MANITOBA CROP ALLIANCE

The Focal Point

Winter 2025 Edition

BUNDLE UP!

Tackling corn's cold tolerance

PLUS

EXPLORING SUNFLOWER PROTEIN POTENTIAL / 7

RESEARCHING SOLUTIONS TO SOIL COMPACTION / 18

MESSAGE FROM THE CHAIR

***Robert Misko** — Roblin, Manitoba*

Welcome to the 2025 edition of *The Focal Point*, Manitoba Crop Alliance's (MCA) annual research magazine.

Over the past year, MCA has continued to grow our research program, ensuring our investments will make every Manitoba farmer member more productive and sustainable. Our commitment to independent, farmer-focused research remains at the core of what we do. With 122 active projects, we are proud of how far we have come and the strong partnerships we have cultivated across the industry.

We are excited to highlight how our research program supports variety development, agronomic best practices and environmental sustainability — directly aligned with the priorities of our farmer members. Investments in meaningful, independent research, as outlined in our strategic plan, ensure every levy dollar is put to work delivering valuable knowledge and practical tools for Manitoba farmer members.

On behalf of the board, delegates and staff at MCA, I want to extend our appreciation for your ongoing support. We hope you find the research featured in *The Focal Point* valuable and applicable to your farm, and we are excited to continue working for you to ensure Manitoba's farming community thrives, now and into the future.

Sincerely,

Robert Misko
MCA Chair

MANITOBA CROP ALLIANCE

CONTENTS

THE FOCAL POINT | WINTER 2025 EDITION

Each project featured in this publication is proudly funded by Manitoba Crop Alliance

4 **BARLEY** | **Meet a Researcher**
GROW Barley lead strives to advance barley agronomy

7 **SUNFLOWER** | **Bulking up**
Exploring sunflower protein potential

10 **CORN** | **Corn vs. the cold**
Pushing the boundaries of early seeding and emergence

15 **FLAX** | **Need for speed**
Accelerated breeding strategy for flax improvement

18 **WHOLE FARM** | **Under pressure**
Researching solutions to soil compaction

21 **WINTER WHEAT** | **Cutting-edge crops**
Modernizing winter wheat production systems

26 **RESEARCH BY THE NUMBERS**

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MEET A RESEARCHER

HIROSHI KUBOTA

GROW Barley lead strives to advance barley agronomy

▲ ***Above and left:*** *Hiroshi Kubota is a research scientist in sustainable cropping systems at Agriculture and Agri-Food Canada's Lacombe Research and Development Centre.*

PHOTOS COUTESY DON BEAUCHESNE (TOP) AND LARRY MICHIELSEN (BOTTOM).

Agronomy has a major impact on grain yield and quality, but there has been limited agronomic research conducted on newly developed barley varieties. New varieties have improved genetic potential, but the agronomic practices to fully optimize these improvements have fallen behind.

Bridging this gap is a key aspect of the Grant for Research Optimization of Western Barley Agronomy (GROW Barley) framework launched in February 2024. GROW Barley is a seven-year commitment to an agronomic scientist focused on advancing barley research to ensure it remains a competitive crop choice for farmers.

The framework is administered by the Canadian Barley Research Coalition (CBRC) and guided by a steering committee made up of farmers, crop commissions and other funding agency employees, and industry members. The steering committee and CBRC board selected Hiroshi Kubota as the lead researcher for the GROW Barley framework.

"Dr. Kubota brings a wealth of knowledge and a passion for barley. He has a track record of solid agronomic research and the background to succeed in this role," says Andrew Hector, agronomy and extension specialist for cereal crops with Manitoba Crop Alliance (MCA) and member of the GROW Barley steering committee.

"In developing the framework, Kubota has sought out increased connection with commodity organizations and farmers to ensure the framework is addressing real-world issues facing our members. I think this connection will be invaluable."

Kubota is a research scientist in sustainable cropping systems at Agriculture and Agri-Food Canada's (AAFC) Lacombe Research and Development Centre (RDC). Originally from Japan, he earned his bachelor of science in agriculture at Tokyo University of Agriculture, focusing on tropical agriculture.

After graduating, he spent a couple years travelling, including time in Papua New Guinea and Australia. Returning to Japan, he worked for food importing companies, while saving money for his graduate studies. In 2009, he moved to Canada to pursue an M.Sc. in plant science at the University of Alberta. After completing his master's, he continued with a PhD, graduating in 2018 before beginning his current position with AAFC. He lives in Lacombe, AB, with his wife and two young daughters.

What is the best part about your job?

Connecting with stakeholders in the agriculture industry. As a relatively new research scientist, and a non-Canadian born one, it is important for me to understand Canadian agricultural systems as much as I can. Farmers, industry stakeholders, commodity organizations and colleagues are always welcome to share their thoughts, experiences and challenges. This collaboration helps me to provide the best scientific information possible.

What got you interested in agricultural research?

My uncle's volunteer work as a science teacher in Africa greatly influenced my interest in agriculture. Growing up without the Internet, I was fascinated by his stories and the photos he shared – both the positive and challenging aspects of life in Africa.

One story about children suffering from poverty and malnutrition made me want to help. The first thing that came to mind was medicine, but I quickly realized I did not like the sight of blood.

That is when I started to think about agriculture as a career and chose to study in Japan. I was not from a farm family. Everything I learned about agriculture at university fascinated me, and I enjoyed my time there. After graduation, I was about to volunteer in Africa when the program was cancelled. I was still interested in agriculture and decided to come to Canada to learn more about crop production here.

ON YOUR FARM

GROW Barley framework closes the barley yield gap and strengthens competitiveness of the crop

Can you tell us about your focus for the GROW Barley framework?

As lead of the GROW Barley framework for the next seven years, my focus is on improving barley agronomy in Western Canada. Good agronomy is critical to improving competitiveness with other crops. Significant investments by industry and government are made in variety development, but the adoption of those new varieties is slow compared to other crops like wheat due to the complexity of the barley industry.

There are several barley agronomy studies underway in Western Canada. Through the GROW Barley framework, I intend to address gaps in existing or ongoing barley agronomy research activities and have identified four key research activities:

Lodging: I will look at the impact of agronomic practices on lodging in barley and explore methods of predicting lodging risk at the early growth stages for timely application of plant growth regulators.

Variety adoption: I hope to speed up adoption of new barley varieties through post-registration agronomy studies. Nitrogen fertilization and fungicide application are two focus areas.

Biological nitrification inhibition:

continues on next page

Captured during the 2024 growing season in Melfort, SK, this photo showcases one of Kubota's barley studies evaluating five new feed barley varieties from Western Canada, Nutrien and Europe to determine optimum seeding rates.

PHOTO COURTESY HIROSHI KUBOTA.

This trait is a promising approach to reduce greenhouse gas emissions, and one I hope to begin foundational studies.

Rotation: I will examine the effect of barley frequency in rotation on net revenue and disease, though this activity may evolve.

As of October 2024, one activity is at the full proposal stage, and we expect a decision in early 2025 with hopes to start that season.

Are there any other upcoming projects or activities that you'd like to share with farmer members?

Outside of GROW Barley I am leading three barley-related projects this year and am grateful for the industry's support for this research.

The first project focuses on determining optimal seeding rates of five new feed barley varieties from different genetic backgrounds, including varieties from Western Crop Innovation, the University of Saskatchewan, AAFC Brandon and Nutrien.

The other two projects are malting barley studies evaluating agronomic practices to achieve uniform maturity.

What can you say about the value of farmers providing funding and support to your work?

Support and funding from farmers are invaluable to me as a research scientist. I'm fortunate to be in Western Canada, where both industry partners and farmers actively contribute to advancing research. This funding makes it possible for me to carry out work that directly benefits farmers, and I'm deeply grateful for the trust and support I've received. It motivates me to ensure the research I conduct delivers practical, meaningful outcomes for the agricultural community.

How does that funding and support directly benefit farmers?

When considering research projects, I review research priorities from crop commissions and, when possible, speak directly with farmers. Since the crop commissions represent farmers, I trust that I'm hearing their key challenges. My focus is on developing research ideas that are practical and beneficial, ensuring the outcomes have a direct impact on the farm.

A recent study reviewing the adoption of new barley varieties highlighted a return of $28 to $1 for farmer dollars invested in breeding. As a part of the GROW Barley framework, I would strive to accelerate the adoption process after a new variety's registration. If we can reduce this process by four years, this could increase the return from $28 to $44 per $1 invested by farmers.

Is there anything else you want our members to know?

I would like to emphasize that I'm always eager to talk and learn from farmers. I'd like to listen to your challenges and discuss new ideas. I would appreciate any opportunity, so please feel free to email me at ***Hiroshi.Kubota@agr.gc.ca*** *or say hello if you see me at a meeting or event.*

What do you do for fun outside of work?

Outside of work I like to do physical activities. I used to rock climb before I injured my knee. With two little kids, it can be hard to find time for hobbies! I also love skiing and swimming. I used to be on a competitive swimming team from Grade 6 to 12 in Japan.

How do you celebrate agriculture?

I love eating and cooking, and I try to eat locally grown crops as much as I can. My kids are two and five, and we try to let them experience any agriculture-related activities as much as we can.

What is your favourite crop?

I would have to say barley, especially now that I am leading the GROW Barley framework. But beyond that, I can see barley's journey from field to table because I like beer! My research lets me help farmers grow the crop, and I get to "experiment" by tasting lots of craft beers. So, I really enjoy working on barley.

GROW BARLEY FRAMEWORK

"What makes this initiative unique is the collaborative, industry-driven funding model, which allows (commodity organizations) to work closely with researchers over a long term to build interest in research and achieve progress in barley agronomy," says Sheila Elder, MCA director and member of the GROW Barley steering committee.

The agreed investment by MCA ($100,000), Sask Barley ($750,000), Alberta Grains ($650,000) and the Brewing and Malting Barley Research Institute ($14,000) totals $1.5 million to be paid over seven years from Dec. 31, 2024, to Dec. 31, 2031. This investment will be leveraged through matching funds, multiplying the impact of farmer dollars to advance the framework's results.

