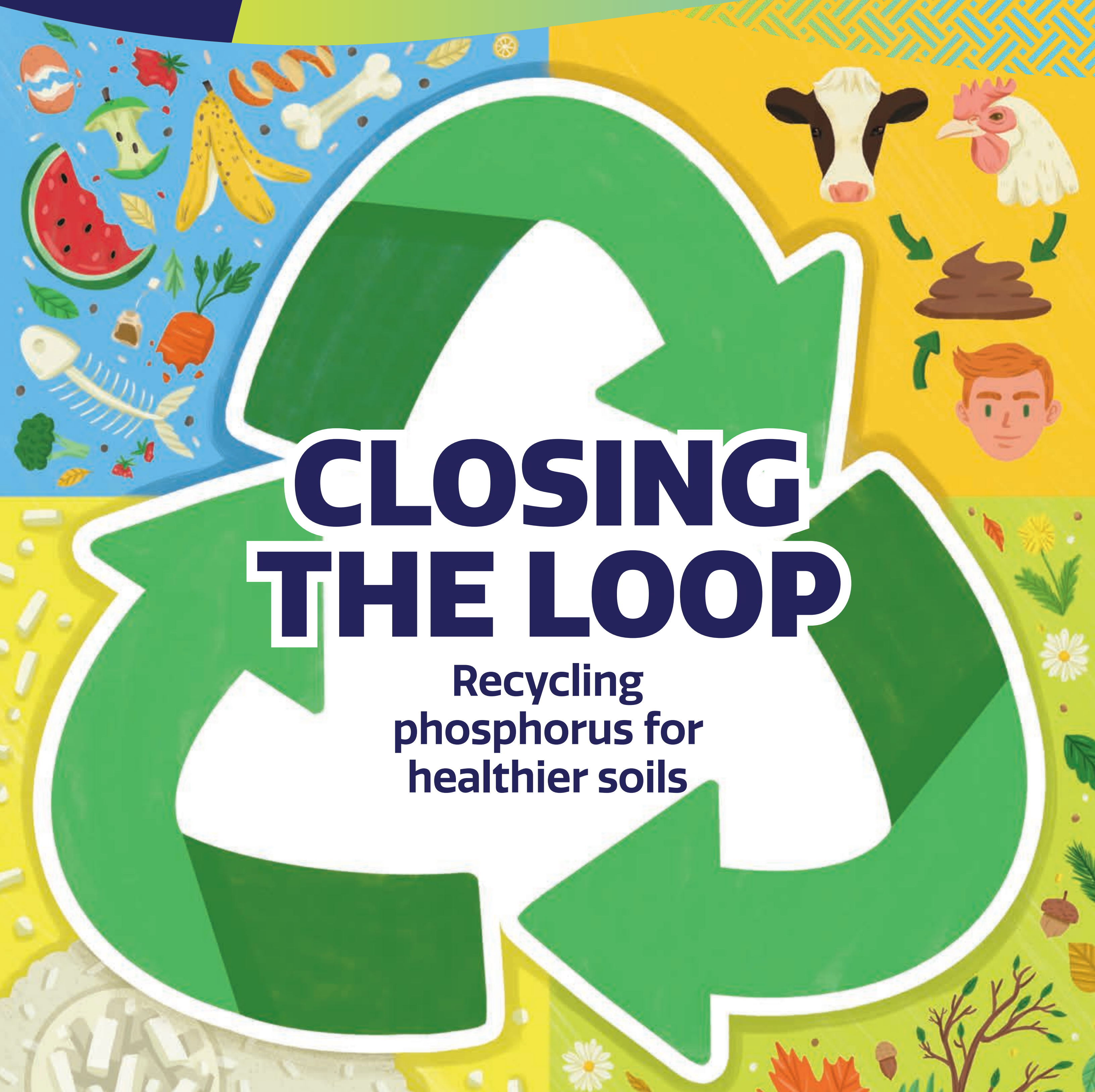
MANITOBA CROP ALLIANCE

The Focal Point

Winter 2026 Edition



CLOSING THE LOOP

Recycling phosphorus for healthier soils

PLUS COVER CROPS & 4R STRATEGIES / 7 MEET A RESEARCHER / 20

MESSAGE FROM THE CHAIR

***Jonothan Hodson** — Lenore, Manitoba*

I'm excited to share the 2026 edition of *The Focal Point*, Manitoba Crop Alliance's (MCA) annual research magazine. This publication is where we highlight some of the meaningful research your check-off dollars make possible.

This year's issue focuses on projects that connect productivity with environmental responsibility. On our farm, nutrient management is one of our biggest expenses, and one of our biggest opportunities. The more efficient we are with fertilizer use, the more sustainable we become, both economically and environmentally.

At MCA, we believe farmer-focused research is key to finding that balance. This edition highlights projects that explore nutrient use efficiency, greenhouse gas reduction and crop diversity – areas where we're helping Manitoba farmers lower their environmental footprint while keeping operations strong and resilient.

Manitoba's crop diversity brings both challenges and opportunities. Supporting research that reflects this made-in-Manitoba reality ensures results are relevant to your farm and your future.

On behalf of the board, delegates and staff at MCA, thank you for your continued support. I hope you find the information in this edition of *The Focal Point* both useful and inspiring for your operation.

Sincerely,

Jonothan Hodson
MCA Chair

MANITOBA
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CONTENTS

THE FOCAL POINT | WINTER 2026 EDITION

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

4 **GREENHOUSE GAS** | **Setting the standard**
Establishing baseline emissions for special crops

7 **GREENHOUSE GAS** | **Two-pronged approach**
Cover crops and 4R strategies to reduce GHG emissions

12 **NUTRIENT MANAGEMENT** | **Rethinking phosphorus**
Unlocking the potential of the circular nutrient economy

17 **NUTRIENT MANAGEMENT** | **Micro-management**
Researchers explore potential of microbes to improve fertilizer uptake efficiency

20 **CROP DIVERSITY** | **Meet a researcher**
Agronomist in Residence sets special crops up for success

23 **CROP DIVERSITY** | **Undercover crops**
Manitoba research assesses potential cover-cropping strategies

26 **RESEARCH BY THE NUMBERS**

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COVER ILLUSTRATION BY ANJA JAVELONA

SETTING the STANDARD

Establishing baseline emissions for special crops

Nitrogen fertilizers have been a staple in agriculture since the 1950s and have driven remarkable increases in crop productivity. While essential for plant growth, nitrogen fertilizer can lead to increased greenhouse gas (GHG) emissions, particularly nitrous oxide (N_2O).

