Western Grains Research Foundation

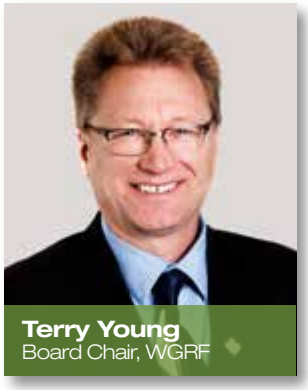
RESEARCH REVIEW

Agronomy research

Whole-farm approach

Advancing agriculture through research

Chair and Executive Director's Message



Terry Young
Board Chair, WGRF

Garth Patterson
Executive Director, WGRF

Profitable and sustainable western Canadian grain farmers. That's the vision for the Western Grains Research Foundation (WGRF). In everything we do, our organization is driven by the mission of *producers directing investment in crop research to benefit western Canadian grain farmers.*

In 2018, those investments totaled more than $15 million, maintaining our long-standing position as the largest producer funder of crop research in Canada. With 146 research projects and activities on over 25 crops, our leadership and commitment to fund research is clear.

Collaborative approach

A constant of WGRF is our collaborative approach to research. With a focus on the major crops (canola, wheat, barley, pea and lentil) through multi-crop agronomy research, our funding is directed at projects that emphasize whole-farm sustainability, resiliency and efficiency of crop production systems. This is evident with the successful development of a National Integrated Crop Agronomy Cluster (ICAC). It's a nine-million-dollar investment into multi-crop agronomy and a great achievement for WGRF.

Another success is our ability to leverage producer investments through Agriculture and Agri-Food Canada's latest policy framework – the Canadian Agricultural Partnership program. Nationally recognized as a major research funder, WGRF is investing close to five million dollars through five agri-science Clusters. Specifically, this includes 36 new research activities focused on agronomic research across multiple crops, organic production, emerging crops, wheat and barley.

Looking forward to continuing profitable and sustainable grain farmers in Western Canada, we have an ongoing initiative to fund research into alternative crops including corn, soybean, fababean, sunflower, mustard, canaryseed, oats, flax and winter cereals.

We are proud to be part of the successful transition of wheat and barley varietal research leadership to the provincial commissions and associations. WGRF continues to invest remaining check-off funds into wheat and barley variety development through investments in Cluster programs.

Technology transfer

Communications is also at the forefront of WGRF activities. Technology transfer is critical to conveying results of our research to agronomists and producers. The award-winning Field Heroes campaign, for example, is increasing producer and agronomist recognition of beneficial insects and the important role they play in pest management. Valuable resources including photos, scouting techniques and best management practices on beneficial insects are available from various sources across Western Canada thanks to this effort.

> With a focus on multi-crop agronomy research, our funding is directed at projects that emphasize whole-farm sustainability, resiliency and efficiency of crop production systems.

WGRF is also very pleased to be a founding sponsor of CanadianAgronomist.ca — a unique website that is translating research into knowledge that agronomists and farmers can use to grow better crops.

Looking ahead

The Board is developing plans for WGRF to continue through the next decade as a leader in funding research to benefit western Canadian grain farmers. Early in 2019 we will be announcing the details of a $20 million program to improve research capacity at public and producer research organizations. We are reviewing our research priorities with an emphasis on continued support for all crops of importance to western Canadian grain farmers.

This annual *Research Review* highlights how WGRF has invested producer dollars into research to advance western Canadian grain crop production. For more details of how these funds have been directed, visit westerngrains.com where more than 420 past and present research projects are now listed. We hope you'll find a strong return on your investment.

Terry Young
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WGRF VISION & MISSION

Vision: profitable and sustainable western Canadian grain farmers.

Mission: producers directing investments into crop research to benefit western Canadian grain farmers.

LARGEST PRODUCER FUNDER OF CROP RESEARCH IN CANADA

INVESTMENT OF **$15** MILLION IN 2018

CURRENT OR COMMITTED FUNDING:

146 RESEARCH PROJECTS & ACTIVITIES

IN OVER **25** CROPS

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 Wheat and Barley Growers Association
- 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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Contents

Integrated Crop Agronomy Cluster

Agronomy research

Whole-farm approach

The launch of the Integrated Crop Agronomy Cluster (ICAC) represents a first in agricultural research – a multi-crop approach that will provide farmers with tremendous value as they tackle widespread agronomic challenges.

"Farmers don't just grow one crop and that's why we're taking a whole-farm approach to agronomic research. We are very excited about the potential of this Cluster," says Terry Young, WGRF Chair. He adds that the process for developing the Cluster began with the realization that a gap had emerged in multi-crop and systems approaches to agronomic research.

"Sometimes research is approached from a fairly local perspective – the Cluster provides an opportunity for a broader geographic perspective, which can be a real advantage," says Pat Flaten, Research Program Manager with WGRF.

Investment totals $9 million

ICAC represents an investment of $9 million in research between 2018 and 2022. Agriculture and Agri-Food Canada (AAFC), under the Canadian Agricultural Partnership, is contributing $6.3 million. WGRF is providing $1.6 million in funding while industry partners are supporting the crop research with an additional $1.1 million (see sidebar for contributing organizations).

"Demand for our grains and other field crops continues to grow around the world and the Government of Canada is working hard to help farmers meet that demand, today and for years to come, through strategic investments in science and cutting-edge research," said federal Agriculture Minister Lawrence MacAulay when he announced the funding in July.

"WGRF's focus on funding research, our western Canadian membership, and our multi-crop funding scope made WGRF uniquely qualified to develop and lead this first-of-its-kind cluster."

"Coordination and collaboration was really important in bringing this Cluster together," says Garth Patterson, WGRF Executive Director. "WGRF's focus on funding research, our western Canadian membership, and our multi-crop funding scope made WGRF uniquely qualified to develop and lead this first-of-its-kind cluster."