These resources will directly address key agronomic research priorities to strengthen the competitiveness of barley. By providing growers with the latest tools and practices to optimize yield and quality, the framework will help accelerate the adoption of new barley varieties and reduce the yield gap.

"By leading GROW Barley, Kubota is building a bridge between science and the field," Hector says. "His work will deliver information to help growers make the most of new barley genetics."

For more information about the GROW Barley framework, visit barleyresearch.ca/grow-barley-funding.

MCA INVESTMENT OVER SEVEN YEARS: $100,000

CO-FUNDERS:

Alberta Grains | Brewing and Malting Barley Research Institute | SaskBarley Development Commission

BULKING UP

Exploring sunflower protein potential

Manitoba grows approximately 90 per cent of Canada's sunflowers. Sunflowers are a good rotational crop as they are adaptable and can be harvested even after an early snowfall without losing quality.

In 2024, according to Manitoba Agricultural Services Corporation (MASC), around 40 per cent of sunflowers produced in Manitoba were grown for confectionary purposes, used primarily in snacks or baking ingredients. Oilseed varieties accounted for the remaining 60 per cent and are mainly used for bird food and sunflower oil production. Sunflower oil is a high-quality vegetable oil, while the meal, which contains around 35 per cent protein, is often used in livestock feed or discarded.

There is growing interest around developing oil-type sunflower seed meal into a potential protein source, as companies explore ways to capture added value from this byproduct. Although sunflower meal isn't widely utilized in human food markets, Canada-based Burcon NutraScience and a few U.S. companies are investigating protein extraction from oilseeds.

Manitoba Crop Alliance (MCA) is interested in gathering more information on this opportunity for our members and is supporting research at the University of Manitoba (U of M) investigating sunflower protein content and composition to uncover value-added opportunities.

Currently, sunflower meal is primarily used for animal feed, but there isn't enough volume to support large-scale feed formulations. This research could lead to opportunities to utilize these lower-volume meals more effectively, creating niche markets for the crop.

"If we can advance our understanding of sunflower protein composition, it could unlock new

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Lead Researcher:

James D. House

James D. House, who passed away in September 2024, was a professor and the Manitoba Strategic Research Chair in Sustainable Protein in the Department of Food and Human Nutritional Sciences at the University of Manitoba in Winnipeg, MB. He received his PhD in amino acid nutrition and metabolism from the University of Guelph in 1996.

possibilities," said James D. House, who passed away in September 2024 but was previously the Manitoba Strategic Research Chair in Sustainable Protein in the Department of Food and Human Nutritional Sciences at the U of M.

"For example, sunflower meal could be used to create food products, like tofu or meat alternatives (e.g., sunflower-based chicken nuggets). These products offer high value without needing massive volumes."

House added that these value-added possibilities could improve product value and demand, leading to increased sunflower acreage for farmers. "Educating the community about these opportunities and the broader benefits of sunflower protein can help build momentum and potentially boost acreage and prices," he said.

The three-year project, "Determination of the impact of genetic and environmental factors and their interactions on the protein quality of sunflower seed," began last year. It aims to:

1. Develop near-infrared spectroscopy (NIRS) calibration equations to predict protein, moisture and amino acid content in dehulled sunflower seeds and defatted meal.
2. Assess protein digestibility, amino acid content and overall quality of sunflower seed protein meals from 11 varieties grown in MCA variety trials at two locations over three cropping years (2023 through 2025).
3. Analyze the impact of genotype and environmental factors on protein quality and link these findings with other agronomic data.

NIRS is a rapid, cost-effective and non-destructive method for predicting protein and amino acid content, offering advantages over traditional, labour-intensive techniques. The data from NIRS can support breeding programs to improve protein quality in sunflower seeds and meal. Its non-destructive nature and low cost make it especially valuable for breeding programs with limited seed volumes, and its rapid analysis (30 seconds to two minutes per sample) requires minimal training.

The project spans five locations across Manitoba: Elm Creek, Carberry, Beausejour, Melita and Rossendale. Over three years, researchers will assess how genotype and environmental factors influence protein quality, using data from MCA's sunflower variety trials. Conducting this study over several years in different agro-climatic regions will provide insight into the influence of environmental conditions, agronomy and genetics on resulting protein content. This will provide foundational information to assist with decision making for both farmers and plant breeders to support sunflower protein as a value-added opportunity.

ON YOUR FARM

Sunflower protein research for potential new market opportunities

"This research is exploratory but has the potential to unlock new market opportunities," says Korey Peters, a delegate on MCA's sunflower crop committee. "We want to be prepared with this information if and when the market demands it, so our members can make informed decisions about variety selection, environment and management practices."

Researchers have completed crude fat and dry matter analyses and are finalizing protein and amino acid profiles. They are also investigating if there are potential components within sunflowers that might prove a challenge or limitation for use in food.

This research aims to help farmers better understand how their agronomic practices and varietal selection not only impact yield and disease resistance, but also the quality of their product. "Farmers can use these findings to position their products for emerging markets,"

In memory of James D. House

Manitoba Crop Alliance is deeply saddened by the passing of James D. House on Sept. 10, 2024. He left an indelible mark on our industry.

House was not only a leader in protein research, but also a dedicated mentor who advanced our understanding of plant- and animal-based protein sources in human nutrition.

As a professor at the University of Manitoba, House mentored more than 40 graduate students and 16 post-doctoral fellows and research associates, as well as more than 40 undergraduate research assistants. His dedication to understanding protein quality helped drive research that will benefit farmers and food systems long into the future.

House's passing is a significant loss, but his legacy lives on in the research initiatives he spearheaded. He will be remembered for his passion and mentorship and will continue to inspire for years to come.

House said. "We have seen small companies grow into bigger players in niche markets, and this could be an opportunity for sunflowers."

The desired outcome is that farmers will be able to use these findings when selecting sunflower varieties for optimal protein content and quality. This may pave the way for identity-preserved breeding and production systems to meet the growing demand for alternative proteins in both animal and human food systems. Expanding the use of sunflower seed protein could also increase demand for sunflower production, an area where Manitoba holds a competitive advantage. ●

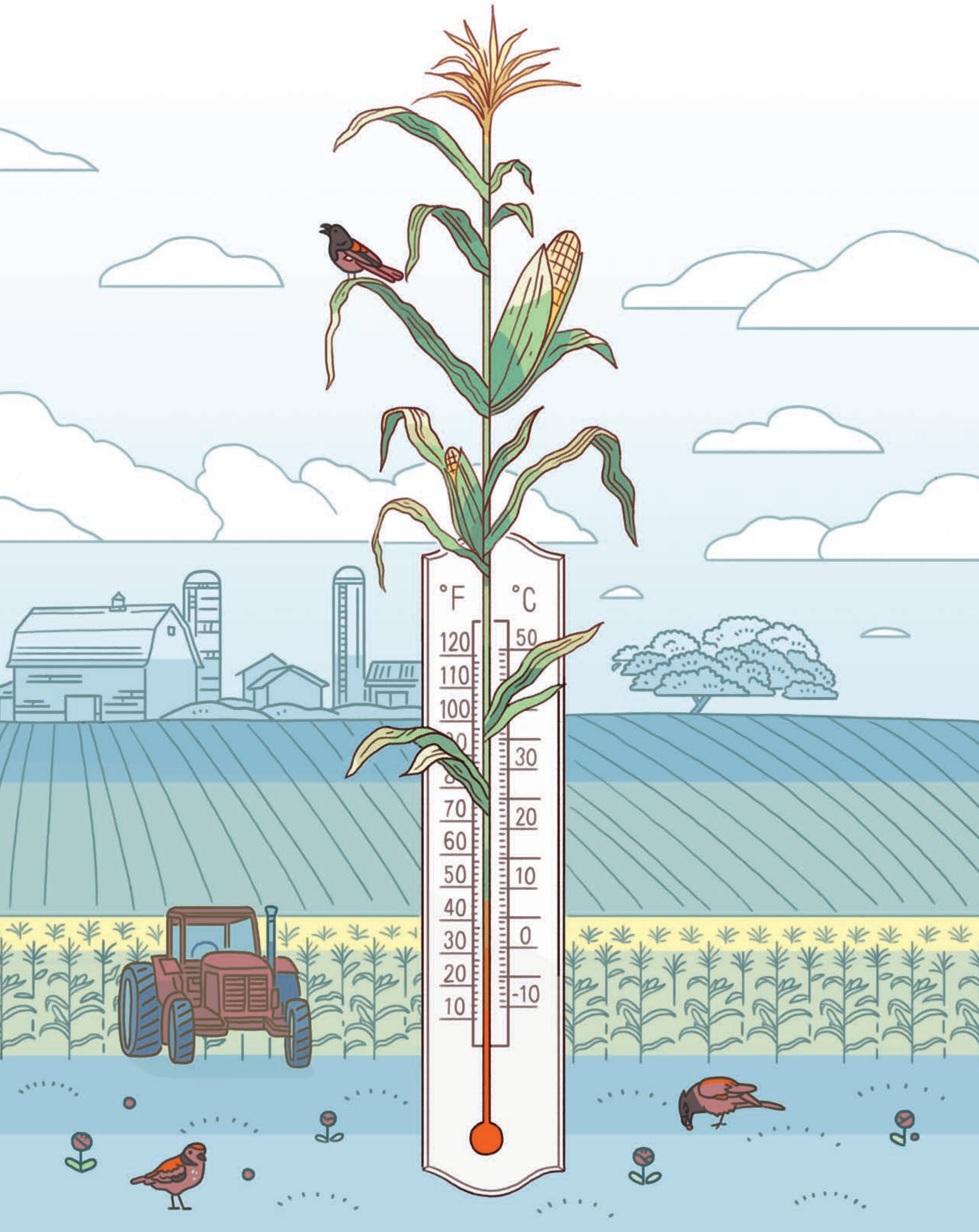
▼ *The L-250 Laboratory Heavy Duty Screw Press (French Oil Mill Machinery Company),* ***below****, has a feed rate of up to 60 kg/h. The steam mixer,* ***inset****, can heat the press from 50 C to 90 C, increasing oil extraction efficiency.*

MCA INVESTMENT OVER THREE YEARS:
$156,802

CO-FUNDERS:

Sustainable Canadian Agricultural Partnership

PHOTOS COURTESY UNIVERSITY OF MANITOBA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CORN vs. THE COLD

Pushing the boundaries of early seeding and emergence

In Manitoba, early corn emergence is key to strong crop performance. Corn is a long-season crop, and early seeding is crucial for maximizing yields. However, fluctuating, cold spring temperatures can harm early planted seeds through chilling injury or increased disease incidence, negatively affecting germination and emergence.

