder and plot combine for his research program. "The new equipment will give us the ability to conduct interesting, novel soil health and nutrient management work," says Crittenden.

He had two specific requests for the new equipment. "I wanted a no-till seeder to represent most of the seeding practices on the Prairies. And I wanted to study the interaction between nutrient availability and where you place the fertilizer in a no-till system because there is a real gap in our understanding of phosphorus fertilizer practices and the link with water quality."

With limited land base, the plot-sized seeder and combine allow him to maximize the number of combinations and repetitions – and some of that information will help inform



Specialized plot-sized combine is one of two new pieces of equipment at AAFC Brandon that help with novel soil health and nutrient management research.

Photo credit: Loni Powell



I want farmers to know that this equipment, made possible by WGRF's investment, will contribute to the bigger picture work we do to provide information to make better decision on the farm, based on relevant, local conditions.

- Stephen Crittenden, AAFC Brandon



4R nutrient stewardship best practices. "One of the novel things we'll be able to do with this new equipment is to make the link between phosphorus application and runoff. There isn't much work out there on that."

He'll also be using the equipment to continue to provide data to update fertilizer recommendations for Manitoba, and the development of soil health indices for the province.

"I want farmers to know that this equipment, made possible by WGRF's investment, will contribute to the bigger picture work we do to provide information to make better decision on the farm, based on relevant, local conditions."

Sowing greater diversity in organic crop research

Research Scientist Myriam Fernandez has been running AAFC's Organic Research Program at the Swift Current, SK Research and Development Centre (SCRDC) since it started in 2007, and has been a Research Scientist at AAFC for more than 30 years. The program investigates cropping practices that can make organic crop production more sustainable, resilient and profitable in the brown soil zone, and gathers information on energy use, carbon footprint and the economics of organic cropping practices.

Over the past 15 years, the program's activities have grown substantially and diversified from monocrops in rotation to mostly intercropping and cover cropping. And with the growth, the need for more specialized equipment to effectively and efficiently make comparisons within and among plot trials. "Our field trials consist of a variety of different crop species with different seed sizes, planted as a mixture, singly or in alternate rows," says Fernandez.

The WGRF funding provided for a new custom-built, pull-type plot seeder that is the perfect fit for the program. The new seeder can sow crops with different seed sizes in the same row at different depths, and sow different crop species in alternate rows.

"We're using the new seeder for all our organic research plots, particularly the intercropping and cover cropping projects," she says. "This equipment is very important to our research to ensure we can seed our field trials more accurately, consistently and effectively. And avoid any risk of contamination by synthetic chemicals – that could happen if we were sharing equipment."

Fernandez points out the value of the research to both organic and conventional crop production, especially with the increased adoption of intercropping and cover cropping, that's now possible in large part thanks to the new plot seeder.



AAFC Research Scientist Dr. Myriam Fernandez leading a field tour at the Organic Research Program.

Photo credit: Organic Research Program at SCRDC-AAFC



The industry needs some long-term solutions for integrated weed management.

- Dr. Dilshan Benaragama, Crop Protection Chair (Weed Management), University of Manitoba



Made-in-Manitoba

New research chair filling weed management gap in the province

Manitoba farmers face some unique challenges when it comes to weed management, and four agricultural commodity groups have joined forces to support more research-based weed management solutions by funding a new research chair at the University of Manitoba.



Dr. Dilshan Benaragama

Dr. Dilshan Benaragama joined the University of Manitoba in May 2022 as the new Crop Protection Chair (Weed Management). It's a five-year position funded jointly by WGRF, Manitoba Crop Alliance, Manitoba Canola Growers Association and Manitoba Pulse & Soybean Growers.

"I'm excited to be in this new position that will help fill the gap in weed research capacity in the province, and ultimately provide producers with new tools to effectively and sustainably manage weeds," says Benaragama, who is also an Assistant Professor in the Department of Plant Science in the Faculty of Agricultural and Food Sciences.

Benaragama comes to the University of Manitoba after serving as a senior lecturer in plant science at the University of Rajarata in Sri Lanka, and as a postdoctoral fellow at the University of Saskatchewan, where he completed his PhD.