The research is by no means a new foray for WGRF; ICAC will build upon its 'Systems Approach to Crop Sustainability' project that was funded with the support of the federal government under *Growing Forward 2*, which ended in March 2018.

Productive, resilient and sustainable cropping systems

ICAC consists of eight research activities ranging from soil health to herbicide resistance and climate change adaptation. It also includes the coordination of crop insects and disease monitoring, assessing and managing spray drift, developing a risk model for mitigating *Fusarium* head blight, and the development and management of productive, resilient and sustainable cropping.

Collaborating research organizations include AAFC, Alberta Agriculture and Forestry, Agri-Metrix, Brandon University, Farming Smarter, InnoTech Alberta, Prairie Agricultural Machinery Institute, Smoky Applied Research and Demonstration Association, University of Alberta, University of Manitoba, University of Saskatchewan, and Western Applied Research Corporation.

A strong knowledge transfer plan is built into all the activities in the Cluster. "We are really hoping to assist with the communication of pest monitoring so that agronomists and producers are up to date with what we're seeing and with what we expect will be a challenge," says Flaten.

WGRF will use various methods to communicate results to producers and agronomists, enabling them to respond to agronomic challenges in a timely way.

$9 MILLION

TOTAL INVESTMENT

$6.3 MILLION — **Agriculture and Agri-Food Canada** under the Canadian Agricultural Partnership

$1.6 MILLION — **Western Grains Research Foundation**

$1.1 MILLION — **Industry Partners** see full list below for all contributing organizations

ICAC FUNDERS

- Agriculture and Agri-Food Canada
- Western Grains Research Foundation
- Alberta Pulse Growers
- Alberta Wheat Commission
- Brewing and Malting Barley Research Institute
- Manitoba Canola Growers Association
- Manitoba Pulse and Soybean Growers
- Manitoba Wheat and Barley Growers Association
- Prairie Oat Growers Association
- Saskatchewan Canola Development Commission
- Saskatchewan Pulse Growers
- Saskatchewan Wheat Development Commission

Managing mycotoxin

Grain storage best practices help prevent contamination

Keeping a crop healthy is a priority for growers during the growing season, but that vigilance shouldn't stop once the grain leaves the field. Ochratoxin A (OTA), a mycotoxin caused by the fungus *Penicillium*, is a perfect example. It's only produced in grain when in storage and research shows there are no pre-harvest agronomic best practices that will prevent it.

"We found there wasn't a linkage between what happened in the field and what's happening in storage, and so we confirmed that OTA is, in fact, a storage issue," says Art Schaafsma, professor of plant agriculture, University of Guelph, Ridgetown Campus.

Schaafsma says preventing mycotoxin formation in storage is crucial for farmers and the grain industry in general. OTA-contaminated grain can lead to down-grading or rejection from the buyer. Concerns have also been raised over the years about its potential risk to human health.

Fortunately, there are several things that can be done to reduce the likelihood of the growth of OTA in storage. Schaafsma recently led a three-year study co-funded by WGRF to determine best management practices for managing OTA in storage of small grains such as wheat, oats and barley. His research resulted in several recommendations for farmers.

"It is very important for grain producers to understand how and when OTA forms during storage so that they can take steps to prevent its formation," says Schaafsma. He points to two key factors – sanitation and temperature/moisture – as the leading causes of the mycotoxin.

The most common source of *Penicillium* spores is from soil particles, last year's stored grain, grain handling equipment and residues remaining in the bin. For this reason, sanitation is critical; farmers must keep bins and grain handling equipment clean and thoroughly remove dust and debris between grain lots as the first line of defence.

Temperature and moisture are the second significant factor. According to Schaafsma, it is important to quickly cool the grain pile to well below 10°C and keep it cool for as long as possible to minimize condensation that can lead to pockets of moisture in the bin.

"We want to advise farmers, and anyone storing grain, that you need to set up your bins to minimize those pockets, and you then minimize the opportunity for ochratoxin to develop," says Schaafsma. "It's not something that you can manage after the fact very easily, so the management of this particular problem has to happen at the front end."

Researchers found that a grain bin's age doesn't matter. "We were surprised that you could find OTA in a well-kept, well-managed grain storage," he says. All it takes is the right conditions for water to come into contact with grain and *Penicillium* will grow. "We found situations in perfectly fine, brand new storages where there was moisture showing up in the grain from various sources."

For example, warm, moist air escaping through cold pipes can cause water to drip onto the grain pile. Water can also condense on the bin wall due to improper venting. In addition, precipitation such as snow or rain can get in through poorly fitting vents, seals or small holes.

"What most people thought were minor sources of foreign moisture, were actually the things that were causing the problems," says Schaafsma. "Grain storages have to be set up so that you don't have these pockets of moisture and you can keep your crop healthy."

Co-funders of this study include: Agriculture & Agri-Food Canada, Canadian National Millers Association, Grain Farmers of Ontario, Kellogg, Mondelēz, Nestlé/Gerber, Pepsico Foods, Prairie Oat Growers Association and the University of Guelph.

TIPS TO PREVENT OTA

- Clean bins and grain handling equipment
- Make sure bins are properly sealed
- Avoid condensation
- Aerate carefully

"Grain storages have to be set up so that you don't have these pockets of moisture and you can keep your crop healthy."

Check for improper seals that can allow precipitation into the storage bin and create pockets of moist grain.

The power of knowing your soil

Saskatchewan Soil Information System provides growers with a valuable tool

Have you ever wondered why crops don't do well on a certain bit of land and it's not obvious why? Angela Bedard-Haughn from the College of Agriculture and Bioresources at the University of Saskatchewan is here to help you figure that out.