Seed treatments help protect against disease, but prolonged exposure in cool soil can wear them down, leaving plants vulnerable to bacterial and fungal infections. Additionally, slow emergence delays maturity, with some corn hybrids failing to mature before a heavy killing frost, which impacts quality and even drying costs.

Scientists at Agriculture and Agri-Food Canada (AAFC) are exploring several strategies to improve speed of emergence and early crop vigour in corn, and new research is exploring the role residue management plays in rapid crop emergence and early season vigour.

"Climate change, or increased variability in our climate, means our varieties have to be resilient," says Malcolm Morrison, a research scientist at AAFC's Ottawa Research and Development Centre (RDC). "Corn varieties need to be able to switch gears quickly, from taking advantage of the warmth to continuing growth in the cold."

Morrison began working on cold tolerance in 2012 with former corn breeder Lana Reid.

ON YOUR FARM

Improved corn cold tolerance for Manitoba growing conditions

Along with a team of researchers, they have been investigating cold tolerance through two rounds of Collaborative Research and Development Agreements (CRADA) funding (2013-17 and 2018-22).

Seven years of self-pollination and repetitive selection at the Ottawa RDC have resulted in corn inbred lines with faster emergence in cold conditions than recommended hybrids in Manitoba. An inbred line is a genetically uniform plant produced from generations of self-pollination. A hybrid, made from two or more inbred lines, is more genetically diverse than an inbred and has hybrid vigour.

When breeders have access to inbred lines with improved cold tolerance, these traits can be incorporated into hybrid development with the objective of improved genetic characteristics becoming available to farmers.

The focus of Morrison's research is on rapid germination, seedling growth and cold tolerance. "Getting the jump on spring corn growth" is a research project that began in 2023 and is led by Morrison.

Building on years of cold tolerance research, the project aims to assist farmers by developing corn that can emerge and thrive in colder soil conditions, which is vital for early planting in Manitoba. The research has three main objectives:

- Repeat corn seedling emergence tests with established inbred lines and hybrids.
- Determine in a growth cabinet if fast coleoptile emergence and root

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Lead Researchers:

Malcom Morrison** and **Ramona Mohr

Malcolm Morrison is a crop physiologist at Agriculture and Agri-Food Canada's Ottawa Research and Development Centre. His career has focused on finding new crop varieties resilient to abiotic stresses such as cold, heat and moisture stress.

Ramona Mohr is a research scientist (agronomy) at Agriculture and Agri-Food Canada's Brandon Research and Development Centre. Since 1998, Mohr has led and collaborated on research focused on developing crop management strategies to support the economic and environmental viability of farming systems in Western Canada.

ILLUSTRATION: HAYDEN MAYNARD

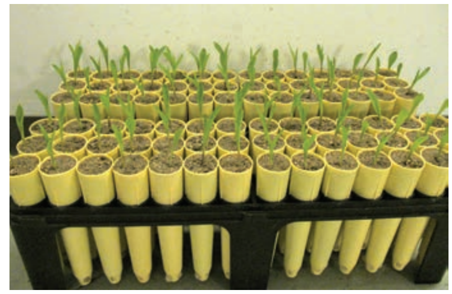

FIGURE 1A (LEFT) | Corn seedlings after 21 days in temperatures from 7 C to 13 C.

FIGURE 1B (ABOVE) | Corn seedlings after 21 days in temperatures from 13 C to 24 C.

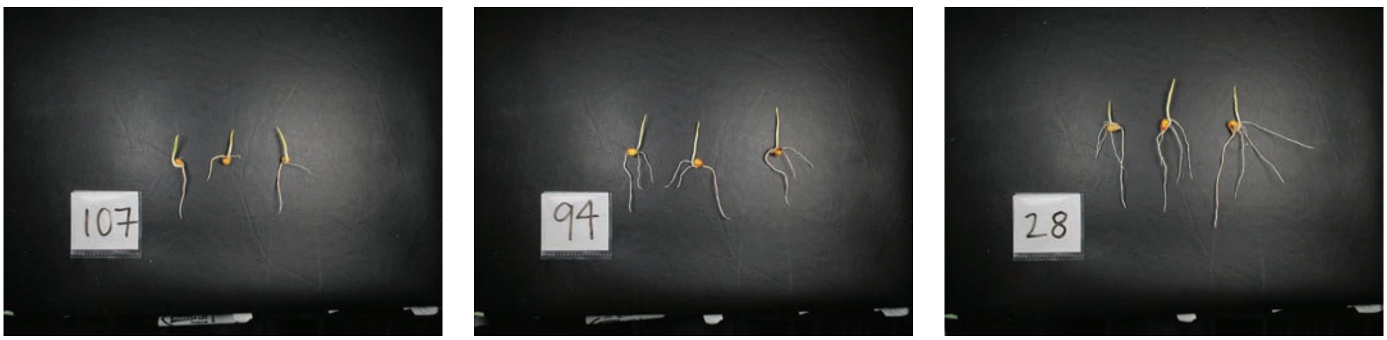

FIGURE 2A | Corn seedlings grown in cold temperatures resulting in low (107) medium (94) and high (28) root growth.

FIGURE 2B | A comparison of line four grown in cold (left) and warm conditions for 145 corn heat units (CHU).

development also lead to faster seedling growth during the first month in temperatures simulating a cold spring day.

- Measure the success of 30 corn hybrids made from lines selected from the cold emergence testing system in field conditions in Manitoba and Ontario (Ottawa).

"Selecting corn hybrids for fast emergence in cold soils will help the corn crop get a jump in spring on cold years," Morrison says. "Developing hybrids that germinate and grow quickly in cold spring soils results in earlier maturity and allows more time for natural cob dry-down, ultimately saving farmers money."

However, that increase in cold-temperature resilience can't come at the expense of performance when the temperatures start to rise.

"If we produce lines that only do well in cold, then in warm temperatures there'd be a penalty," Morrison adds. "We don't want that, we want lines that perform well under any condition."

In this project, seed from 141 inbred lines, three parents and six commercial corn hybrid varieties were tested for cold-tolerant germination.

Seeds were planted 20 millimetres deep in a mix of sand and vermiculite (1:1) in nine-inch, yellow, cone-shaped containers ***(Figure 1A)***. Sand and vermiculite were used rather than soil to avoid nutrient interference. The cones were placed in trays with water covering only the bottom of the cones. A hydroponics system was used to ensure the temperature of germination was not influenced by any external factors.

The cones were placed in a growth cabinet and grown at cool temperatures ranging from 7 C to reflect nighttime lows and 13 C to reflect daytime highs. The

PHOTOS AND FIGURES COURTESY MALCOLM MORRISON'S RESEARCH PROJECT: GETTING THE JUMP ON SPRING CORN GROWTH same lines were grown in warm temperatures ranging from 13 C to 24 C for the check ***(Figure 1B)***.

After 21 days, the seedlings were photographed ***(Figure 2A)*** to evaluate both above- and below-ground development. Coleoptile height was measured, with 25 millimetres being equal to emergence. The researchers compared cold and warm conditions ***(Figure 2B)*** for days to emergence, root number and length, and coleoptile length.

One of the key measurements from the first year was days to emergence. In cold conditions, days to emergence ranged from 16.5 to 22 days ***(Figure 3)***, with the check lines averaging 20 days. Some lines emerged 4.5 days earlier than current corn hybrids, showing faster adaptation to cold conditions.

Alongside emergence times, root system development became a focus in the later cycles of cold-germination selection. Researchers observed that cold temperatures also impacted the development of both main and seminal roots.

Among the hybrids tested, root development varied, with some hybrids showing low, medium and high growth under the same temperature conditions ***(Figure 2A and 2B)***. The check hybrids had an average root length of 98 millimetres, while some lines exceeded 200 millimetres ***(Figure 4)***. As anticipated, cold-tolerant lines not only emerged faster, but also had quicker root development.

These initial findings demonstrate a connection between faster emergence and enhanced root development in colder temperatures. Some hybrid corn lines emerged up to five days earlier than the checks, with root growth following a similar pattern in those hybrids, showing increased root development at lower temperatures. In warm temperatures, differences between hybrids disappeared. Initial field trials in Ottawa in 2024 indicate that hybrids seeded early on May 6 reached maturity by Sept. 18.

The next steps of this research will involve testing whether early germination leads to faster seedling growth and co-ordinating field trials in Manitoba and Ontario. When asked about how quicker emergence could affect the corn crop during the remainder of the growing season, Morrison noted that they expect to learn more in field testing.

CO26 is one cold-tolerant line released from the program, representing the culmination of many years of work, and other inbred lines will be released soon. The parents of the new inbred originally came from Manitoba.

Residue management is another area of interest for Manitoba Crop Alliance (MCA). A new study led by Ramona Mohr, a research scientist at AAFC's Brandon RDC, titled "Residue management practices to optimize corn production" is addressing the question of how different residue management practices impact corn establishment, yield and quality in Manitoba conditions.

The study, which began in 2023, focuses on the effects of preceding crop choice (soy, wheat and canola), tillage management (no-till, strip till and conventional till) and straw management in a no-till system (standing stubble with straw removed, or straw chopped and returned).

"Our goal is to see what effect these varying treatments have on soil temperature and moisture conditions at seeding, looking at emergence date, plant stand, as well as crop yield and quality," Mohr says.

The study focuses on canola, wheat and soybean as preceding crops, as these are the top three crops by acreage in Manitoba. Crops are grown using standard management practices, treatments are applied in the fall and corn is seeded the next spring.