▲ *University of Saskatchewan M.Sc. student Emily Anweiler learning how to collect gas samples during spring thaw.*

Our atmosphere is built to handle moderate levels of emissions, but when they rise too high, the system becomes stressed. Worldwide, many industries are under increasing pressure to lower GHG emissions and agriculture is no exception.

Farmers have been presented with a challenge: reduce N_2O emissions, while maintaining or even increasing plant productivity. Significant agronomic advancements have been made through fertilizer practices, such as the principles of 4R fertilizer management (the right source at the right rate, right time and right place) and technologies like enhanced efficiency fertilizers (EEFs). These tools have demonstrated through scientific evidence a potential to reduce emissions while maintaining productivity. Ongoing research continues to explore and refine management strategies to reduce agricultural emissions.

While the toolbox of strategies is growing, how do we measure progress and demonstrate impact? That's where baselining comes in. By establishing clear baselines and measuring outcomes, scientific results can be compared with "business as usual" to identify practices with the potential for reducing emissions while maintaining productivity.

Research on emissions baselines has focused on major crops like wheat, leaving a gap in research on smaller-acreage crops such as sunflowers and flax. Despite accounting for fewer acres across the Canadian Prairies, these crops play a vital role in our agricultural systems.

PHOTO BY MATT BRADEN.

Lead Researcher:

Kate Congreves

Kate Congreves is an associate professor in the Department of Plant Sciences at the University of Saskatchewan and the Jarislowsky & BMO Research Chair in Regenerative Agriculture.

Recognizing this gap, Manitoba Crop Alliance (MCA) is supporting research at the University of Saskatchewan to better understand GHG emissions for special crops. Taking a closer look at these crops offers a unique opportunity to build foundational knowledge on nitrogen use, baseline emissions and reduction strategies in diverse crop types.

"By supporting this research, farmers can be equipped with actionable insights to improve crop productivity, access new markets and increase profitability," says Madison Kostal, MCA's research and production coordinator. "Baseline data, combined with proven management techniques, can not only support emissions reductions, but also enhance resilience and long-term farm profitability."

N_2O is a GHG that is produced when microbes process nitrogen. For example, as microbes change ammonium to nitrate (called nitrification) and nitrate to nitrogen gas (called denitrification), some N_2O is produced and leaks out of the soil. These microbial processes are most active when nitrogen is readily available (i.e., after nitrogen fertilizer is applied), especially when soils are wet.

To expand our understanding of emissions in special crops, researchers Kate Congreves and Richard Farrell at the University of Saskatchewan are leading the "GHG program for diverse field crops" project, funded by the Diverse Field Crops Cluster (DFCC). The project aims to build baseline N_2O emission measurements for five diverse field crops

The research aims to measure GHG emissions from camelina, carinata, mustard, flax and sunflower, using spring wheat as the reference crop.

"Different crops have different growth patterns and nutrient requirements and, therefore, also have different nitrogen fertilizer needs," Congreves says.

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▲ *Urea fertilizer plus AGROTAIN™ nitrogen stabilizer.*

IMAGE COURTESY EMILY ANWEILER.

IMAGE COURTESY MCA.

"Identifying new crops that offer benefits like good nitrogen use efficiency or reduced GHG emissions, and which fertilizer practices help to ensure that outcome, will support the agricultural industry as they consider promising diverse field crops suitable for the region and market."

Researchers are looking at whether improved nitrogen management practices in these crop types could help reduce emissions. Using chambers installed in soil, they collect gas samples throughout the growing season and during spring thaw to measure emissions associated with each crop. They will also study how nitrogen moves through the soil and contributes to crop nitrogen use efficiency. Finally, the team is aiming to improve the capability to model N_2O emissions from different crops, helping to explore how management decisions made today may affect outcomes in the future.

To establish baseline GHG emissions data, the researchers are measuring GHG emissions when these crops are produced according to conventional fertilizer management: urea fertilizer applied at a rate informed by agronomic recommendations based on target yield and soil zone.

"Doing this across multiple sites and years will provide a baseline for the typical GHG emission patterns that one might expect," Congreves says.

For comparison to the baseline, researchers are then measuring GHG emissions when these crops are produced with improved fertilizer management scenarios. These include an enhanced efficiency product applied at a lower rate (informed by soil tests); an advanced fertilizer management practice involving split applications of fertilizer (an even lower amount of enhanced efficiency product at seeding, followed by a side-dress application informed by soil tests); and a control treatment with no nitrogen fertilizer applied.

"This experiment will show us at what point — as we move from conventional, to improved, to advanced fertilizer management — might we see N_2O reduction benefits without comprising yields," Congreves says.

This project is still in early stages, but so far researchers are seeing N_2O reductions for nearly all six crops as they move from conventional to improved nitrogen fertilizer management. However, "N_2O research needs multiple years' worth of research to draw any comment from," Congreves cautions.

Beyond the data, this project is giving students valuable field experience measuring GHG emission dynamics. M.Sc. student Emily Anweiler is part of the team, collecting samples and tracking emissions through the growing season.

The work is still underway, and results will be shared as data becomes available. Follow along for updates as researchers continue exploring how improved nitrogen management can reduce emissions and support sustainability.

IMAGE COURTESY EMILY ANWEILER.

▲ *University of Saskatchewan M.Sc. student Emily Anweiler collects gas samples in season.*

ON YOUR FARM

Emissions baselines demonstrate impact of crop management practices

MCA INVESTMENT: $85,144 OVER FIVE YEARS

CO-FUNDERS:

Bayer Crop Science

Mustard 21 Canada inc.

Nuseed

Sask Wheat

Sask Oilseeds

WGRF Advancing Agriculture through Research

Funded in part by the Government of Canada under the Sustainable Canadian Agricultural Partnership's AgriScience Program — Clusters component.