Bedard-Haughn, Associate Dean Research and Graduate Studies, leads the Saskatchewan Soil Information System (SKSIS), a phased research project that aims to know everything there is to know about the province's soil resource and make that data accessible to farmers.

> "I want farmers to better understand the land they're working, that's the base line. To manage soils effectively, you have to understand them."

Phase 1 entailed the development and launch earlier this year of the SKSIS digital platform – sksis.usask.ca – a website where all existing information on Saskatchewan's soils, collected mainly by government agencies throughout the 20th century, is stored and fully searchable.

Bedard-Haughn says the site is intended to be used by farmers, researchers, agronomists, consultants, students – anyone with an interest in or need for knowledge about soils in a specific area so that they can understand better what's happening on the ground, literally. "Part of what we were hoping to provide is a tool to allow people to understand why a piece of land isn't producing," she says, adding that people can use the site to investigate things like soil texture, salinity, pH and much more. "So far, it's going really well," she says. "The feedback we've had has been really positive."

A digital farming tool for the modern age

While SKSIS-1 has successfully gathered the fragmented historical soil record into one place, Bedard-Haughn isn't done. With funding from WGRF, SKSIS-2 aims to build on this framework, to refine and expand the information it contains, to find digital avenues for greater flexibility and share-ability, and to make it a true digital farming tool for the modern age.

"There are two main things we want to do," she says. "The first is to enhance the refined information." To explain this, you almost need to look at the map that greets you when you are on the SKSIS website. A grid of green lines overlays a map of Saskatchewan where the familiar soil zones are appropriately colour-coded.

Each one of the squares in that grid is known as a polygon. "When they did the original soil surveys, they did it quarter section by quarter section," says Bedard-Haughn. It was a method that tended to negate the fact that different types of soils tend to exist together, which means the polygons are a little clunky by today's precision agriculture standards when it comes to truly granular soil information.

For example, one big information gap in the maps now is a lack of topographical information. "We're trying to come up with a method where farmers can input their own information and get back refined data of their own," she says. "We couldn't have imagined at the time that the polygon maps were developed that precision farming would be at the level it is now." In other words, knowing everything there is to know about every square inch of soil is information that can actually be used to good effect with today's precision ag equipment.

Enhancing data sharing

The second main focus of SKSIS-2 is to enhance the way this data is shared. "So that researchers and, wherever possible, producers, don't spend so much time reinventing the wheel," says Bedard-Haughn. Given how long this land has been farmed, researched and documented, it's highly likely that someone has literally gone over the ground before and made notes. "Some things don't change too much over time, like texture, so if another researcher goes to an area five years later and tests again, not knowing that information already exists, it's a waste of time and resources."

The trouble is that not all of these records are in one place. "In the case of soils, it's not like Facebook where data can be harvested without you knowing. It has to be more deliberate," she says. By providing a venue to share that information, the soil database gets richer, deeper and more useful.

> "Part of what we were hoping to provide is a tool to allow people to understand why a piece of land isn't producing."

To be sure, the goal is to document much more than things that stay relatively static over time. "There's increasing interest in monitoring things like carbon, for example, to see patterns of change over time as they relate to climate or production," says Bedard-Haughn. As well, infrastructure and events related to resource extraction, such as boreholes and spills, or natural events, such as fires and floods, all have an impact on soil productivity and can be noted in the SKSIS database to help develop high-resolution maps of soil characteristics so that farmers can better determine why a certain situation exists in their fields, which is the first step toward fixing it.

"I would love for farmers to be able to use this system to gradually improve the data available on their land," says Bedard-Haughn. "They can bring yield and quality information into it and really understand how this land responds year over year, so precision ag means something."

To that end, the SKSIS system was built using open-source software, making it fully accessible, editable and useable by anyone. The more robust the data becomes over time, the more useful it is. "I want farmers to better understand the land they're working, that's the base line," says Bedard-Haughn. "To manage soils effectively, you have to understand them."

Leveraging producer investment

WGRF pledges nearly five million dollars to Cluster research

Collaboration in 36 new research and technology transfer activities totaling close to five million dollars is WGRF's latest commitment to agronomic, variety development and post-harvest management. Organic production, emerging crops, wheat and barley are each a focus of four new agri-science Clusters made possible by the Canadian Agricultural Partnership – a federal-provincial-territorial investment to strengthen Canada's agriculture and agri-food sector over the next five years. Participation in each industry-led Cluster enables WGRF to leverage producer dollars to help maximize on-farm profitability and sustainability.

Enhancing Canada's organic sector

Picking up where the previous organic Cluster left off, the Organic Science Cluster III (OSCIII) was announced in 2018 to enhance the sustainability of Canada's organic sector.

"Issues like crop rotation, pest monitoring and management, nutrient management, crop adaptation to climate change, and soil health impact all farms. Research in this Cluster can help provide benefits to all producers," says Terry Young, WGRF Chair.

WGRF's investment of $675,000 will help fund nine of the 28 research activities included in OSCIII, which is led by the Organic Federation of Canada in collaboration with the Organic Agriculture Centre of Canada. The Cluster also includes the participation of 60 researchers at 15 AAFC research centres, and 14 universities and research institutions across Canada.

WGRF's contribution will specifically support work in organic soybean production, breeding of winter cereals, diversified cropping strategies to improve sustainability, innovative weed management tools and soil health.

Supporting emerging crops

Supporting emerging crops such as flax, canaryseed, sunflower and mustard is another strategic priority for WGRF. The organization is contributing more than one million dollars to the Diverse Field Crop Cluster (DFCC) led by Ag-West Bio. The DFCC will align industry and research stakeholders to seize market opportunities and accelerate the acreage and returns of these high-potential crops in coming years.