Part of this research stems from another study supported by MCA looking

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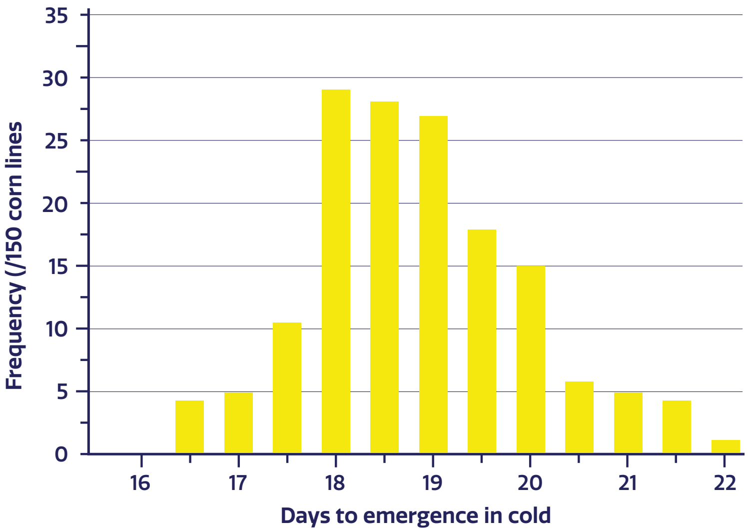
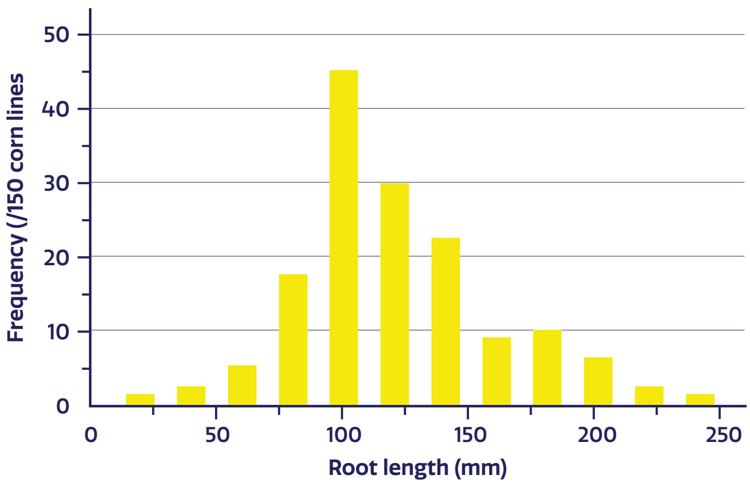


■ **FIGURE 3** | Days to emergence for corn lines germinated at cold temperatures (7 C to 13 C). The average emergence of six commercial corn hybrids was 20 days.



■ **FIGURE 4** | Root length of 150 corn lines grown in cold soil conditions.

FIGURES COURTESY MALCOLM MORRISON'S RESEARCH PROJECT: GETTING THE JUMP ON SPRING CORN GROWTH

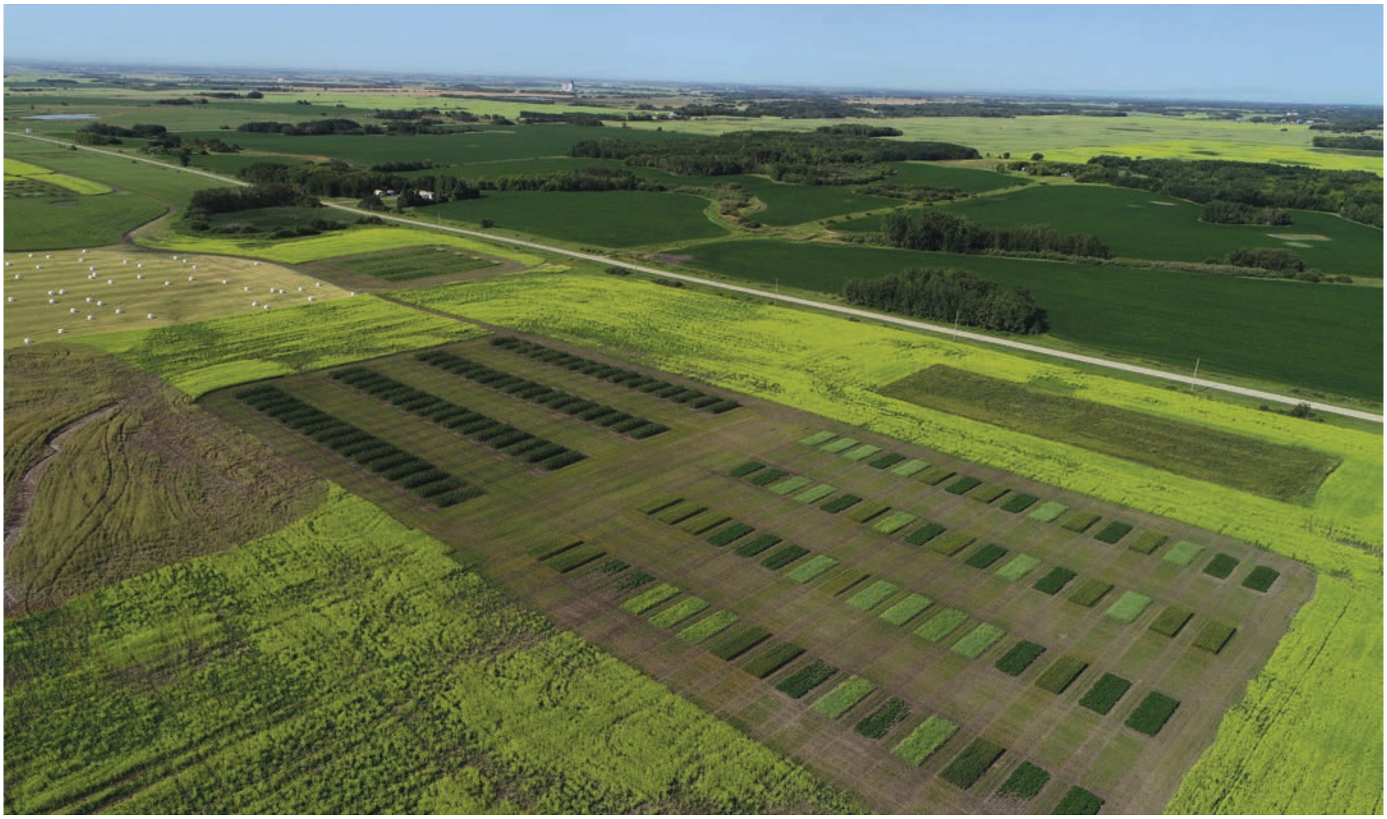


PHOTO COURTESY GORDON FINLAY.

▲ *F2024 trial during the growing season: the corn phase of the experiment is on the left, and the preceding crop phase, which will be seeded to corn in 2025, is on the right.*

at introducing corn and/or soybean into wheat-canola rotations in Western Canada. That study is looking at zero till only, so this project allows researchers to look at a broader range of residue management practices and preceding crops.

Residue management can have several impacts. "How we manage residue can impact soil temperature at time of seeding and can affect moisture conditions," Mohr says. "That has implications for germination and emergence of the corn crop, which is the focus of this study."

This research, funded in part by the Government of Canada and the Government of Manitoba under the Sustainable Canadian Agricultural Partnership, aims to provide farmers with practical strategies to improve corn crop performance.

"Our goal is to provide information to farmers that they can implement on their farms," Mohr says.

"In this project, our main objective is to try to understand how these different residue management practices affect crop establishment and growth right through to yield and quality of the corn crop. We want to see if there are some practices that might improve performance and that would be valuable for growers to implement on their farm."

Both the "Getting a jump on spring corn growth" and "Residue management practices to optimize corn production" projects reflect MCA's commitment to enhancing corn production in Manitoba.

"MCA has made significant investments in ensuring our farmer members will have access to hybrids that are better suited to Manitoba's growing season," says Katherine Stanley, MCA's research program manager for special crops. "As research continues, integrating the potential of new hybrids with improved farming practices will help Manitoba growers overcome cold spring challenges, optimizing corn yields and ensuring greater sustainability and economic viability." ●

MCA INVESTMENT:

$92,840 over five years for "Residue management practices to optimize corn production"

$45,012 over three years for "Getting the jump on spring corn growth"

CO-FUNDERS:

Sustainable Canadian Agricultural Partnership

NEED FOR SPEED

Accelerated breeding strategy for flax improvement

PHOTO COURETSY BUNYAMIN TAR'AN.

Lead Researcher:

Bunyamin Tar'an

Bunyamin Tar'an is the Ministry of Agriculture Strategic Research Program Chair in Chickpea and Flax Breeding and Genetics at the University of Saskatchewan Crop Development Centre. Tar'an grew up in South Sumatra, Indonesia, and moved to Canada in 1992 to pursue his post-secondary education. He earned both his M.Sc. and PhD from the University of Guelph, specializing in plant breeding and genetics.

Flax breeding plays a crucial role in supporting the Canadian flax industry. The University of Saskatchewan's (U of S) flax breeding program is the only remaining public flax breeding program in Canada. Their efforts provide the seed and genetics that fuel the industry – from farmers to processors and consumers.

"Our goal is to deliver the best possible seed to support every part of the flax supply chain, and given our unique position, this task is more critical than ever," says Bunyamin Tar'an, the Ministry of Agriculture Strategic Research Program Chair in Chickpea and Flax Breeding and Genetics at the U of S.

The "Accelerated breeding strategy for flax improvement" research, funded in part by Manitoba Crop Alliance (MCA), focuses on identifying the best conditions for speeding up flax growth and seed production, testing speed breeding methods to create a flax population for genetic mapping, and using speed breeding to develop new flax lines by incorporating marker-assisted selection and selecting plants based on their traits.

"With competition from other countries and fluctuating flax prices, it's critical to deliver the best possible seeds to farmers quickly," Tar'an says. "That's our goal with all these projects."

His team is collaborating with Agriculture and Agri-Food Canada (AAFC)

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in Ottawa to expand genetic variety in flax using genomic selection and molecular markers, streamlining the breeding process.