TWO-PRONGED APPROACH

Cover crops and 4R strategies to reduce GHG emissions

Nitrous oxide (N_2O) is a powerful greenhouse gas (GHG) released from agricultural soils when microbes break down nitrogen (N) fertilizers. It traps heat in the atmosphere about 265 times more effectively than carbon dioxide and contributes to ozone depletion.

Agriculture is the main source of N_2O emissions with roughly 60 per cent coming from nitrogen fertilizers. As a result, there has been significant effort in agricultural research to identify ways to reduce emissions with a focus on fertilizer.

Corn is a major agricultural commodity, with recent increases in yields and area planted. Corn requires more nitrogen than many other crops, so finding ways to reduce N_2O emissions without compromising farm profits is important.

Two promising strategies for the goal of reducing emissions from agriculture are cover cropping and incorporating 4R nutrient management (i.e., using the right fertilizer source, at the right rate, at the right time and in the right place). These approaches can reduce N_2O emissions, limit nitrogen leaching and help increase soil organic carbon over time.

Researchers involved in the "Cover crops and 4R strategies to mitigate GHG emissions" project, supported by the Canadian Field Crop Research Alliance Cluster, are testing these strategies across multiple sites in major Canadian corn-growing regions. The goal is to see how they perform under different conditions and to give farmers practical information on managing nitrogen more efficiently.

Eight core treatments are being evaluated in six Canadian regions, including south-central Manitoba. These treatments explore several combinations of practices, including the presence or absence of cover crops, use or non-use of dual inhibitor fertilizers, and conservation vs. no-tillage systems.

Specifically, trials incorporate a fall-planted cereal rye cover crop and an injected side-dress application of UAN fertilizer with combined urease and nitrification inhibitors at corn's five- to six-leaf stage. Researchers are also comparing no-till and conservation tillage with a corn-soybean rotation, except in Manitoba, where a corn-field pea rotation is being studied due to the need for a larger fall window to establish the cover crop prior to corn.

In Manitoba, additional treatments include spring applied urea and urea treated with the nitrification inhibitor eNtrench NXTGEN™. These additional treatments allow researchers to assess the timing of fertilizer application and the potential benefits of different inhibitors.

N_2O emissions are measured using the static vented chamber

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Manitoba Researchers:

Mario Tenuta** and **Mikhail Maslov

Mario Tenuta is the NSERC/WGRF/Fertilizer Canada Industrial Research Chair in 4R Nutrient Stewardship, a professor of soil ecology and acting head of the Department of Soil Science at the University of Manitoba. His training includes a B.Sc. in botany and physical geography, an M.Sc. in soil science, a PhD in plant sciences and post-doctoral research in nematology.

Mikhail Maslov is a research associate at the University of Manitoba and professional agrologist specializing in sustainable agricultural practices in the Canadian Prairies. His work contributes to the development of region-specific best management practices that enhance nitrogen use efficiency, promote soil health and mitigate agriculture's environmental footprint under Prairie climate conditions. His training includes an M.Sc. in biology and a PhD in soil science and biogeochemistry.

Principle Investigator: Craig Drury, Agriculture and Agri-Food Canada (AAFC) – Harrow

Collaborators: Claudia Wagner-Riddle (University of Guelph), Joann Whalen (McGill University), Ikechukwu Agomoh (AAFC – Fredericton), Mario Tenuta (University of Manitoba), David Pelster (AAFC – Québec), Ward Smith (AAFC – Ottawa), Lori Phillips (AAFC – Harrow), Xueming Yang (AAFC – Harrow), Alfons Weersink (University of Guelph)

To see how cover crops and 4R fertilizer practices affect N_2O emissions, researchers are tracking a few key things over the growing season.

Total emissions: The cumulative N_2O emissions from planting to harvest. Researchers estimate the cumulative emission based on numerous measurements of daily N_2O emissions throughout the season. The lower the cumulative emission, the better. Weather, soil type and fertilizer practices all affect emissions. For example, dry conditions keep emissions low, while wet, warm conditions cause an increase.

Emission factor: The comparison between how much nitrogen is applied and how much gets lost as N_2O. Usually, only about one per cent of applied nitrogen is lost this way, which indicates the nitrogen is mostly an environmental concern rather than agronomic.

Environmental cost of production: Evaluating the ratio of N_2O emissions to a unit of grain produced. The lower the number, the smaller the footprint when producing grain.

Nitrate loss: Soil samples are collected throughout the growing season to determine their ammonium and nitrate content. After harvest, a more detailed evaluation of nitrate distribution in the soil profile is conducted and used to estimate nitrogen lost as nitrate leaching through the soil profile.

Yield: Grain and plant material are analyzed for nitrogen content. This evaluation tells researchers the quality of the grain and how efficiently it uses fertilizer, as well as how much nitrogen returns to the soil through crop residue at the end of the season.

method. Small acrylic chambers are placed in the soil and remain in place throughout the growing season, except during field operations. During sampling, lids are placed on the chambers and gas is collected at 0, 20, 40 and 60 minutes using 20 mL syringes or after 0, 10, 20 and 30 minutes at sites with higher emissions. Samples are transferred into vials and transported to the laboratory for analysis. Soil temperature and moisture at 5-10 cm depths are also recorded. N_2O concentrations are analyzed using a gas chromatograph.

"The field part of our research is both critical and highly labour intensive," says Mikhail Maslov, a research associate at the University of Manitoba.

"Within a short period, we must do a large number of various measurements. To accomplish this, we hire about a dozen summer students each year for various projects, whose dedication is essential to our success. Many return for multiple seasons, which benefits us in two ways: we can rely on their accuracy in performing field operations, and we are able to pass on our values and commitment to environmentally responsible agriculture."

Given the scale of trials — with 96 combinations of tillage, cover cropping and nitrogen fertilizer treatments — they collect 600 gas samples on each sampling day, totaling more than 25,000 samples over a growing season.

In the fall, once students return to their classes, responsibility shifts to a small group of technicians and Maslov. "Although gas sampling becomes less frequent later in the season, fall brings its own demands: harvesting peas and corn, planting cover crops and collecting soil cores to track nitrate leaching," he says. "Finally, all the accumulated data must be processed and analyzed — an effort as demanding, and as essential, as the fieldwork itself."