WGRF's funding will specifically support four projects: the development of flax cultivars for Western Canada; germplasm and variety development of condiment mustard for improved yield and quality; the effect of heat treatment on the storage stability, functional properties, and sensory and microbial quality of food-grade canaryseed groats and flours; and the development of long-type confection sunflower hybrids.

Improving wheat breeding

Wheat research has long been a mainstay of WGRF focus and funding. Since 1995, the organization has invested an average of five to six million dollars annually into wheat breeding research and served as administrator of the previous wheat Cluster.

Now, WGRF joins the Canadian Wheat Research Coalition (CWRC), in the new Canadian Wheat Cluster – an integrated national approach aimed to deliver benefits to Canadian wheat producers.

"With provincial wheat and barley commissions firmly established and with the formation of the Canadian

"Issues like crop rotation, pest monitoring and management, nutrient management, crop adaptation to climate change, and soil health impact all farms. Research in this Cluster can help provide benefits to all producers."

Wheat Research Coalition, this really completes the transition for WGRF out of the lead role in funding wheat variety development," says Young.

WGRF's commitment to wheat is still strong. The organization will invest nearly $2.5 million into 18 activities ranging from the development of pre-breeding and breeding tools to improving yield, yield stability and grade protection, and management of *Fusarium* head blight.

Keeping barley competitive

Finally, WGRF is investing $740,000 into the National Barley Research Cluster. Led by the Barley Council of Canada, the Cluster includes representation along the entire value chain from producer groups to the end-users. This includes Alberta Barley, SaskBarley, and Manitoba Wheat and Barley Growers Association, the Brewing and Malting Barley Research Institute along with the Canadian Field Crop Research Alliance (CFCRA). CFCRA partners include: Atlantic Grains Council, Grain Farmers of Ontario, Producteurs de grains du Québec, and SeCan Association.

The Cluster will focus on projects that help maintain barley as a competitive crop choice for Canadian producers through improvements in agronomics, disease resistance and processing traits. WGRF will specifically support activities focused on variety development and pathology.

WGRF'S CLUSTER RESEARCH CONTRIBUTIONS

36
RESEARCH AND TECHNOLOGY TRANSFER ACTIVITIES

NEARLY
$5
MILLION

FOUR NEW AGRI-SCIENCE CLUSTERS

ORGANIC SCIENCE CLUSTER III
$675,000

DIVERSE FIELD CROP CLUSTER
$1,000,000

CANADIAN WHEAT CLUSTER
$2,500,000

NATIONAL BARLEY RESEARCH CLUSTER
$740,000

Wheat genome breakthrough

New research unlocks huge potential for variety development

After more than a decade and the efforts of 200 scientists from over 70 research institutions in 20 countries, including Canada, the International Wheat Genome Sequencing Consortium (IWGSC) has completely mapped the wheat genome. Researchers worldwide are celebrating this colossal feat – a chromosome-by-chromosome picture, which is five times larger and even more complex than the human genome.

"Essentially, we have completed the wheat genome jigsaw puzzle with all the pieces put together in their correct position and order, providing an enormous advantage for breeders when searching for genes that control important traits in the crop," says Curtis Pozniak, Researcher and Wheat Breeder in the Crop Development Centre (CDC) at the University of Saskatchewan (U of S).

Pozniak led the Canadian contingent for the massive undertaking through CTAG^2 (Canadian Triticum Applied Genomics). The CTAG^2 team is co-funded in part by WGRF and Genome Canada and includes researchers from the National Research Council of Canada, Agriculture and Agri-Food Canada (AAFC), the U of S, University of Guelph and the University of Regina.

Giving breeders a tool to improve wheat more quickly

Wheat breeders are excited about what the breakthrough research can mean for their work. "Breeders will now have the information they need to identify economically important traits more rapidly, which will better enable development of wheat varieties with increases in yield, enhanced grain quality, improvements in disease resistance and more resilience to environmental stresses," says Richard Cuthbert, Research Scientist and Wheat Breeder at AAFC's Swift Current Research and Development Centre. "The result will be more nutritious grain that can be grown more effectively and efficiently in harsher climates."

First application of the completed wheat genome

Researchers didn't hesitate to put the new wheat genome sequencing to work in the field and lab. Kirby Nilsen, an Assistant Plant Breeder at the CDC, is one of the first researchers to do so globally. He is using the new sequence to identify genes that will lead to the development of insect-resistant varieties to protect wheat yield and quality.

Wheat stem sawfly is a pest that can cost wheat producers 30 percent of their yield annually under infestation. According to Nilsen, solid wheat stems are key to preventing sawfly damage and may improve a plant's ability to handle heat stress.

Thanks to the completed wheat genome, Nilsen is able to use a molecular marker-assisted selection technique to identify the genes that carry hollow or solid-stem traits.

"Without using the complete wheat genome sequence it would have taken years to find the genes associated with stem solidness," he says, adding that it will now only take days to select the desirable genes for breeding.

Nilsen's project is just the first example of the how the wheat genome map can unlock potential for wheat breeders and producers.

"Essentially, we have completed the wheat genome jigsaw puzzle with all the pieces put together in their correct position and order, providing an enormous advantage for breeders when searching for genes that control important traits in the crop."

Canadian Agronomist

Knowledge translation and transfer

New website bridges information gap between the lab and field

Putting research insights into the hands of agronomists and farmers to help grow better crops. That's the goal of CanadianAgronomist.ca, a website launched in October 2018 by Bruce Barker, a professional agrologist and veteran agricultural writer and reporter.

"I've written a lot about research and research findings, and I've always felt there's been a bit of a gap in technology transfer," he says. "Researchers do a pretty good job, but sometimes important work falls through the cracks, and this is just another way of getting their valued information out to agronomists."