The new research chair was established to strengthen integrated weed management through research, teaching and extension.

Big picture view

With an overall goal to enhance weed management research in Manitoba, Benaragama will develop a research program with two approaches – fundamental and applied research. "As a scientist, I first want to take a broad view of the situation by understanding how weeds adapt to different weed management practices and cropping systems," he says.

That big picture begins with assessing the problems Manitoba growers are facing when it comes to weed control, and what research needs to happen to move towards some new solutions.

"I want to understand the root causes of some of the weed challenges and look at how we can develop effective management strategies that are also sustainable. I want to keep the work broad and focused on the overall issue of weed management, as opposed to focusing on managing individual weeds in certain crops." This broader understanding of weeds can help devise specific weed solutions as well.



Photo credit: University of Manitoba

Practical on-farm application

From there, he'll focus on ways to share the knowledge and information for practical, on-farm applications – from how to use herbicides more effectively, how to make informed decisions on weed management in their own farms, and how to apply integrated weed management tools with a precision approach. "We will look at how to use different remote sensing tools, first to make more informed decisions and then implement to manage weeds, particularly herbicide-resistant weeds that are the main concern among farmers right now," he says.

Moving the needle on effective weed management strategies is a big ask. But Benaragama isn't under any illusions that five years will completely change the face of weed management in Manitoba. "The industry needs some long-term solutions for weed management. I know we can't solve all these issues in the short term, but this position will lay the foundation for the development of the research capacity of the province, particularly in the direction of precision weed management. I am going to do my best to come up with new strategies to help producers," says Benaragama.

The new University of Manitoba Crop Protection Chair (Weed Management) is jointly funded by



Catching up **kochia**

Investigating new strategies to tackle resistant biotypes

When it comes to herbicide-resistant kochia, Charles Geddes doesn't mince words. He's clear and concise about the tremendous challenges Prairie farmers face with kochia populations, and about promising new research that's offering new tools and approaches to combat kochia.



Dr. Charles Geddes

A Research Scientist with Agriculture and Agri-Food Canada at Lethbridge, AB, Geddes is leading a Prairie-wide, five-year collaborative and practical research project to look at various cultural practices to help growers get ahead of

kochia. The project is funded through the WGRF-led Integrated Crop Agronomy Cluster.

"If you just use chemicals to manage herbicide-resistant kochia, it's not going to work well," says Geddes. "It's safe to assume that all kochia in Western Canada is resistant to Group 2 herbicides, the majority is now glyphosate resistant (Group 9), and a portion are also showing resistance to Group 4."

The compounded trouble with kochia

Geddes knows we're long past simple herbicide solutions for kochia. The trouble lies largely in the very biology of the weed – almost as if it was designed by nature to spread. "It's a tumbleweed that's very efficient at

dispersing its seeds among multiple fields and multiple farms within the same year," he says. "And as a long season plant, kochia continues to grow throughout the season as long as conditions are favourable."

Group 2 resistant kochia was first identified in Western Canada in the late 1980s. In 2011, the first glyphosate-resistant kochia was identified in southern Alberta. In the last 10+ years, glyphosate resistance has reached more than 50% of the kochia populations tested across the Prairies. "And there is no silver bullet solution," says Geddes.

That's why he's leading a team of collaborators in Alberta, Saskatchewan and Manitoba in a series of research projects over the last four years – they're searching for new approaches to manage glyphosate-resistant kochia in a range of environments across the Prairies.

Crop rotation disrupts kochia life cycle

The first part looked at diversifying the crops in a rotation to disrupt kochia's foothold. They added winter wheat in two of the four years of several rotations, and added an alfalfa crop for hay production into another rotation.



We know that once weeds are resistant to multiple modes of action, we have to look at the biology of the plant to find control options. It makes weed management more complex than just spraying herbicides, and it's where integrated weed management truly is necessary.

- Dr. Charles Geddes, AAFC



The strategy with winter wheat is that it is well established in the spring when kochia is trying to emerge, so the crop is more competitive from the start. “Plus, winter wheat is harvested before kochia has begun producing viable seeds so we’ve reduced the opportunity for kochia seeds to be released at harvest and go back in the seed bank.”