In 2024, cover crops reduced N_2O emissions at the Manitoba site, but grain yield dropped by five to 13 per

◀ *Technician Brad Sparling divides the collected metre-long soil column into sub-samples to study the depth of nitrate migration after the growing season.*

▼ *Soil sampling goes much faster when you do it as a group.*

IMAGES COURTESY UNIVERSITY OF MANITOBA APPLIED SOIL ECOLOGY LAB

▲ *In-season application of UAN (urea + ammonium + nitrate) liquid fertilizer with or without nitrification inhibitors (3-4 weeks after corn planting).*

IMAGE COURTESY UNIVERSITY OF MANITOBA APPLIED SOIL ECOLOGY LAB

cent. Not every practice that reduces emissions will make sense for a farmer's bottom line, so part of this research is understanding which approaches are both practical and sustainable in real-world conditions.

This project is still in its early stages. Each year of the project has seen extremley variable weather conditions. While challenging for farmers, this type of variation is perfect for research.

"Weather conditions significantly affect both corn yields and GHG emissions," Maslov says. That's why it is critical that research on complex and dynamic processes like GHG emissions is supported over multiple seasons and growing regions.

In 2024, inhibitors reduced N_2O emissions by up to 54 per cent, a substantial drop. When emissions are reduced, more nitrogen remains in the soil. The question then becomes whether total nitrogen rates can be reduced while maintaining yield and crop quality. Research on wheat supports this idea. When inhibitors were used, nitrogen rates could be decreased 30 per cent without any impact on yield.

"Lowering emissions also has longer-term benefits: reducing our impact on the environment and slowing down climate change," Maslov says. "This reduces crop losses during extreme weather events such as drought, early frosts or floods."

However, there are trade-offs. Ammonia volatilization increased with nitrification only inhibitor use in 2024 but not 2023. 2024 was wetter at the time of in-season application than in 2023, and 2024 was the first trial among several previous studies to show increased ammonia loss with a nitrification only inhibitor.

Comparisons between cover cropping and nitrogen management strategies raise another question: which practice gives Manitoba growers the biggest impact? According to Maslov, both have value but also limitations. "Using a combination of measures, we can increase their overall effectiveness and achieve better results," he says.

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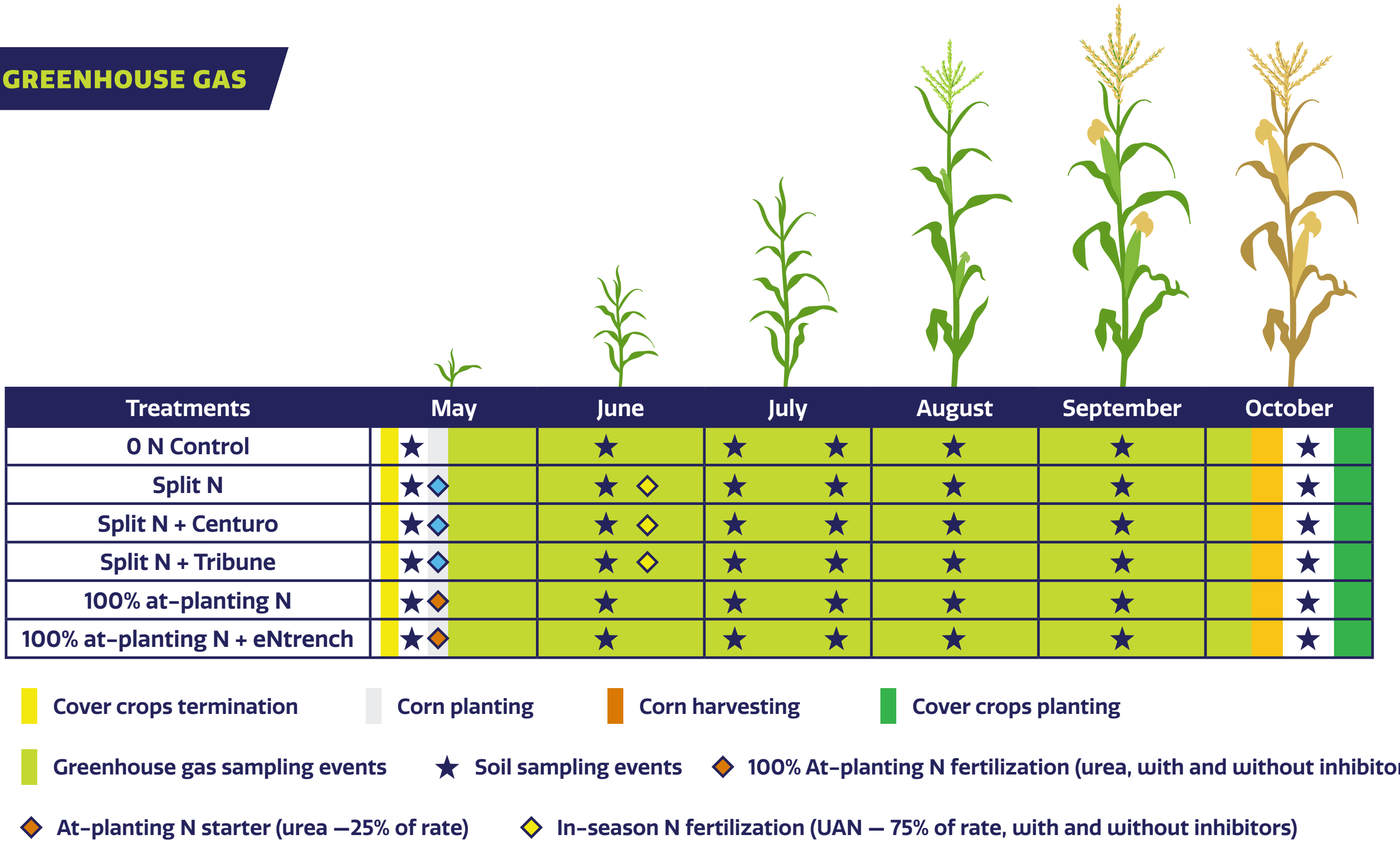

Interestingly, tillage practices didn't significantly effect N_2O emissions or yield, although conventional tillage slightly reduced CO_2 respiration emissions. Maslov explains this result as part of the slow process of carbon accumulation. "Tillage reduces the biodiversity of soil microorganisms and reduces soil aggregates that protect soil organic matter from decomposition and loss," he says.