Agronomists in Western Canada are the primary target for the information, but farmers who visit the site will benefit, too. "Research published in scientific journals often sits on the shelf or on websites as abstracts. Most agronomists don't have the time to search for articles or even have access to the journals," says Barker whose company Haywire Creative is based in Bragg Creek, Alberta. "I pick and choose the research that I think has immediate practical application for agronomists and farmers."

The website summarizes the research from peer-reviewed academic journals or final research reports, into easily accessible and digestible 'Research Insights.'

"What I'm trying to do with Canadian Agronomist is keep on top of really good research papers that may not get out to the public. Even if the researchers are presenting at conferences, it's just another way of trying to get it out in a more formalized format for agronomists and farmers to use," says Barker.

Sponsorship and distribution

CanadianAgronomist.ca is solely funded by annual sponsorships via grower organizations and maintains independence from advertisers. WGRF, for example, is a founding sponsor at the platinum level.

"Getting involved with Canadian Agronomist is a natural fit for our organization," says Mike Espeseth, WGRF's Communications Manager. "As Canada's largest producer funder of crop research in Canada, we see the tremendous value in science communications and are a strong supporter of technology transfer."

Agronomists, farmers, researchers and students can sign up to receive email notifications of new Research Insights on the CanadianAgronomist.ca website. Research Insights are posted about every second week.

The response so far has been very positive. "Everyone's been really supportive," says Barker, referring to the intended audience as well as the research community. "The researchers that I've contacted, because I seek their approval on the summaries, think it's a great idea. The journal publishers – especially the Canadian ones – are also really quite supportive of it."

Visit CanadianAgronomist.ca to view the latest Research Insights, sign up to receive email notifications, browse the archives or use the search function to access specific topics.

> "I pick and choose the research that I think has immediate practical application for agronomists and farmers."

Specialty crop sequencing

Identifying the best rotational fit

Farmers of a certain age will remember that when canola was introduced it was called a specialty crop because it was new. It's hard to imagine now, given the ubiquity of canola across the Prairies and its role as the principal moneymaker on many farms.

Canola will always be a staple, but Jan Slaski would like farmers to have more high-revenue crop choices to add into their rotations; crops that may be novel now but that are as viable and profitable as canola has been for all these decades.

> "We want to offer a decision-making tool for growers so they can select the best stubble to grow specific crops on, and help avoid stubbles that are particularly bad for the yield and quality of the next crop."

Slaski is a Senior Researcher in ecosystems and plant sciences at InnoTech Alberta, an applied research organization in Vegreville. That last part is key. "Our whole mandate is about finding answers to farmers' questions," says Slaski. "So the genesis of this project was to answer the questions I was being asked by farmers at meetings."

The project he's referring to is a four-year crop sequencing study, funded in part by WGRF, designed to find out how to successfully introduce high-value specialty crops to typical western crop rotations. Because when farmers can generate canola-worthy revenue from novel crops, it's better for the soil, the environment and the economy.

Finding answers through sequencing

For nearly 20 years, Slaski has worked on and spoken about the agronomics of industrial hemp. "But growers were asking me 'where does it fit into my rotation?' And I couldn't really answer that question. I could tell them when to seed hemp, how to grow it, when to harvest it and so on, but not where it would grow best in the rotation," he says. "We could say don't grow hemp or flax after canola, but that was all we had. I couldn't say what it would do to next year's barley crop."

Farmers had the same question about other high profit potential crops, such as flax, pulses, corn and even quinoa. How could they put any one of these crops into rotation with minimal impact on their 'regular' crops?

A crop rotation study would seem to be in order. But Slaski and his team re-thought that and designed a crop sequencing study. "Sequencing means we can incorporate more crops and get more rotation scenarios," he says. "It addresses not only existing rotations, but comes up with more configurations than a straight rotation study."

For this project, 12 different crops, novel and conventional, are being grown in three agro-climatic zones of Alberta: the brown soil zone in the Lethbridge area, the black soil zone around Vegreville and the grey soils found in Falher, up in Peace Country. The Lethbridge site is under irrigation so, in partnership with Agriculture Canada, a fourth site at Indian Head, Saskatchewan, was added to include a rain-fed southern Prairie scenario.

The conventional, or core, crops in each region will be the same: wheat, barley and canola. The specialty

crops will differ depending on region. “We’re covering the novel crops that grow in and are relevant to specific areas,” explains Slaski. “That’s why we have canaryseed at Indian Head, because farmers already grow it there.”

On the specialty crop side, pea, hemp and quinoa are present at all four sites. Flax and faba bean are included at Vegreville and Falher, corn and dry beans at Lethbridge, and soybeans and canaryseed at Indian Head.

In 2018, using a replicated strip trial design, all eight crops were seeded for a total of 32 strips per site (eight crops x four reps). This year, the same crops will be seeded in strips perpendicular to the originals – imagine a chessboard pattern. Over the course of the study, this chessboard will be repeated three times on new ground at each of the four study locations.

The study design subverts normal rotational trials by not pre-determining crop order – quinoa will wind up on quinoa stubble, as well as stubble from all the other crops grown at a site. It will generate a huge amount of data. By the end of year two, Slaski and his team will have 64 crop sequence combinations from each trial site. By the end of the study, they will have 12 station-years of data that is far more robust than they’d have with a rotation-only trial.

Decision-making tool for yield and quality

Slaski’s goal for all of this data is not, as you might assume, to develop prescriptive rotational advice. “We want to offer a decision-making tool for growers so they can select the best stubble to grow specific crops on, and help avoid stubbles that are particularly bad for the yield and quality of the next crop.”

Jan Slaski, Senior Researcher in ecosystems and plant sciences, InnoTech Alberta

He wants to avoid the short rotation conundrum canola finds itself in – where, in an attempt to reap the rewards (literally) of a high-value crop, growers overplant it, which leads to increased disease incidence and severity, resulting in higher production costs and poorer returns. “Canola-snow-canola-snow, this is not good,” says Slaski. “Monoculture is a mistake, no matter what the crop.”