Adding a forage produced a similar result because again, harvest happened before kochia was producing seeds. Both approaches are showing promise.

“Changing spring wheat for winter wheat resulted in a decrease in kochia biomass by 64% and density by 74% in year three of the study,” says Geddes. “Adding in a forage decreased kochia biomass by 89% and density by 99% in year three.”

Cultural tools create more competitive crops

They also looked at altering cultural practices to improve a crop’s competitiveness against kochia including using

narrow or wide row spacing, and recommended seed rates or doubled rates. Doubling seeding rates in two of the four years of the rotation saw kochia biomass decreased by 64%. And narrower rows brought a benefit in all four years with a 56% reduction in kochia biomass.

“When we combined both factors – higher seeding rates in narrow rows – we saw an overall 80% decrease in kochia biomass. That’s the same as the threshold of control required by herbicide regulators to designate that a herbicide controls kochia,” says Geddes.

So, optimizing the plant spatial arrangement in a field – to boost the competitiveness of crops against kochia – brings a level of control similar to adding a new herbicide mode of action against kochia.

Harvest timing helps weed management

The final part of the project looked at how harvest dates could impact kochia seed production. “Understanding the biology of kochia, we wanted to see if it makes sense to use a pre- or post-harvest herbicide, and if harvest date has an impact on that,” says Geddes.

Kochia starts producing seeds in mid- to late-August. If you cut off kochia during crop harvest when plants are still vegetative (before flowering), the plants tend to regrow.

“If you harvest before kochia is producing seed (August or earlier), a post-harvest herbicide makes sense to prevent kochia from regrowing. But if you are harvesting in September or later, you don’t need post-harvest control because when you cut down kochia that is producing seed, it tends to die off and not regrow,” he says.

Realistic recommendations

The project is wrapping up, and Geddes has identified some clear recommendations for growers.

- Kochia responds to competitive crops by reducing its biomass and seed production, so anything you can do to promote a competitive crop is a good option, including narrow rows and higher seeding rates.
- Harvest timing is important for kochia management. Earlier harvest can decapitate kochia before it produces viable seeds, but it’s important to consider a post-harvest herbicide to control regrowth.



ICAC plot sign for GR kochia research
Photo credit: Charles Geddes



Why monitoring matters

Collaborators monitor and manage field crop disease through new Prairie-wide network

When disease strikes a nearby field crop, information is key. What disease is it, and what crops does it affect? How fast does it travel, and what should growers watch for? What category of fungicide will it respond to? Access to fast, coordinated information can make all the difference in stopping a yield-robbler in its tracks – and it requires a coordinated approach.

That's the idea behind the Prairie Crop Disease Monitoring Network (PCDMN), established to foster a more cohesive, collaborative approach to field crop disease monitoring for Alberta, Saskatchewan and Manitoba. It's a five-year Canadian Agricultural Partnership funded project as part of the Integrated Crop Agronomy Cluster, led by WGRF and now in its final year.

"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 value of monitoring

Turkington points to the development of cereal rust risk forecasts for the Prairies as one key function of the network. Leaf rust, stripe rust and stem rust can produce spores that are long lived, and are resistant to UV

radiation, wetting and drying. Spores can be carried by parcels of wind over hundreds or thousands of kilometres.

"As a network, we consider whether we have a source of rust in the U.S., and whether we have wind trajectories that will carry those rust spores into the Prairie region," says Turkington. "Then we look at Prairie weather conditions and crop development, and we are able to identify specific at-risk regions where producers and consultants need to be on the lookout for emerging rust issues and the need for timely fungicide application."

Beware of shifts in virulence

While it's important to forecast how a disease travels or where it may appear, Turkington says it's just as important to monitor its changes over time. Over the last several decades of monitoring rust pathogens in cereals, researchers have a better understanding of the breadth and virulence that is out there.

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.

- Kelly Turkington, AAFC

“When we look at cereal rusts, or the pathogens that cause blackleg in canola, or barley leaf spot diseases, we see shifts in virulence over the last 20 years,” says Turkington. “As an industry we need to monitor these shifts so we know the most effective sources of resistance that can be bred into new varieties, and we also need to be aware of shifts in fungicide sensitivity.”