"Ultimately, this can reduce CO_2 emissions caused by respiration from the microbes. However, the main negative effect of conventional tillage on soil organic matter is soil erosion, when wind or water cause some of the soil to be lost. No-till or minimal tillage might be more promising practices for preserving soil organic matter."

There are several insights farmers should take from the Manitoba results so far, Maslov says. These include the value of utilizing split nitrogen applications or timing fertilization to match crop uptake where possible, using nitrification inhibitors (especially under wet season conditions), avoiding surface broadcast, and using urease inhibitors to reduce ammonia volatilization and nitrogen losses. Regarding cover crops, he also

IMAGE COURTESY UNIVERSITY OF MANITOBA APPLIED SOIL ECOLOGY LAB

▲ *Passive colorimetric ammonia dositubes for measuring ammonia volatilization rate in the field.*

recommends prioritizing early seeding options, choosing fast-establishing varieties and targeting fields at higher risk of erosion and leaching.

GHG work required study of numerous variables, such as crop type, regions, management practices and climate conditions. While field trials provide critical insights, they are limited by labour, funding, time, weather and geography. That's where the Canada Denitrification-Decomposition (DNDC) model comes in.

"The Canada DNDC model is a process-based model that takes into account all the key factors we measure in the field, including soil nitrogen levels, fertilizer source and rate, soil type, temperature and moisture," says Craig Drury, a soil biochemist with Agriculture and Agri-Food Canada. "The DNDC model can match and predict what we're seeing in the field when we do these research trials."

Once calibrated with real-world data from the six research sites and historic weather data, the model will be able to test different scenarios. "There are so many different combinations of 4R and conservation agriculture practices that it's not practical to test them all in any one field study," Drury says. "The Canada DNDC will let us explore those combinations and identify the most promising ones to take into field trials."

Drury adds that outputs from the model could feed into calculators and decision support tools for farmers, providing practical guidance on nitrogen management strategies that are most likely to improve nitrogen efficiency and reduce losses under Canadian conditions.

Research associate Dr. Mikhail Maslov collects greenhouse gas samples and checks the soil temperature and volumetric moisture.

IMAGE COURTESY UNIVERSITY OF MANITOBA APPLIED SOIL ECOLOGY LAB

The Manitoba results offer important insights, but researchers emphasize that this project is about capturing a much larger story. Soil carbon and soil health improvements take time. "Realistically, it will be closer to the end of the study before we see differences in those parameters," Drury says. "But we're hopeful and expecting to see increases in soil carbon and health when we use cover crops and conservation tillage practices."

Economics is also part of the equation. Economists from the University of Guelph are evaluating different management strategies to "analyze how each approach stacks up financially," Drury says.

Weather variability matters, too. One reason the study spans multiple years and regions is to capture a range of realistic conditions. "The nitrogen cycle is complicated, as it is controlled by soil microbes and it's impacted by weather," Drury says. "Some years you have drought, others excess moisture. Some of these management practices can help us deal with both extremes, but we need multi-year data to really understand the effects and develop recommendations."

At the end of the day, farmers should only implement the practices that fit their operation. "Not every practice will be right for every farm," Drury says. "Most can adopt inhibitors with their fertilizer products, but not all have the equipment to inject instead of broadcast."

Stacking practices is the most effective route. Single inhibitors can sometimes shift losses instead of reducing them overall, but dual inhibitors and 4R strategies can reduce both N_2O and ammonia losses.

Drury uses the analogy of nitrogen moving through the soil like water through a pipe with several leaks, each representing a way nitrogen can be lost. "If you plug just one hole, losses might increase somewhere else. But if you use valves — like different 4R practices together — you can slow down several leaks and keep more nitrogen in the soil for the crop."

MCA INVESTMENT: $207,610 OVER FIVE YEARS

CO-FUNDERS:

Atlantic Grains Council | DIAGEO | Grain Farmers of Ontario | Producteurs de grains du Québec

Funded in part by the Government of Canada under the Sustainable Canadian Agricultural Partnership's AgriScience Program — Clusters component.

NUTRIENT MANAGEMENT

RETHINKING PHOSPHORUS

Unlocking the potential of the circular nutrient economy

Phosphorus is a non-renewable resource. While we often think about phosphorus pathways as a cycle, in practice, it takes more of a one-way trip. It begins in rock phosphate mines, is applied as fertilizer and is then taken up by crops. After food production and consumption, much of it moves out of cities in waste and eventually ends up in landfills, lakes or oceans.

Recycling as much of that phosphorus back to the land is important from an environmental perspective, but it also has agronomic benefits. Because phosphorus is a non-renewable resource, moving it from places where it is causing harm to places where it can add value will benefit both farmers and ecosystems. This approach is part of creating a circular nutrient economy – capturing nutrients from waste streams and returning them to productive use on farms, rather than letting them escape into the environment.

That's the focus of "Optimizing the environmental and agronomic co-benefits of recycled phosphorus inputs for field crops," a research project led by the University of Manitoba's Joanne Thiessen Martens and Henry Wilson from Agriculture and Agri-Food Canada (AAFC) – Brandon. Their work is looking at how recycled phosphorus sources can be used in field crop production in Western Canada.

The goal of this research is to create phosphorus-enriched compost products and test their potential in Prairie cropping systems. These products are made by combining different nutrient-rich wastes, such as compost from yard waste, household food scraps and organic livestock manure, with commercially available struvite fertilizer. "Hopefully by composting struvite with other materials

Lead Researcher:

Joanne Thiessen Martens

Joanne Thiessen Martens is an assistant professor in the Department of Soil Science at the University of Manitoba. Her research focuses on nutrient dynamics in agricultural systems, especially those based on ecological crop production practices.