“I think it’s the right time,” he says. “Farmers seem interested, they realize there is potential – blackleg and clubroot are curbing canola production, so they are more receptive to new ideas. With this information they can have some peace of mind to know how a new crop can fit.”

REGION-DEPENDENT CROPS	PLANTED ACROSS ALL LOCATIONS: CORE CROPS	PLANTED ACROSS ALL LOCATIONS: SPECIALTY CROPS
FLAX, FABA BEANS	WHEAT	PEAS
FLAX, FABA BEANS	BARLEY	QUINOA
CORN, DRY BEANS	CANOLA	HEMP
SOYBEANS, CANARYSEED		

Oat disease management

Filling in the blanks

Growing up on the family farm in eastern Saskatchewan, Jessica Pratchler thought everybody grew oats. And no wonder – the area is an oat powerhouse. Indeed, most of the milling-quality oats produced for the North American food market are grown on the Prairies, with roughly one third of that coming from eastern Saskatchewan.

Jessica Pratchler, Research Manager, Northeast Agriculture Research Foundation

Despite this high-value market, oats are a blip in terms of seeded acres next to staples like wheat and canola: compare the 3.1 million acres of oats planted in 2018 to the 24.7 million acres planted to wheat, or the nearly 23 million acres of canola.

That lack of popularity is one reason that oat research is somewhat thin on the ground. “Oats don’t have a lot of agronomy dollars thrown at them,” says Pratchler, who is Research Manager for the Northeast Agriculture Research Foundation (NARF) in Melfort, Saskatchewan. “The information we do have about the best ways to grow oats is anecdotal or outdated.”

Improving oat yield and quality

It’s no understatement to say that Pratchler is very pleased to be running a three-year research project, funded partly by WGRF, designed to see if some of that anecdotal information has some objective truth to it that oat growers can use to improve yield and quality.

Specifically, she’s looking at an integrated approach to disease management in oats that includes factors such as plant population (seeding rate), genetic disease resistance and fungicide timing. She wants to find out what combinations of these factors work best to reduce disease while increasing yield and quality.

As Pratchler explains, there are some key knowledge gaps when it comes to integrated disease management in oats. Past studies have looked at single-issue aspects of oat production – like cultivar response to fungicide, or the effect of fungicide use on yield and quality – but that’s not real life in the field. “Farmers aren’t faced with making one decision on one crop,” she says. “This study encompasses more of their questions.”

Questions like is it useful to apply fungicide to any oat cultivar – even ones with disease resistance? Does seeding rate affect fungicide timing? Does cultivar choice dictate seeding rate? When is the best time to apply fungicide in oats? Does fungicide use affect milling quality?

To find answers, Pratchler has designed a small plot research study in four key oat-growing regions: Melfort, Yorkton, Indian Head and Redvers – all in Saskatchewan. "We're using CS Camden and Summit across all locations," she says, explaining that both are approved milling varieties. Summit has intermediate resistance to crown and stem rust while CS Camden is rated susceptible to both.

The trial is a typical randomized plot design with four replicates. "Seeding rate and variety are together as one treatment," explains Pratchler, adding that each variety was seeded at 300 (current recommended seeding rate for oats) and 450 seeds per metre-row. There were three fungicide treatments: application at flag leaf, application at heading and untreated.

"We did disease ratings before each fungicide application and at the milk stage of kernel development," she says. It's important to note that along with the major oat disease problems, rust (crown and stem) and the Septoria leaf blotch complex, Pratchler and her team also looked for *Fusarium* head blight (FHB). It's not that FHB poses a lot of problems for oat quality, but in an area where a lot of wheat is grown, infected oats could become a problem with inoculum buildup, making it an important disease to include in the study.

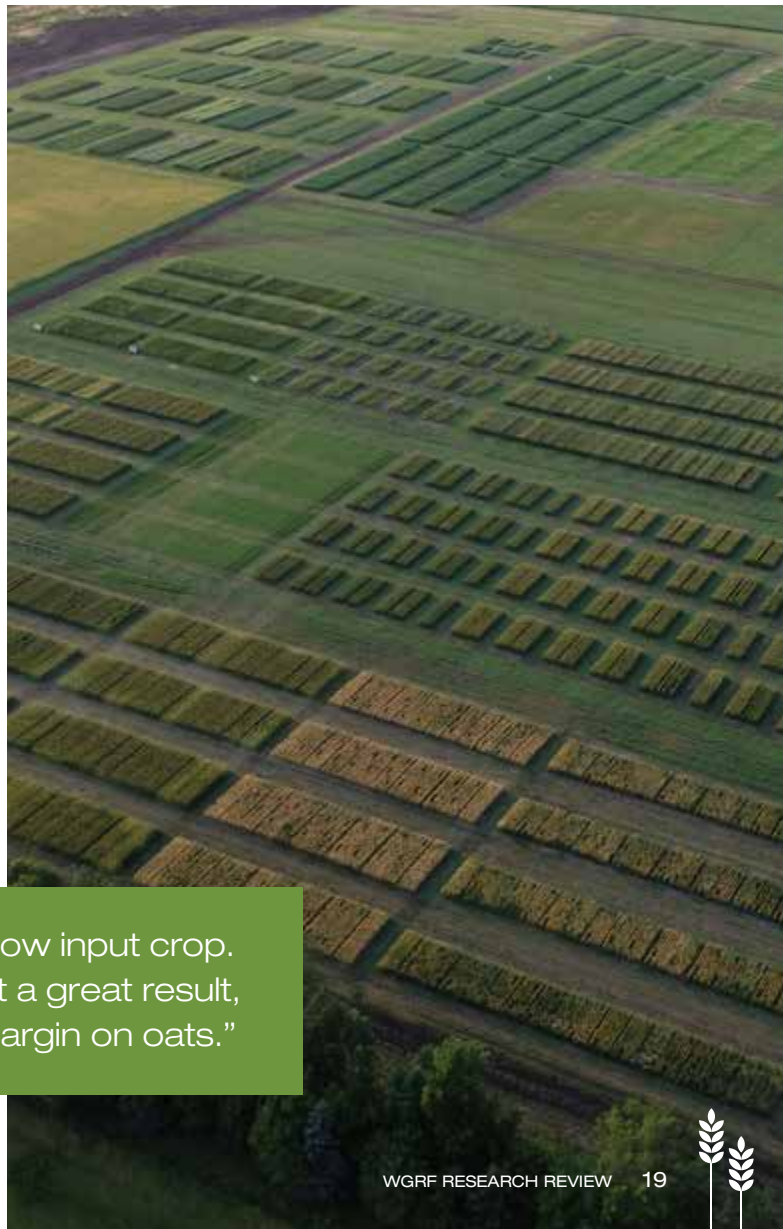
The team also rated the plots for lodging, maturity, yield and quality. Pratchler's team will be looking at 1,000 kernel and test weights, and samples from harvested plots will be sent to General Mills. "They'll do a milling quality analysis and test for the effects of fungicide on milling quality," she says.