Knowledge transfer tools

The network uses a blog, Twitter and factsheets to share information. In 2021, they launched the PCDMN quick disease reporter tool, accessed as an app or website form. The tool allows users to choose the crop, disease issue and upload a picture. Data is only collated based on municipality, and once reports are reviewed to flag potential misidentifications, the network generates maps that identify risk based on the number of disease reports by region.

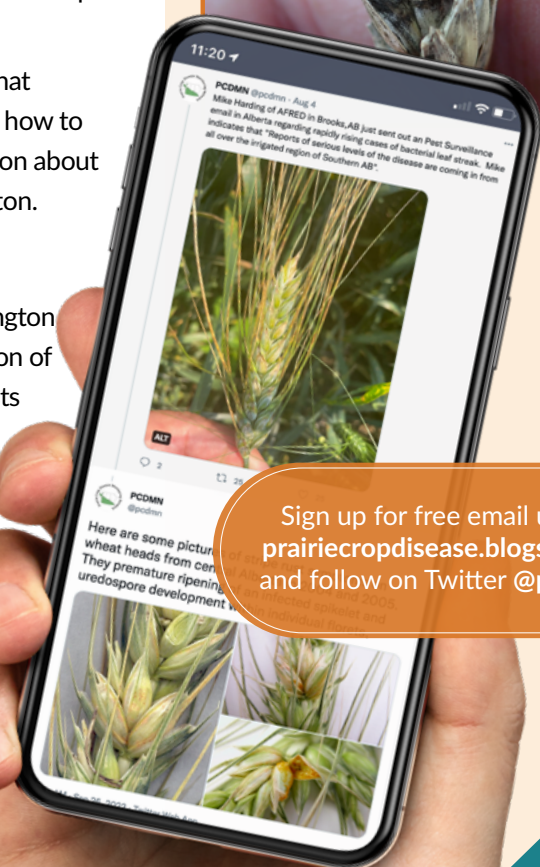
“We’re then able to communicate with producers and consultants that regionally they need to be on the lookout for a specific disease, and how to identify it, provide key management information, and give information about assessing risk and determining the need for fungicide,” says Turkington.

Plans to grow the network

The PCDMN’s initial five-year project is coming to an end, but Turkington says proof of concept is there. He hopes to facilitate further expansion of the network in the coming years, including the number of pathologists and other collaborators, the range of diseases and number of crops.

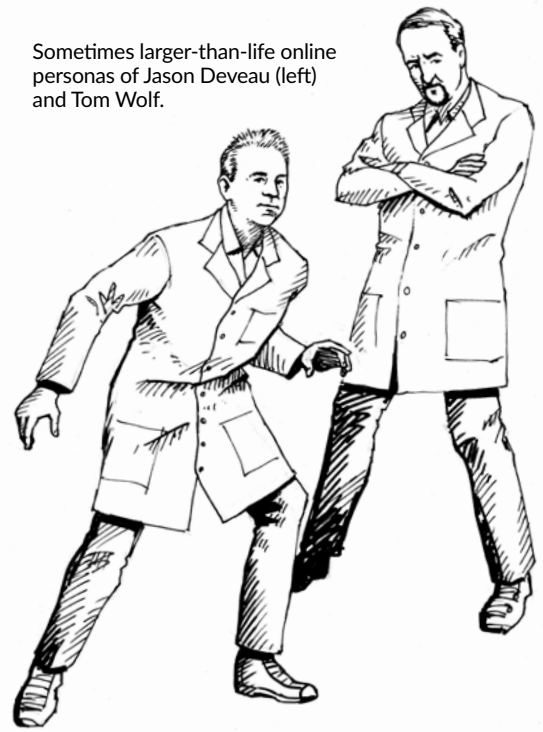
As pandemic restrictions continue to ease, he also hopes to build a broader range of avenues to share information, including in-person events such as field days, crop walks and training sessions.

“As an industry, we need to understand what crop diseases are out there so we can develop appropriate management strategies, or initiate research that will lead us to new or better tools for disease management,” says Turkington. “That information needs to run from the farm to policy makers in government, so we know where to put our resources.”