Genomic selection involves creating a training population, evaluating it over a range of environments and analyzing its genetic traits, and using these data to develop a model to predict how new breeding lines will perform without needing extensive field trials. This approach significantly speeds up selection, making it possible to develop improved varieties faster and more efficiently.

Speed breeding, a key part of this research, exposes plants to 22 hours of light and two hours of darkness under controlled conditions. While this process produces fewer seeds than traditional methods, it cuts the time to grow inbred populations nearly in half – from four months to two. This has allowed Tar'an to grow up to six generations per year.

"This technique has helped us develop inbred populations in just one year, rather than two to three, which is a significant cost-saving measure saving us one year worth of rental cost of one chamber and the associated salary of the research technician," he says.

To save time, they also use winter nurseries in New Zealand, growing flax during the Canadian winter. High-value selected material is sent to New Zealand, where it is seeded in November and returned to Canada by April, just in time for seeding in Saskatchewan. This method is expensive, but allows the researchers to complete an additional generation each year.

A key benefit of speed breeding is that it lets breeders narrow their populations while increasing their chances of finding the best material. By using predictive information when selecting parents for a cross, breeders can make more efficient crosses and increase the likelihood of success. "Once we've identified promising material, we can accelerate the process through methods like winter nurseries and reducing seed increase time by one year," Tar'an says.

Traditionally, breeding new flax varieties takes 10 to 12 years, as it involves selecting plants that meet a lot of criteria, including yield, maturity, plant height, disease resistance, seed size, oil content and alpha-linolenic acid. Tar'an is hopeful that by using advanced techniques such as speed breeding, they can shorten that time frame to six to eight years, helping farmers get access to better-performing varieties sooner.

ON YOUR FARM

Advanced flax breeding shortens path from seed to field

A longer-term challenge Tar'an's breeding program is addressing is straw management. "Flax straw has traditionally been problematic for farmers, tangling in combines and complicating harvests," he says. "To tackle this issue, we're working to reduce plant height and improve maturity, which will result in less straw while maintaining strong yields."

In the long run, the goal is to change flax's morphology, reducing straw content while increasing seed production. Historically, flax was bred for fibre rather than seeds. By going back to its wild ancestor, *Linum bienne*, and crossing it with modern varieties, the breeding program has been able to introduce beneficial traits, such as a bushier plant structure that increases seed production. "The goal is to reduce the straw content while enhancing seed yield," Tar'an says.

As part of a newly approved initiative, one of Tar'an's research students is focused on making these selections in flax. Four-row plots were set up comparing the new materials with an older variety, clearly illustrating the difference between the two.

Working with wild characteristics comes with challenges. For example, the wild plants tend to have bolls that open when mature, leading to seed loss. But there is a lot of potential. "We are focusing on selecting plant types that address these issues and can produce more biomass and seeds, while diverting

By the numbers
CDC ESME

***Note:** Yield, maturity and height are compared with the check variety, CDC Glas (yield 36 bu/ac).*

YIELD	**MATURITY** +/- 102 DAYS
37 bu/ac	2
HEIGHT +/- 68 CM	**SEED COLOUR**
–2	BROWN
SEED SIZE TSW	**OIL CONTENT**
6.3	44.5

OIL QUALITY

IODINE NUMBER	ALA CONTENT
192.0	57.1

RESISTANCE LEVEL

LODGING	FUSARIUM WILT
G	MR

PHOTO COURETSY BUNYAMIN TAR'AN.

▲ *Research plot showing the progeny from crosses between* Linum bienne *and cultivated flax, compared to current varieties (CDC Bethune).*

less energy into fibre," Tar'an says.

This is a long-term objective for the program, but an exciting step toward fundamentally changing the look and behaviour of flax in the field. "We hope flax will evolve beyond its current form, becoming more efficient for seed production and easier to manage for farmers," Tar'an says. "We can't only rely on what we have; we need to think outside the box while continuing the work already in progress."

This wild species possesses several important characteristics, notably heat tolerance, which is critical for flax during flowering. Trials at the university show that high temperatures can lead to significant flower damage, resulting in empty seed pods. This wild variety demonstrates the ability to withstand such heat blasts, making it a valuable addition to breeding efforts.

There is also evidence that this wild species is more resistant to Pasmo, although the quality is not on par with cultivated varieties. To address this, they are crossing the best cultivars with these wild species and applying advanced techniques to enhance their attributes.

There are still challenges, particularly in screening for diseases such as Pasmo, as disease presence depends on the weather. But by tapping into the variability in wild species, Tar'an hopes to make significant improvements in this area.

"We have developed markers for some diseases, which allows us to select for resistance through DNA testing," he says. "We're also testing markers for Pasmo and powdery mildew."

Space limitations also affect their breeding efforts. "We share our facilities with other programs, which restricts our capacity," he says. "Developing effective nurseries for soil-borne disease screening is a lengthy process, but we are lucky to have use of the nursery at Morden, MB."

Despite these challenges, the program is committed to delivering quality results. Tar'an is grateful for support from organizations such as the Western Grains Research Foundation, SaskOilseeds and MCA. "Their trust in our work is what makes it possible for us to keep advancing our breeding program," he says.

Regarding new varieties, the program is still in early stages of testing potential candidates. The process requires thorough testing across multiple locations over several years to ensure stability and consistency before release. They have some promising lines, but more data is needed before introducing them to farmers.

The latest flax varieties – such as CDC Rowland, CDC Kernen and CDC Esme – represent a leap in yield potential. CDC Esme has shown excellent results across Canada, including in Saskatchewan, Alberta and Manitoba. "We anticipate these varieties will be readily adopted by farmers due to their higher performance," Tar'an says.

Ultimately, the goal is to make flax varieties more profitable for farmers by improving disease resistance, which could reduce chemical inputs. "Flax is a cost-effective crop with lower input requirements compared to others, and it fits well into crop rotations," Tar'an says. "Maintaining diverse rotations — such as including flax alongside oilseeds, cereals and pulses — can help mitigate disease cycles and benefit overall productivity." ●

MCA INVESTMENT OVER FOUR YEARS: $73,129

CO-FUNDERS:

DFCC DIVERSE FIELD CROPS CLUSTER

Saskatchewan

SASK OILSEEDS

Sustainable Canadian Agricultural Partnership

PHOTOS COURTESY PRAIRIE AGRICULTURAL MACHINERY INSTITUTE.

FIGURE 1 | Equipment used for trials: power unit and tracked cart, left, and wheeled cart, right.

UNDER PRESSURE

Researching solutions to soil compaction

Performing field operations on wet soils leads to soil structural damage including smearing, puddling and compaction. Compaction reduces the space for air and water in the soil, reducing water infiltration and impacting seedling emergence, root growth and crop yields.

According to Manitoba Agriculture's Soil Management Guide, the first pass over a field causes 80 per cent of the compaction that four passes on the same spot would cause. Factors contributing to compaction severity include axle load, soil moisture conditions, organic matter content and the pre-compaction status of the soil. Compaction can last for years, making prevention critical.

Farmers can manage their soil to reduce compaction risks. Controlled Traffic Farming (CTF), for example, aims to limit compaction to specific areas of a field by ensuring machinery operates along the same tracks every year. Additional strategies, such as managing axle loads and optimizing tire pressure can also minimize compaction risks.

Research is vital to understanding the effects of larger equipment on crop

Lead Researchers:

Charley Sprenger, Stephen Crittenden and Afua Mante

Charley Sprenger is an agricultural research engineer with the Prairie Agricultural Machinery Institute (PAMI) managing a wide range of projects to help answer some of the questions that farmers face about risk management and productivity. PAMI is an applied research, development and testing organization serving stakeholders in the agricultural sector across Canada and North America.

Stephen Crittenden is a research scientist in soil health and nutrient management and lead of the Soil, Water, and Crop Production Science Team at Agriculture and Agri-Food Canada's Brandon Research and Development Centre. He grew up in Collingwood, ON, and has worked in several countries, gaining a unique understanding of agricultural practices around the world.

Afua Mante is an assistant professor of soil physical processes in the Department of Soil Science at the University of Manitoba. She was born and raised in Ghana, where she attained a bachelor's degree in agricultural engineering and an M.Sc. in water supply and environmental sanitation. In 2011, she moved to Canada for her graduate studies at the University of Manitoba, where she received an M.Sc. in mechanical engineering and a PhD in biosystems engineering.

production and identifying management practices that minimize long-term soil damage. As part of Manitoba Crop Alliance's (MCA) Whole Farm research priority of addressing soil management and health, we are investing in research aimed at reducing the risk of compaction. This research delves into innovative techniques, helping farmers protect their soils and boost long-term productivity.

PROJECT

Effect of using low ground pressure (LGP) traffic systems for seeding on soil compaction and cereal yields in heavy clay soils affected by extreme moisture conditions.

This research, led by Charley Sprenger at the Prairie Agricultural Machinery Institute (PAMI), concluded in 2022. The study examined how using LGP traffic systems for seeding affects soil compaction and cereal yields in heavy clay soils affected by extreme moisture conditions.

Large equipment and different LGP traffic systems were tested for their impact on compaction and yield. Post seeding, grain carts fitted with either tracks or low-pressure tires were used to simulate compaction ***(Figure 1)***. Trials were conducted in a long-term CTF field, allowing for comparisons between freshly compacted and non-compacted areas.

Carts carried 10 or 20 tonnes of product to simulate different axle load scenarios, and their effects were measured in both high-trafficability areas (with drier topsoil) and low-trafficability areas (moister, lower sections of the field).

Due to drought conditions in 2021, data collection was limited to one site in 2022. Results showed that tracks caused substantial compaction for 10-tonne axle loads, while tires caused slightly higher compaction for 20-tonne axle loads ***(Figure 2)***. High-trafficability areas were more compacted than low-trafficability areas ***(Figure 3)***.

Compaction reduced wheat emergence in all cases, particularly in low-trafficability areas. Tires, especially high-flotation LGP tires, had less impact on emergence than tracks. Though yield differences between tires and tracks were minimal, non-trafficked areas consistently showed significantly higher yields.