Early results

She is still crunching the numbers on year one, but Pratchler has noted a couple of things. "At Melfort, we saw that seeding rates definitely help with better crop uniformity," she says. "The fungicide kept oats greener longer but maturity between treated and untreated was within a few days of each other."

The next two years will reveal more about the interactions between oat cultivar, seeding rate, fungicide use and timing, and how these interactions can influence yield, maturity, quality and, ultimately, profitability.

"I'm hoping to show oats aren't just a low input crop," says Pratchler. "That if you show it some TLC you'll get a great result, and you can still have a competitive margin on oats."



"I'm hoping to show oats aren't just a low input crop. That if you show it some TLC you'll get a great result, and you can still have a competitive margin on oats."

Provincial weed surveys

Knowledge is power when it comes to weed management

When you make herbicide decisions, you probably think about much more than price. You likely think about the weed spectrum on your land, what resistance issues you have noticed in the past, or what you may have in the future. If you're really keen, you might even dig up some field histories and take note of any changes in weed populations over time. The point is you can't start planning how you're going to defeat the enemy until you know who the enemy is, exactly.

That job is about to get a bit easier once all data collected through Agriculture and Agri-Food Canada's (AAFC) provincial weed surveys goes online.

Making info accessible for farmers

"We are going to combine all the survey data from when they started in the 1970s up to 2017," says Julia Leeson, Weed Monitoring Biologist with AAFC in Saskatoon. "We want to make it more accessible to the public." It's not that farmers can't access this information now, she explains, but they have to ask for it and it doesn't come in a digital format.

> The dream is that farmers can go online and, with a few simple clicks, see weed trends across provincial boundaries, what weeds are where, how abundant they are, where resistant populations exist, and the year-over-year changes.

With funding from WGRF, Leeson and her team will not only get historical weed survey data online, they'll also be able to complete the sixth set of weed surveys across all three Prairie provinces. That will happen between 2019 and 2023. "It's a bit of a shorter timeframe," she says, adding that the usual gap between surveys is five to ten years, sometimes longer, depending on funding availability.

That shorter timeframe is important because while weed trends are revealed over time, letting too much time go between surveys can potentially skew results. "The last Saskatchewan survey in 2014 showed over 40 weed species that increased in frequency since the previous survey," says Leeson. "But Saskatchewan was really wet in 2014 and dry in 2015, so we'll find out if that was just a flash in the pan or if that survey was highly influenced by the weather in the year it was done."

The lessons of history

Prairie weed surveys were formalized in the 1970s, but Leeson says data was being collected long before that. In the 1960s Agriculture Canada sent questionnaires to the many extension staff across the Prairies to collect information about weed populations and distribution in each of their areas.

Even before that, AAFC was interested in the subject. "There was a guy who took a train across the West and documented all the weeds he found at stations along the way," she laughs.

"We do refer to all that older data," says Leeson. "It gives you an idea of when particular weeds may have been introduced here."

When Gord Thomas, a now retired AAFC Research Scientist, formalized the surveys, the goal was to get a sense of what weeds were present on the Prairies and how they were distributed.

By the 1980s, a management component was added where farmers were asked about the management practices used on surveyed fields. "There was some degree of management data before that time, but it simply made sense to formalize it," says Leeson. "All these weeds are here, but why? Is it tillage practices, herbicide timing, the crop?"

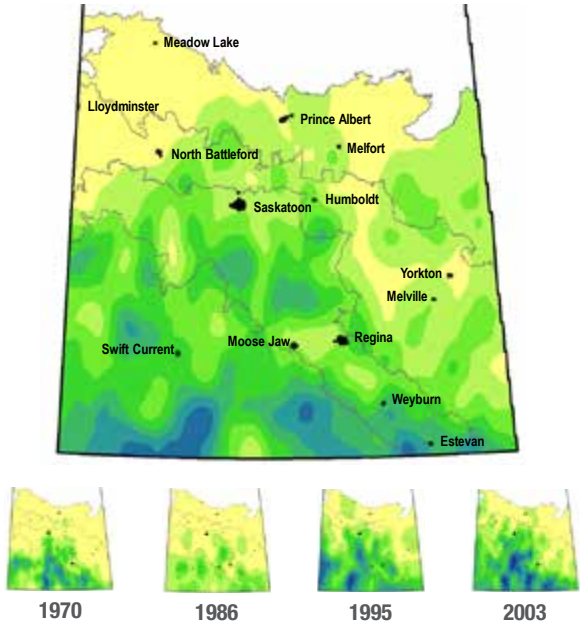
Another layer of data was introduced in the 1990s when post-harvest resistance surveys were added to the mix to determine the incidence and range of key resistant weeds.