Sign up for free email updates at prairiecropdisease.blogspot.com and follow on Twitter @pcdmn.

Sometimes larger-than-life online personas of Jason Deveau (left) and Tom Wolf.



Sprayer superheroes

Entertainment helps educate industry on best practices

Tom Wolf and Jason Deveau use a unique approach to up the ante on best practices for applying crop protection products...humour. It's not that they take the subject matter lightly. They've just found a delivery style that helps engage with followers of their sprayers101.com content – a site dedicated to information on boom and airblast spraying.

The heart of their site, and indeed their approach, is rooted in a solid understanding of the importance of communicating relevant and timely information in an engaging way. It's communication101 and it's working for this dynamic ag comedy duo.

Wolf, a former Agriculture and Agri-Food Canada researcher turned independent Research Consultant with Agrimetrix Research and Training, and Deveau, an Application Technology Specialist with the Ontario Ministry of Agriculture, Food and Rural Affairs, launched their new information venture in May 2015. They wanted to fill a void they saw in the availability of sound best practices information for application technology.

"I was working with RealAgriculture on a video project and it gave us the idea that video might be an interesting way to breathe fresh life into sprayer information," says Wolf. And when the cameras turned on them, that's when the fun started.

Serving up science with a side of wit

Since launching the site nearly eight years ago, the idea to share sprayer best practices in interesting and engaging ways has spawned so much more, in so many forms. The site houses more than 300 articles, includes

content from over 20 guest authors, links to a YouTube channel, a video series that busts common sprayer myths and a comic book.

The energy and synergy is real between these two, and once they started working together, they developed unique sprayers101 online personas, separate and distinct from their professional realities. And humour plays a huge part.

"I have always taken a lighthearted approach to presentations," says Deveau. "It can be tricky to balance a little entertainment with education and ensure you are never compromising the main message."

Wolf doesn't come by the funny guy schtick so easily, but you can't tell on camera. "I didn't use humour in my previous research work, but it just came together when Jason and I started imagining this new venture. When we get an idea for a new topic or new research to cover, we get excited about how to make it fun without missing the message," says Wolf.

And they know they are in an enviable position of neutrality. "We are able to create and share content in an approachable tone and style that pushes the entire industry to do better when it comes to spraying," says Deveau.

They deliberately sought sponsorship from non-profit, grower-based organizations, including WGRF, to fund the creation of the content that feeds the science-based information hub. The site is robust and interconnected to allow users to search on any number of topics, and easily access all the information on the site. They track metrics to see what and how their users want information and adjust the content to match.

Not just about nozzles

With articles, videos, handbooks, apps and tools, the topics covered on the site go far beyond nozzles and droplets. There are spray basics, application productivity, safety and transport, and environmental stewardship, presented in ways that reflect Wolf and Deveau's engaging approach to sharing information.

"We've done pantomimes, held Haiku competitions on Twitter, created parodies of popular songs and poems – all to remind growers of foundational best practices for spraying, in a fresh way," says Deveau.

Twitter has responded well to their content and has become an important vehicle for information sharing. sprayers101.com articles and information on their respective handles – @Spray_Guy and @nozzle_guy.

"We cater to all those different learning styles in our portfolio of material," says Wolf. "And we don't shy away from making ourselves look a little ridiculous, like in our busting spraying myth videos."

Co-star creators

Wolf and Deveau oversee all content development for the sprayers101 site. They write the scripts and star in the videos. And they are constantly on the search for new, science-based information to share – their own or what they glean from around the globe. "We try to make it fun and engaging to deliver research-driven information," says Wolf.

Drones are a topic on their radar. "There is a lot of excitement about drones, but when it comes to future possibilities with spraying, there are a lot of unknowns about efficacy, drift, reliability and regulatory," says Deveau.

While spraying technology may get lost in the margins, this pair's approach to blend humour with best practices is resonating. "We get a lot of engagement," says Deveau. "It's not just producers, but educational institutions, sprayer operators, regulatory, equipment manufacturers and agronomists."



“We try to make it fun and engaging to deliver research-driven information.”