Collaborator: Henry Wilson, Agriculture and Agri-Food Canada – Brandon

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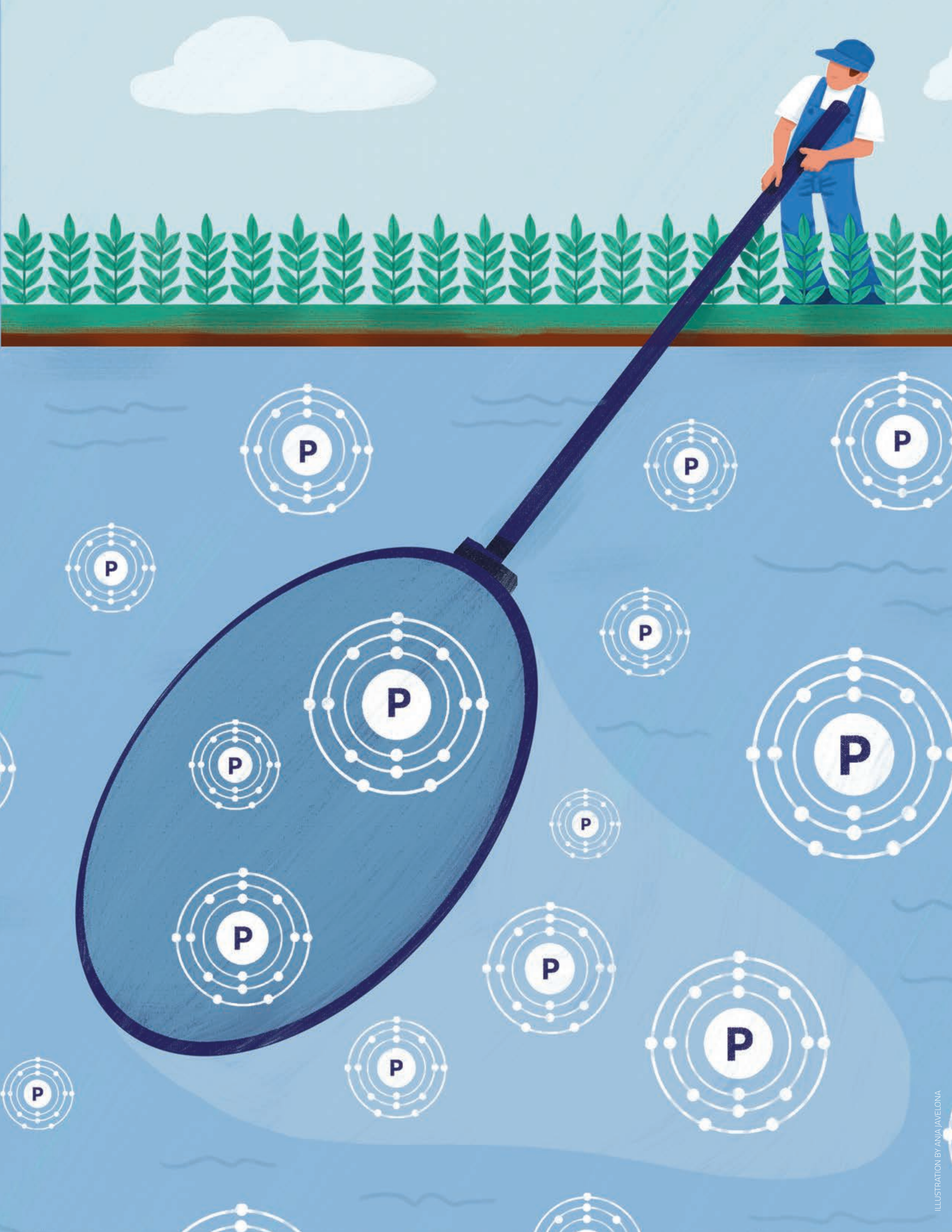


ILLUSTRATION BY ANJA JAVELONA

ON YOUR FARM

Recycling phosphorus for more economically and environmentally sustainable crop production

like manure and municipal waste, that composting process will create some synergistic effect that we don't get when we apply the products separately," Thiessen Martens says.

Struvite is especially interesting, as a granular fertilizer made from phosphorus recovered from wastewater. Unlike other wastewater treatment methods, such as adding iron compounds that lock phosphorus into sludge that usually ends up in landfills, struvite naturally crystallizes into small granules when the right balance of magnesium, nitrogen and phosphate are combined under alkaline conditions in a wastewater treatment plant. Those granules can be collected and used as a slow-release fertilizer and applied similar to other commercially available granular fertilizers.

Thiessen Martens tested struvite fertilizer in field experiments several years ago and found it promising, but the release of phosphorus was quite slow. That led researchers to wonder if adding struvite into compost would help it release more quickly.

This research began in fall 2024 with the composting process, called accelerated aerated compost. The nutrient-rich waste was collected, mixed and placed in large drums, each with a rotating arm inside that constantly mixes the material. The drums are temperature controlled, with moisture and aeration monitored closely.

Struvite granules were added at the beginning of the composting process in some treatments, while others were composted without added struvite to provide a comparison. The accelerated compost process takes 48 hours from raw material to compost, followed by a four-week maturation phase before final testing to ensure it is stable.

"The thought behind this is that the activity of the microorganisms in the compost might help make the phosphorus in the struvite more available," Thiessen Martens says. "If we create phosphorus-enriched compost with a phosphorus content of five to 10 per cent, compared to most manure at less than one per cent, it means we can apply a much lower rate to meet a crop's phosphorus needs."

Another benefit of using this waste product is keeping nutrients out of water bodies. Researchers test the compost products for the nutrient composition, carbon-to-nitrogen ratios and certain contaminants to ensure they are safe. "Contaminants are more likely to come from household waste, manure or yard waste rather than from the struvite," Thiessen Martens says. "We are interested to see if there are any contaminants in the first place and, if so, how they are degraded."

Preliminary tests were conducted through pot experiments over the winter and early spring, before moving into field experiments that were established in spring 2025 and will continue to next year.

"When we test these in the field, on the productivity side of things we are looking at crop growth, nutrient uptake and yield," Thiessen Martens says.