The weed surveys Leeson is about to undertake look a lot different from the early days. "We survey areas with similar landform characteristics, such as soil type, topography, and natural vegetation," she says. These eco-districts have been identified right across Canada and provide a more accurate picture of weed populations and distribution than the older surveys that were structured around Rural Municipality boundaries.

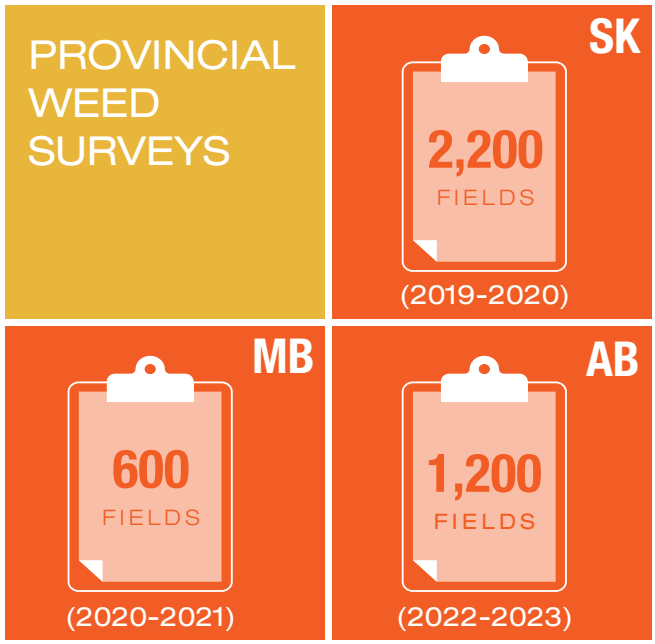
The Saskatchewan survey will begin in 2019 and take two seasons to complete. "It's because the cropping area there is so big," says Leeson, adding the target is to survey 2,200 fields in that province. The Manitoba survey (600 fields) begins in 2020, and Alberta (1,200 fields) in 2022. The number of fields surveyed is based on seeded acreage in each province and target the most common annual crops, as well.

Once these new surveys are complete, they will also be added to the online resource Leeson is in the process of developing. The dream is that farmers can go online and, with a few simple clicks, see weed trends across provincial boundaries, what weeds are where, how abundant they are, where resistant populations exist, and the year-over-year changes. It's powerful knowledge that will help growers make more informed management decisions.

Kochia



A snapshot of Kochia prevalence collected through the Saskatchewan provincial weed survey that dates back to the 1970s.



Cereal, pulse and oilseed avengers

Protect the pest-fighting superheroes in your fields

There is a powerful team of pest-fighting superheroes at work in fields across Western Canada. Ground beetles gobbling cutworms, lady beetles devouring aphids – these are just two examples of courageous beneficials controlling insect pests at no cost to growers.

"We have this hidden army of beneficials running around on the ground cleaning things up that nobody really sees," says Tyler Wist, Research Scientist and Field Crop Entomologist with Agriculture and Agri-Food Canada in Saskatoon. "The acceptance of beneficial insects and the ability of people being able to identify them in their own crops is really going up."

This knowledge base is growing thanks to the work of Wist and other entomologists across the Prairies. Awareness is also increasing thanks to Field Heroes, an educational campaign spearheaded by the Western Grains Research Foundation since 2017. Its ongoing goal is to encourage growers to 'think beneficials before you spray.'

Get to know common beneficials and pests

Scouting is an important best management practice and one way to help growers consider beneficial insects in their crop production decisions.

"What's important is to get to know the most common beneficials," says John Gavloski, Entomologist with Manitoba Agriculture and key contributor to the Field Heroes effort. "You don't have to identify everything in your sweep net but know your most common pests and beneficials. Field Heroes is doing important work by encouraging people to get to know beneficial insects so they're not confusing them with potential pest insects."

In year two, Field Heroes focused in on the top beneficials in key western Canadian crops. To this end, the campaign featured the pest-fighting insects that make up the 'Cereal Avengers,' the 'Pulse Avengers' and the 'Canola Avengers.' Tied into an 'Insect Wars'

"We have this hidden army of beneficials running around on the ground cleaning things up that nobody really sees. The acceptance of beneficial insects and the ability of people being able to identify them in their own crops is really going up."

creative theme, the timely and eye-catching promotional materials helped growers take notice and directed them to the FieldHeroes.ca website for scouting information and resources.

This year's campaign also encouraged growers to reach out to agronomists for help protecting beneficials. In fact, it's helping people connect in all sorts of ways.

Growing online community

The Field Heroes conversation is largely carried online via social media. The engagement on Twitter is so strong that it is producing an ever-growing online community. The @fieldheroes Twitter handle has amassed nearly 1,000 followers and more than one million Twitter impressions in just over one year.

Many of the active Twitter followers are entomologists, like Wist, who encourage growers to get involved. "Scout your fields and know what's there. If you don't know what it is, it's pretty easy to tag someone on Twitter," he says. "You'll get an answer right away and a suggestion about what do to about it."

Growers and agronomists are encouraged to join the conversation online @fieldheroes.

INSECT WARS

THE PULSE AVENGERS

LADY BEETLES

GREEN LACEWING

HOVER FLIES

GROUND BEETLES

MINUTE PIRATE BUGS

Get to know the team of Field Heroes who are natural enemies to the pests in your pulses.

ACCESS THE SCOUTING GUIDE NOW.

fieldheroes.ca

FIELD HEROES

THINK BENEFICIALS BEFORE YOU SPRAY