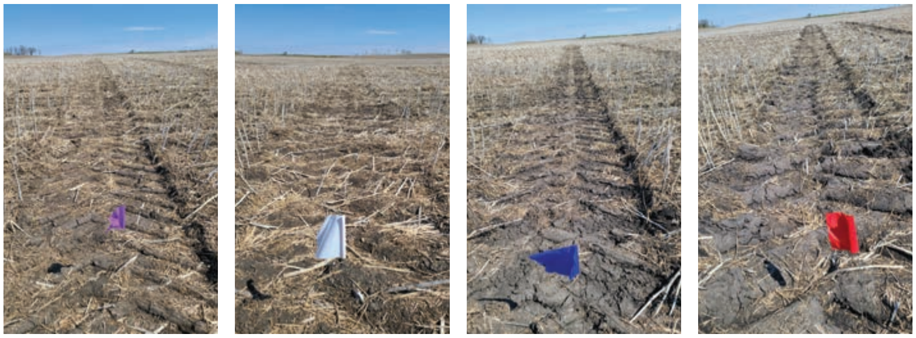

FIGURE 2 | Compaction paths (left to right): tracks with 10 T load, tires with 10 T load, tracks with 20 T load, tires with 20 T load.

FIGURE 3 | Visible differences between low (left) and high (right) trafficability zones.

PHOTOS COURTESY PRAIRIE AGRICULTURAL MACHINERY INSTITUTE.

This research laid the groundwork for further studies. A follow-up project, "Effect of using LGP traffic systems for seeding on soil compaction and yield in different soil types," will continue beyond 2024.

Results from the field season were not yet available at the time of writing, but the objectives of this project remain focused on continuing the analysis of LGP traffic systems by gathering additional site years of data and further examining the compaction effects of field operations across different soil types. The methodology remains the same, and the project was conducted on one field in the first year (2024) with the intention of adding more sites in subsequent years.

PROJECT

Is CTF a win-win in Manitoba? Does CTF reduce soil compaction, contribute to climate change mitigation and adaptation, as well as improve crop yield stability?

This project, led by Agriculture and Agri-Food Canada's Stephen Crittenden, began in 2024. It compares soil health and crop performance in CTF and random-traffic fields, evaluating the logistical and economic feasibility of transitioning to CTF.

Soil compaction can reduce yields, so this research aims to understand how emerging technologies can help prevent compaction.

Research plots were established on two fields of the same soil type near the Assiniboine River: one under CTF and the

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other not. Researchers measured various soil physical and chemical properties, including soil carbon, water infiltration, water retention, soil compaction, water content, aggregate stability, soil fertility, soil texture and soil pH. The project will also assess current and historical yield data and perform a full economic and feasibility analysis.

Initial results showed that the CTF field had less compaction than the random-traffic field on average. The CTF field was also slightly drier (29 per cent moisture by volume vs. 29.5 per cent) than the random-traffic field. Additional analysis is ongoing.

PROJECT

Building resilient soils with cover crops in Manitoba

Led by the University of Manitoba's Afua Mante, this project, which began in 2023, aims to assess how cover crops can meet short-term agronomic goals on the farm while addressing long-term climate change impacts.

One key objective is to evaluate the effects of fall shoulder season cover cropping on soil structure, water dynamics, trafficability and compaction risk, with a focus on fall rye.

Preliminary results suggest that the current guideline for seeding fall rye (Sept. 15) in Manitoba does not allow sufficient fall crop growth to support soil water regulation, soil strength for trafficability or reduced compaction risk.

As a result, researchers are reimagining how intercropping and under-seeding practices, in addition to the fall shoulder season cover cropping, can improve soil structure and enhance water infiltration and percolation — key processes for water regulation.

In the spring, due to the high relative humidity in Manitoba, evaporation and transpiration processes are less effective at removing water from the soil, making proper soil structure management critical to facilitate water movement to deeper layers. Achieving this will be beneficial during the mid-season by reducing the risk caused by drought.

The adoption of intercropping, under-seeding and fall shoulder cover cropping also provides year-round soil protection, helping reduce the risk of surface crusting, which reduces infiltration, particularly during the mid-season when Manitoba experiences high-intensity rainfall.

ON YOUR FARM

Sustainable management practices for soil health, productivity and resilience

M.Sc. student Emmanuel Agyapong and PhD student Ishmeet Kaur are working on this project under Mante's supervision. Agyapong is studying how long-term weather impacts the establishment of fall rye and its effects on soil strength for spring trafficability. Kaur is building on Agyapong's research to develop strategies for improving soil structure and regulating soil water throughout the year. The potential benefits of these strategies on soil health will also be assessed.

Soil compaction remains a challenge. But these innovative, MCA-supported research projects are paving the way for sustainable soil management practices. By focusing on strategies such as CTF, LGP traffic systems and cover crops, we aim to equip farmers with the tools to improve soil health, boost productivity and ensure the resilience of their operations for future generations.

MCA INVESTMENT: $24,706 over three years for "Effect of using low ground pressure (LGP) traffic systems for seeding on soil compaction and cereal yields in heavy clay soils affected by extreme moisture conditions" (completed in 2022)

$39,165 over three years for "Effect of using LGP traffic systems for seeding on soil compaction and yield in different soil types"

$83,989 over three years for "Is controlled traffic farming (CTF) a win-win in Manitoba? Does CTF reduce soil compaction, contribute to climate change mitigation and adaptation, as well as improve crop yield"

$126,066 over five years for "Building resilient soils with cover crops in Manitoba"

CO-FUNDERS:

Manitoba Canola Growers

Manitoba Pulse Soybean Growers

Sustainable Canadian Agricultural Partnership

CUTTING-EDGE CROPS

Modernizing winter wheat production systems

Winter wheat offers several benefits to western Canadian farms. Fall-seeded into standing stubble of the previous crop, it captures early spring moisture, allowing it to grow quickly and outperform weeds. Winter wheat acts like a cover crop by anchoring soil and providing additional crop residue in the fall to support winter survival and soil health, while producing a harvestable crop the following season.

Years of research from Agriculture and Agri-Food Canada (AAFC) have been key to advancing winter wheat management practices. Their studies show that timely seeding, high seeding rates and the use of seed treatments can improve winter wheat yields, uniformity and weed competitiveness.

In Western Canada, approximately 70 per cent of winter wheat is seeded into canola stubble. Canola maturity has gotten progressively later, and a shift from swathing to straight cutting raised questions about the feasibility of planting winter wheat after canola. To answer those questions, AAFC research scientist Brian Beres led a research project under the last five-year wheat cluster focused on modernizing wheat production systems.

"Sequencing has always been identified as a challenge when it comes to winter wheat," he says. "We wanted to look at how to fit winter wheat into rotations depending on the preceding crop, and the timing challenges associated with crops like canola."

To explore these topics, Beres and fellow researchers developed four key experiments with the following objectives:

1. Determine how best to manipulate agronomic factors for optimal canola harvest timing, productivity and crop sequencing with winter wheat.
2. Understand the role of growth habit (spring vs. winter) in the differential responses of crops and soil.
3. Determine how system integration and intensity influence winter wheat production and its interactions with weeds and disease pests.
4. Elucidate the influence of preceding break crops on succeeding winter wheat crop responses in the Canadian Prairies.

Lead Researcher:

Brian Beres

Brian Beres is a senior research scientist in agronomy at Agriculture and Agri-Food Canada's Lethbridge Research and Development Centre and adjunct professor at the University of Alberta. He is also editor-in-chief of the Canadian Journal of Plant Science, and co-chair of the Wheat Initiative Expert Working Group for Agronomy.

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EXPERIMENT ONE

Canola hybrid, harvest and weed management impact on winter wheat

This experiment was inspired by farmers, particularly James (Jim) Halford, an inventor and soil conservation champion in Saskatchewan. After a field day at the Indian Head Research Farm, Halford invited Beres to his farm, where he had implemented an idea partially inspired by practices in Australia.

Halford had a swather equipped with a sprayer and a pull-behind tank, allowing him to simultaneously swath canola and apply pre-harvest weed control. Under his cutting table he sprayed weeds to prepare a clean field for planting winter wheat, eliminating the operational step of a pre-seed herbicide application.

"By removing the pre-seed herbicide step before winter wheat, Jim streamlined his operations, allowing for more efficient planting after a late canola crop," Beres says.

Seeing the impressive weed control in his field, Beres and fellow researchers designed an experiment to validate Halford's approach through controlled field trials.

The experiment examined how combining different canola genetics with various harvest management methods impacts winter wheat planting, fall stand establishment and overall crop competitiveness. Research was conducted at five locations: Lethbridge and Lacombe, AB; Saskatoon and Indian Head, SK; and Brandon, MB.

The selected canola cultivars were L233P (early maturing) and L255 PC (late-maturing), and AAC Wildfire (the most planted winter wheat variety in Manitoba) was planted. The harvest methods included:

1. Swathing early at 40 per cent seed colour change.
2. Swathing at conventional timing (60 per cent seed colour change).
3. Straight cutting when seed moisture was at 10 per cent.

The weed management treatments were:

1. Pre-harvest herbicide (tank mix: Heat® and glyphosate),
2. Pre-harvest (same as treatment one) and pre-plant herbicides (Focus®),
3. Pre-plant herbicide only (Focus®).

Results indicated that winter wheat grain yield was influenced by preceding canola harvest management. Straight-cutting canola produced lower winter wheat yields than conventional or early timing swathing. Treatments did not affect test weight.

Weed management strategies showed promise. Pre-harvest herbicide applications during swathing with an onboard sprayer improved winter wheat yield by two per cent, while pre-harvest and pre-plant applications increased yield by four per cent compared with pre-plant only ***(Table 1)***.

Thus, growers can gain efficiencies by combining canola harvest management with winter wheat pre-planting operations, eliminating isolated operational steps in fall and improving winter wheat grain yield.

TABLE 1 | Winter wheat grain yield and protein level and proceeding canola crop yield responses to canola hybrid, and harvest and weed management.