She adds that soil health is also a key focus. "We are looking at carbon since we are adding carbon to the soil in the compost itself. We are hopefully promoting better crop growth, which can also help add more carbon to the soil. So, we are looking at active carbon, as well as total carbon and also soil phosphorus concentrations."

Healthy soil, she explains, will neither be very low nor very high in phosphorus. "We are starting on soils that are quite low in phosphorus and want to see if by adding these products we are actually improving the soil phosphorus status longer term as well."

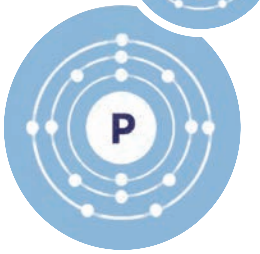
The research also looks at mycorrhizal fungi. "Adding phosphorus fertilizers tends to suppress mycorrhizal fungi because plants don't really need them as much, while adding compost tends to support these fungi," Thiessen Martens says. "It is not clear how adding a phosphorus-enriched compost will affect these beneficial fungi. It will be interesting to see what happens."

During the growing season, students collected root samples, stained them and examined them under a microscope to look for fungus growing in the roots.

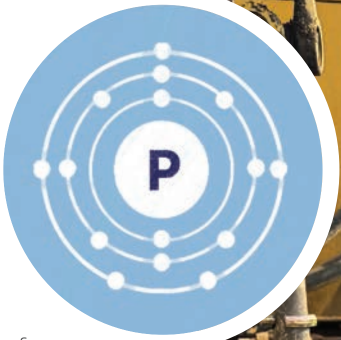
Phosphorus release timing is another factor the researchers are studying. "We do not have a complete answer for when the phosphorus becomes available, but we know from other research, unlike most phosphorus fertilizers, granule size matters, as smaller granules dissolve faster," Thiessen Martens says.

Thiessen Martens' earlier struvite research used larger granules than those commercially available today. Her work showed that while some phosphorus was released in the year of application, it did not become available early in the season when crops really need it.

Research from Saskatchewan supports this, recommending that struvite be blended with a more soluble phosphorus source for conventional farmers. This approach gives crops an early season boost, plus the longer release from the struvite.



A student of Thiessen Martens' colleague, Francis Zvomuya, tested applying struvite some time before planting in a pot experiment to see whether applying the slow-release struvite earlier would make it more available to plants. The results showed that applying it a month before planting further reduced phosphorus supply to the plants compared to when it was applied right at the time of seeding. This suggests struvite interacts with the soil in ways that are not yet fully understood.



All these findings raise more questions. "For now, applying struvite with the seed in spring is reasonable," Thiessen Martens says. "Conventional farmers may still want to add another phosphorus fertilizer at the same time."

Another big part of this study is looking at the risk of phosphorus loss from land when these different composts are applied. As most runoff occurs during spring snowmelt when soils are still frozen, this testing will begin in spring 2026.

Researchers will install a cylinder (i.e., PVC pipe) into the soil in the research plot. There will be a flooding test where water is added to the cylinder and sits there with the phosphorus and plant material growing on that plot in the fall of 2025. Samples will be taken of the water sitting on top of the soil at various points after adding it to see how much phosphorus gets released from that soil and plant material up into the water.

Then, in the late winter, they will pack the same pipes with the equivalent amount of snow and bring in generators and heat lamps to artificially melt the snow in these cylinders.

"The amounts of phosphorus that are lost in runoff are typically small enough that a farmer would not necessarily notice the loss in terms of crop yield, but it only takes a tiny concentration of phosphorus in that water to cause problems in the environment," Thiessen Martens says.

Wilson is working with Thiessen Martens on this step. He works in hydrology, focusing mostly on nutrient losses, especially in the spring snow melt season.

Thiessen Martens says the "circular nutrient economy" as a concept is all about closing our nutrient cycles. "We know we're exporting nutrients from

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IMAGE COURTESY HENRY WILSON.

▶ *Nitesh Kumar installing testing equipment in the research plots.*

fields, but we need to find a way to bring them back," she says. "That means what we've traditionally considered to be wastes, especially in municipal wastewater, those nutrients need to be captured."

Where the economic piece comes in is finding value in those nutrients. "If those can be captured and used as a fertilizer that works well and replaces some of the nutrients that are coming from non-renewable resources, then we're helping to create that circular economy," she adds.

Of all the nutrients, phosphorus is the one where achieving a circular economy is the most important. "It's a non-renewable resource coming from mined sources, we have deficiencies of phosphorus in our soils, so we need to add phosphorus fertilizers of some kind, and losing these to our waterways causes environmental harm," Thiessen Martens says.

There are still barriers to making this circular economy a reality. Struvite is relatively new to the market, costs more than standard monoammonium phosphate fertilizer and supply cannot always meet demand. However, there are also signs those barriers could be reduced soon. "Saskatoon and Edmonton are already recovering struvite out of their wastewater, and Winnipeg will soon have its own struvite recovery facility," Thiessen Martens says.

Currently, any products that come from wastewater are not permitted in organic production, but that regulation is under review and a decision is expected soon.

For both conventional and organic farmers, struvite has the potential to fill a gap in bioavailable fertilizers. And, as Thiessen Martens reminds us, the nutrient cycle doesn't stop on the farm.

"I think everyone should think about how they are part of the nutrient cycle. In natural everyday activities, we are consuming, transforming and excreting nutrients back out into the world. I think we should pay attention to where those nutrients are coming from and also where they're going once they've gone through us."

MCA INVESTMENT: $82,500 OVER FIVE YEARS

This research is part of Organic Science Cluster 4, co-managed by the ***Organic Federation of Canada*** *and the* ***Organic Agriculture Centre of Canada*** *at Dalhousie University, and supported by the* ***AgriScience Program*** *under Agriculture and Agri-Food Canada's* ***Sustainable Canadian Agricultural Partnership*** *and* ***Ostara, Manitoba Organic Development Fund*** *and* ***Western Grains Research Foundation.***

IMAGE COURTESY JOANNE THIESSEN MARTENS.