- Tom Wolf, AgriMetrix

Sowing seeds of synergy

Intercropping makes efficient use of land and resources

Saskatchewan researchers are quantifying the value of an older agronomic practice that may bring new opportunities for some growers in Western Canada. Intercropping – the process of growing two or more crops in the same field at the same time – has been around for a long time. The practice doesn't account for big acreage in Prairie agriculture but a recent research project set out to look closer at the benefits of growing a grain legume together with a non-legume oilseed.



Dr. Jeff Schoenau

Dr. Jeff Schoenau, in the Department of Soil Science at the University of Saskatchewan, oversaw the two-year project that included MSc graduate student Melanie Reid, co-supervised by department colleague Dr. Diane Knight, and Lana Shaw, Research

Manager at the Southeast Research Farm near Redvers, SK. The project was jointly funded by WGRF and the Saskatchewan Agriculture Development Fund.

“There is limited documentation of the nutrient cycling benefits coming from intercropping – a practice that’s of particular interest to reduced input and organic operations,” says Schoenau. “We set out to reveal and quantify some of the benefits of legume/non-legume mixes, particularly the ability of the legume to transfer biologically fixed nitrogen to the non-legume partner crop.”

Comparing yield and nutrient uptake

They set up two study sites – in the drier brown soil zone in south-central SK and the more moist black soil zone in the southeast area of the province. During 2019 and 2020, they grew two different crop mixes

– chickpea/flax and pea/mustard – in two different intercropping configurations. The crops were grown in mixed rows where legumes and non-legumes were planted together in the same row, and also in plots where the crops were grown in alternating rows 25 cm apart. No commercial fertilizer was added to the intercropping plots.

“We looked at yield and nutrient uptake – specifically nitrogen (N) and phosphorus (P) – as well as N and P in the root zone during growth to examine the impact on nutrient availability and crop utilization,” says Schoenau.

Benefits of working together

What they found – that was quite consistent across sites, years, intercropping configuration and crop mixes – was a greater efficiency in yield produced per unit area of land when two crops were grown together compared to either crop grown on its own. The intercropped crops also made more efficient use of nutrients.

“We can attribute these benefits to synergy between the two crops, specifically related to the grain legume obtaining biologically fixed nitrogen and transferring a portion of it to the non-legume oilseed crop during the growing season,” says Schoenau. “This was also consistent

with what we found in the root zone as the crops grew together. Legumes contributed higher levels of soluble nitrogen in the rhizosphere and higher supply rates of available nitrogen over the season as measured using PRS probes.”



There might also be some reciprocal benefits from the non-legume to the legume. Schoenau explains that chickpeas are quite susceptible to disease and there was some evidence that when grown in an intercrop configuration, there might be a slower spread of diseases in the chickpeas, thanks to its non-legume partner.

Intercrop considerations

While the benefits are there, Schoenau points to a few practical aspects of an intercropping system that should be considered by growers. “There was some additional complexity involved in harvesting as the two crops are grown and harvested together, and then are separated post harvest,” he says.

Weed control is the other consideration, particularly finding herbicide options that are appropriate for both crops in the mix, and that don’t limit recropping choices.

“I think the farmers that intercropping may be especially appealing to – low input and organic – understand these systems require a unique type of management to be successful,” says Schoenau. “We’ve had a lot of interest from growers who are looking for alternative ways to



Photo credit: Jeff Schoenau
Melanie Reid completed her MSc on the intercropping project, and is seen here sampling chickpea root zone soil.

meet the nutrient requirements of their crops that are acceptable to the agencies that certify their product as organic.”

Schoenau is now looking ahead to a larger number of crop combinations – legumes and non-legumes – that may hold promise for intercropping, as well as introducing perennials crops like alfalfa and other forages into the mix. “This includes looking at different legumes and evaluating their suitability in different combinations and environments, as well as the impact on the following crops in rotation.”



When evaluating the benefits of intercropping, the researchers frequently considered the land equivalent ratios or “LER” values – a measure of the efficient use of land and resources to produce a crop. A value greater than one indicates a system that makes more efficient use of the land and resources, the kind of synergies they found with both intercropping mixtures.





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