	WINTER WHEAT		CANOLA
	Grain Yield (bu ac^{-1})	Protein content (%)	Grain Yield (bu ac^{-1})
Canola hybrid			
L233P	55.4	12.5a	35.0b
L255PC	55.1	12.4b	38.4a
$LSD_{0.05}$	ns	0.14	3.0
Canola harvest system			
Conv windrow	56.3a	12.5	36.6ab
Early windrow	56.0ab	12.5	32.9b
Straight-cut	53.6b	12.3	40.7a
$LSD_{0.05}$	2.5	ns	4.3
Weed management system			
*Pre-harvest	55.4ab	12.4b	NA
Pre-plant	54.2b	12.5a	NA
Pre-harvest + pre-plant	56.3a	12.5a	NA
$LSD_{0.05}$	1.5	0.15	NA

ns = non-significant. Different letters within columns after the means indicate signifiant differences between the treatments.
NA = not available.
***Performed during canola windrowing operation using a windrower equipped with an onboard sprayer or applied when the plots reached 60 per cent seed colour change for straight-cutting.

ON YOUR FARM

Resilient winter wheat for productive and sustainable crop rotations

EXPERIMENT TWO

Winter wheat vs. spring wheat

This experiment emerged from ongoing questions about how winter wheat compares to spring wheat. Farmers face challenges with winter wheat establishment and in-crop management, prompting the investigation into whether winter wheat can outperform alternatives such as high-quality milling wheat, Canadian Prairie Spring wheat and durum, in a canola-wheat-field pea rotation. The expectation was that winter wheat yields would be higher than spring wheat, but the real question was whether it would pay off, given some of the associated challenges such as logistics of planting at the same time as harvest.

The research was conducted at five

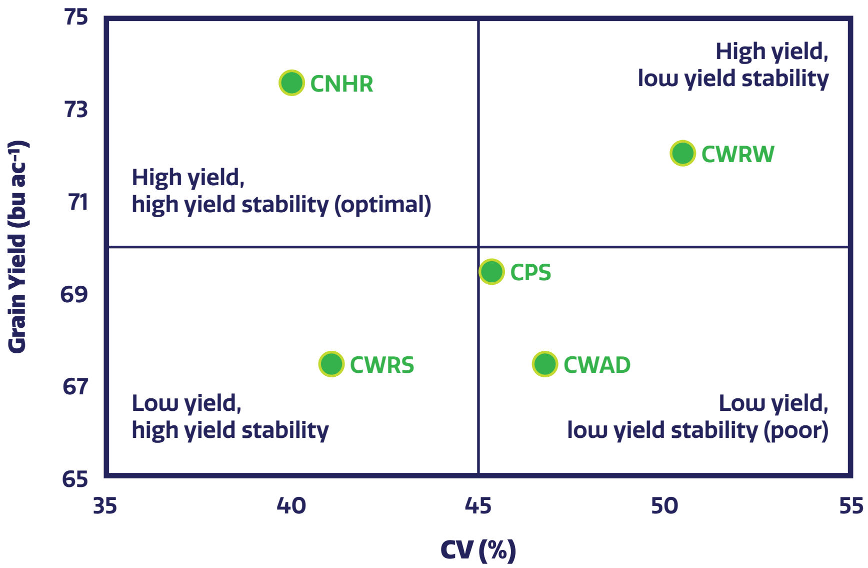

FIGURE 1 | Biplot summarizing the effects of wheat class and rotation on average yield of wheat compared with its respective coefficient of variation (CV). CPS, CWRS, CWRW, CNHR and CWAD represent Canada Prairie Spring (*AAC Penhold*), Canada Western Red Spring (*AAC Viewfield*), Canada Western Red Winter (*AAC Wildfire*), Canada Northern Hard Red (*ConquerVB*) and Canada Western Amber Durum (*CDC Desire*), respectively.

locations: Lethbridge and Edmonton, AB; Saskatoon and Indian Head, SK; and Brandon, MB. The objective was to study how winter wheat compares with spring wheat in relation to grain yield, yield components and soil health, particularly carbon sequestration, in a canola-wheat-pea rotation.

The study had five different canola-wheat-pea rotations, each with a different wheat class:

- Canada Prairie Spring (CPS) — AAC Penhold
- Canada Western Red Spring (CWRS) — AAC Viewfield
- Canada Western Red Winter (CWRW) — AAC Wildfire
- Canada Northern Hard Red (CNHR) — ConquerVB
- Canada Western Amber Durum (CWAD) — CDC Desire

Rotations were fully phased, so each crop sequence was grown every year. Canola hybrid L233P and field pea variety AAC Lacombe were used in all rotations. The goal was to determine which rotation was the most productive, generated the highest profit and had the smallest carbon footprint.

Results indicated that CWRW (AAC Wildfire) generally outperformed most spring wheat classes and had comparable yield to CNHR ***(Figure 1)***. AAC Wildfire demonstrated consistent, acceptable grain protein concentration, while high-quality wheat classes such as CWRS and CWAD showed superior protein levels. At most locations, all wheat classes met or exceeded the minimum protein requirement for their respective grades.

In terms of protein and yield relationships, AAC Wildfire recorded high protein levels in low-yielding environments (Saskatoon and Brandon), showing the inverse relationship between yield and protein content. In high-yielding areas such as Lethbridge and Edmonton, several wheat classes (CNHR, CPS, CWAD and CWRW) had lower protein levels, occasionally falling below the required standards for No. 1 grades.

Regarding the environmental impact on wheat classes, CWAD (CDC Desire), an early maturing variety, produced higher yields than all classes except CWRW in traditional areas such as Lethbridge, and surpassed CPS and CWRS at Brandon, a non-traditional area to grow CWAD.

Protein concentrations were generally not an issue in most study environments, except in high-yielding conditions, where protein content dropped due to yield increases.

Although further experimentation is needed, results indicate that winter wheat can effectively compete with certain wheat classes in specific regions. Overall, winter wheat was competitive if not superior in most environments, so producers may want to revisit using this market class as it also would inject cash flow into the business earlier in the year, given the earlier harvest and subsequent demand for grain in local markets.

EXPERIMENT THREE

Optimizing weed and disease management for sustainable winter wheat production

The idea for this experiment emerged from ongoing questions about effective herbicide programs for winter wheat. The researchers wanted to explore how different weed management strategies can enhance competitiveness in winter wheat production while also considering the role of fungicides, as high yield potential often coincides with potential for disease.

This experiment aimed to test the idea that winter wheat can be grown sustainably with reduced pesticide use, and to evaluate how system integration and intensity affect winter wheat production and its interactions with weeds and diseases. The study was conducted at four locations: Lethbridge and Lacombe, AB; Saskatoon, SK; and Brandon, MB.

The treatments included:

1. **Pre-plant weed management:** comparing glyphosate alone with glyphosate and pyroxasulfone (Focus® herbicide).
2. **In-crop weed management:** evaluating three options: fall 2, 4-D herbicide; fall and spring 2, 4-D; and no treatment.
3. **Fungicide management:** comparing one application, two applications and no applications, using Prosaro XTR® (containing prothioconazole and tebuconazole) at a rate of 325 millilitres per acre with 40 litres of water per acre.

The findings revealed that herbicide applications during the growing season did not significantly boost yields, test weight or protein content ***(Table 2)***. The study reinforced the idea that winter wheat can be highly competitive if properly managed.

In terms of weed management, pre-plant herbicide treatments (i.e., glyphosate

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alone or tank mix with pyroxasulfone) affected winter wheat protein concentration but not grain yield or test weight. In-crop weed management had no significant influence on these factors compared with the no in-crop herbicide control, suggesting that in-crop herbicide applications are unnecessary due to the high competitiveness of winter wheat against weeds.

Regarding disease management, a single in-crop fungicide treatment (Prosaro XTR®) increased winter wheat grain yield by four per cent over the control and two applications boosted yield by seven per cent. Protein concentration and test weight remained stable with in-crop fungicide treatments. Two fungicide applications were more beneficial in high-productivity environments such as Lethbridge, Lacombe and Brandon, where disease pressure was higher ***(Figure 2)***.

Researchers noted that in high-yield-potential situations, the likelihood of disease also increases, underscoring the need for careful planning. If no fungicide was applied, there were yield penalties. A single fungicide application proved essential for disease management, while additional applications did not yield substantial economic benefits.

The interaction of herbicide and fungicides demonstrated that combining pre-plant glyphosate tank-mixed with pyroxasulfone – along with fall and spring 2,4-D, and two fungicide applications – resulted in the highest and most stable grain yields, although more yield may not compensate for the cost of all these operations. Other pre-plant herbicide treatments combined with two fungicide applications also resulted in higher-than-average grain yields, but lower than average stability if no in-crop 2,4-D was applied.

For detailed findings from this experiment, you can read the published paper at cdnsciencepub.com/doi/abs/10.1139/cjps-2024-0043.

TABLE 2 | Responses of winter wheat grain yield and protein to herbicide and fungicide management.

	Grain Yield (bu ac^{-1})	Protein content (%)
Pre-plant weed management		
Pre-plant glyphosate	80.7	11.3
Pre-plant glyphosate + pyroxasulfone	81.0	11.5
$LSD_{0.05}$	ns	ns
In-crop weed management		
No in-crop herbicide	82.1	11.3
Fall 2,4-D	80.1	11.4
Fall + spring herbicides	80.2	11.5
$LSD_{0.05}$	ns	ns
Fungicide management system		
No in-crop fungicide	78.1b	11.5a
One fungicide	81.1a	11.4b
Two fungicides	83.0a	11.4b
$LSD_{0.05}$	2.1	0.1

Fall + spring denotes fall 2,4-D plus site-specific spring in-crop herbicides.
ns = non-signficant. Different letters within columns after the means indicate significant differences between the treatments.

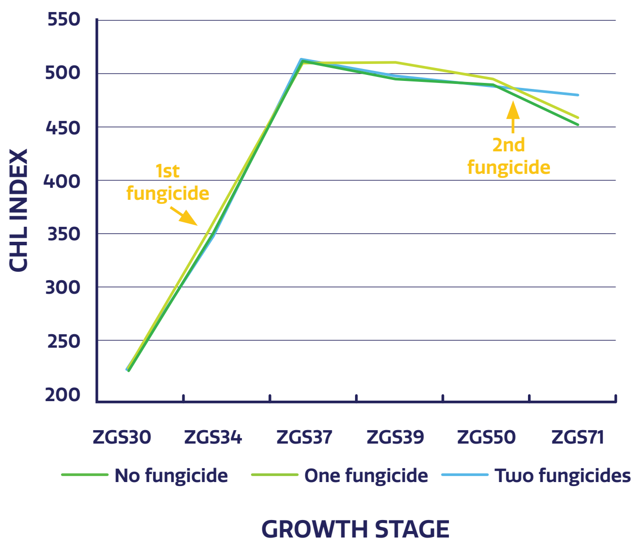


FIGURE 2 | Responses of chlorophyll index (a measure of the amount of chlorophyll in the plant's leaves, which can be an indicator of general plant health) to fungicide application at different growth stages. No fungicide, one fungicide and two fungicides represent no in-crop fungicide, one fungicide applied at ZGS60 (beginning of flowering), and two fungicides applied at ZGS32 (second node detectable) and ZGS60, respectively.

EXPERIMENT FOUR

Exploring break crops

Previous studies highlighted the importance of break crops in enhancing winter wheat yields. Break crops are the crop preceeding winter wheat in this study, and winter wheat was planted into the break crop stubble. Findings indicate that crops with less stubble, such as peas, can produce equivalent or higher grain yields than canola.

The objective of this experiment was to understand how different break crops influence the growth of winter wheat in the Canadian Prairies. The study took place in Lethbridge, AB; Saskatoon and Indian Head, SK; and Brandon, MB.

The treatments involved two main factors: seven break crops (flax, canola, field peas, oats, faba beans, soybeans, and lentils) and three wheat phases, including winter wheat after winter wheat, spring wheat followed by winter wheat and winter wheat followed by spring wheat.

Yield differences were notable. Winter wheat following oats consistently yielded lower than wheat preceded by all pulse crops. Yield and protein concentration were particularly responsive grown on pea stubble, and both lentil and soybean stubble showed positive effects on winter wheat grain yields ***(Table 3)***. Some of

TABLE 3 | Winter wheat grain yield and protein response based on previous crop type.

	PRECEEDING CROP STUBBLE							
	Soybean	Lentil	Peas	Faba bean	Canola	Flax	Oats	$LSD_{0.05}$
Grain yield (bu ac^{-1})	64.9a	63.4ab	60.6bc	61.3ab	57.7c	60.1bc	56.6c	4.2
Protein content (%)	12.7	13	13	12.9	12.8	12.9	12.8	ns

Different letters after the means indicate significant differences between the treatments.

these alternative crop stubbles may help overcome the challenge of timely winter wheat planting in late-maturing canola fields.

Additionally, winter wheat saw smaller yield reductions than spring wheat in the second year following a rotation.

A big advantage of growing winter wheat is the synergy with canola in terms of weed management. "You've got an opportunity to do some cleanup with an herbicide-tolerant crop, followed by a competitive crop that targets the same spectrum of weeds," Beres explains. "This approach offers a double benefit, reducing reliance on herbicides."

The findings from this research highlight that canola is not the only viable option for farmers considering their winter wheat rotations. Soybeans, lentils, faba bean and flax can be equally effective alternatives. Moreover, soybean and lentil consistently outperformed canola in terms of grain yield and protein concentration for the succeeding winter wheat crop.

Wheat is more flexible than often perceived. These experiments demonstrate that various preceding crops can support successful winter wheat production by enhancing soil and improving seed-to-soil contact.

Winter wheat's resilience is evident, particularly in scenarios where planting may be delayed due to weather or logistical challenges. This research affirms that if managed properly, late planting can still yield positive results.

For Beres the message remains clear: Do your homework.

"We have answered a lot of potential questions through three funding cycles of this winter wheat agronomy research," he says. "Thanks to the funders to date, this extensive body of work has generated valuable insights to provide farmers with tools to make informed decisions tailored to their unique farming systems."

Beres recommends considering the system and what will work best on your farm. By embracing a framework that considers genetics, environment and management practices, farmers can effectively enhance their winter wheat production. ●

CWRC INVESTMENT (INCLUDES MCA CONTRIBUTION): $1.4 MILLION

CO-FUNDERS:

CWRC Canadian Wheat Research Coalition

Agriculture and Agri-Food Canada / Agriculture et Agroalimentaire Canada

Sask Wheat

WGRF Advancing Agriculture through Research

MANITOBA CROP ALLIANCE

MCA RESEARCH

by the numbers

122 Active research projects

(as of July 31, 2024)

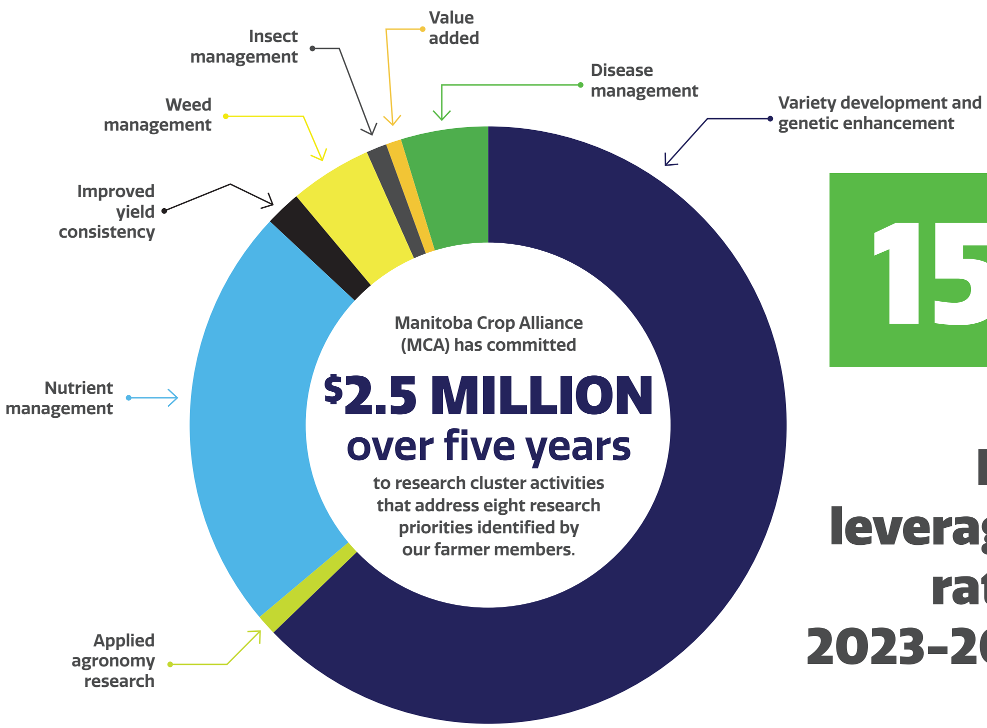
- **69** Barley & Wheat
- **29** Whole Farm
- **7** Flax
- **4** Corn
- **5** Sunflower
- **7** Winter Wheat
- **1** Increasing Capacity

Lifetime value of 122 current projects:

$145,188,678

Total MCA contribution:

$15,299,410



15 Completed projects in 2023–24.

MCA leveraging rate in 2023–2024:

For every farmer member **$1** → MCA leveraged to **$9**

MCA total investment in research and production in **2023–24** fiscal year:

$5,859,520

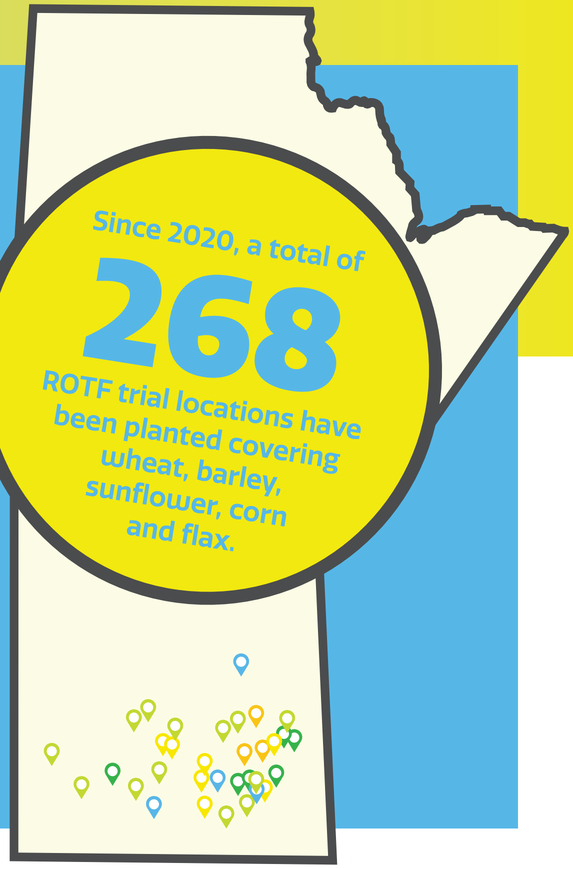
Research and production budget for **2024–25** fiscal year:

$6,631,780

RESEARCH ON THE FARM

2024 Research on the Farm

- 12 protocols
- 2 Barley, 4 Wheat, 2 Corn, 2 Flax, 1 Winter Wheat, 1 Sunflower
- 48 trial locations



Since 2020, a total of **268** ROTF trial locations have been planted covering wheat, barley, sunflower, corn and flax.

Scientific Research & Experimental Development (SR&ED) Tax Credit

Farmer members who contributed check-off dollars to Manitoba Crop Alliance (MCA) ***are eligible to claim a federal tax credit*** through the Scientific Research and Experimental Development (SR&ED) program.

52.85%

In the 2023–24 fiscal year, 52.85 per cent of the MCA check-off was eligible to earn an investment tax credit.

Variety Performance Trials

MANITOBA CORN COMMITTEE:

12 locations

476 Total number of ***corn hybrids*** (grain & silage) have been tested since 2020.

SUNFLOWER VARIETY PERFORMANCE:

5 locations

60 Total number of ***sunflower hybrids*** (confection & oil) have been tested since 2020.

For more information about Manitoba Crop Alliance research, visit ***mbcropalliance.ca***

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