▲ *On the left is the large granule product used in Joanne Thiessen Martens's original field research (Crystal Green NXT — this is not commercially available). On the right is Crystal Green Pearl SGN 150 (1.5 mm diameter) which is the most common commercially available product. The current research actually uses an even smaller size SGN 90, (0.9 mm).*

MICRO-MANAGEMENT

Researchers explore potential of microbes to improve fertilizer uptake efficiency

Lead Researchers:

Ivan Oresnik and George diCenzo

Ivan Oresnik is a professor at the University of Manitoba, where he has been a mainstay of the Department of Microbiology for 26 years. He completed his PhD in plant biochemistry and physiology at Queen's University and a post-doctoral fellowship at the University of Calgary studying rhizobium genetics.

George diCenzo earned his PhD at McMaster University in rhizobium genetics and completed a post-doctoral fellowship in the Department of Biology at the University of Florence, where he studied computational biology and rhizobium genomics. He is currently an associate professor at Queen's University and an adjunct professor at the University of Manitoba.

Manitoba Contributer:

Matthew Bakker is an associate professor in the Department of Microbiology at the University of Manitoba. He earned his PhD in plant pathology from the University of Minnesota and gained research experience through roles at Colorado State University and the U.S. Department of Agriculture. He joined the University of Manitoba in 2019, where his research program addresses Fusarium head blight as well as soil bacteriology.

Fertilizer is one of the largest input costs in crop production. Nitrogen fertilizer, in particular, is susceptible to loss, reducing fertilizer use efficiency and contributing to greenhouse gas (GHG) emissions. A team of Canadian researchers believe bio-inoculants, microbes that help plants use nutrients more efficiently, could be part of a solution.

Bio-inoculants add beneficial micro-organisms to the soil to foster symbiotic relationships with plants. A well-known and widely adopted example is rhizobia, a nitrogen-fixing bacteria for legume crops. Sixteen researchers from institutions across the country are exploring bio-inoculants as a tool to improve fertilizer uptake efficiency by the crop.

Project BENEFIT, also known as "Bio-inoculants for the promotion of nutrient use efficiency and crop resiliency to mitigate greenhouse gases in Canadian agriculture," is working to identify microbes from Canadian soils that could help improve crops' use of fertilizer and reduce GHG emissions associated with crop production.

Researchers are focusing on four major crops — wheat, barley, canola and dry beans — with the goal of developing microbial products for Canadian farmers. Nitrogen is a major focus of the research, but the team is also exploring benefits beyond nitrogen, such as phosphate-solubilizing bacteria that release phosphate from the soil, making it more available for the crop to use.

"Broadly speaking, the goal is to try and reduce reliance on chemical fertilizers, or optimize their use, with microbial products like bacteria and fungi," says Queen's University associate professor and Project BENEFIT co-lead George diCenzo. "These microbes can help plants fix nitrogen, solubilize phosphorus, take up nutrients from the environment and some can even have effects on pests, diseases or stresses like cold temperatures."

Project BENEFIT includes five research activities that use genomics-driven strategies to develop bio-inoculants. The project objectives are to develop microbial inoculants that maintain crop yields while decreasing fertilizer usage, to deliver tools to support on-farm adoption and to develop plant genomics databases for breeders to develop climate-smart crop varieties.

The "below-the-ground" piece is critical to this research. The rhizosphere is the area around plant roots that is affected by what the roots release.

"Plants photosynthesize, and anywhere from 20 to 60 per cent of that carbon is delivered to the roots and leaks into the soil as usable sugars," says University of Manitoba (UM) professor and Project BENEFIT co-lead Ivan Oresnik. "Any plant is going to foster a population of bacteria in and around it, and different plants recruit different microbes. We don't understand enough about that relationship yet."

That complexity is what makes bio-inoculants both promising and challenging. "Some organisms are very fastidious and difficult to work with. Some may be fine to work with in the lab but can't be scaled up industrially," Oresnik says. "And soil chemistries are different — the Prairies aren't southern Ontario. Ideally, we'd like to have a potential inoculum for every crop."

Matthew Bakker, an associate professor at the UM and Manitoba contributor on Project BENEFIT, says bio-inoculants are an attempt to guide the

continues on next page ▶

natural microbial community to benefit the plant. "Any plant in nature grows and interacts with a microbial community, which influences its growth and nutrient uptake," he says. "We're trying to understand and direct those interactions to produce a beneficial response."

Fertilizers that aren't taken up by plants often become environmental problems, either washing out of soil into waterways or being converted by microbes into nitrous oxide, a powerful GHG.

"We want the plant to utilize as much of the fertilizer as quickly as possible, so we're looking at traits we think would contribute to that," Bakker says.

"In some cases, we're trying not to predetermine the mechanism, but to remain open to unexpected ones. If we can get an inoculant that causes the plant to acquire nitrogen faster, we may not know exactly what mechanism produced that, but the outcome is still a good one."

ON YOUR FARM

Harnessing microbes for more sustainable and profitable crop production

Activity 1. Identification of potential inoculants from Canadian soils

This activity focuses on isolating, screening and identifying soil microbes that support crop nutrition and resilience. Researchers are building a collection of candidate microbes from Canadian soils and testing them for traits that could improve nutrient use efficiency and plant health.

"In the soil, there are thousands of different living organisms," Bakker says. "We want to isolate pure cultures of bacteria so we can study their functions. We've already isolated and sequenced the genomes of over 800 bacteria, including from soil samples submitted by Manitoba Crop Alliance (MCA) and Manitoba Pulse & Soybean Growers (MPSG)."

The process involves diluting the bacteria from soil samples, growing individual bacterial cells into visible "colonies," and then purifying and sequencing the DNA of each strain. Researchers also extract DNA directly from soil to profile the wider microbial community and compare it against their collection. This allows them to see whether their isolates reflect the diversity of the soil and capture important functional traits. They are screening for growth-promoting traits in interaction with live plants, as well as nitrogen transformation and phosphate solubilization functions.

The researchers are looking for microbes that interact well with plants without any drawbacks. "Microbes can bring new capacities to the (plant/soil) relationship, not merely tweaking something the plant can do itself," Bakker says. "It's like a whole new function."

The screening process works like a funnel: starting with lots of microbes, narrowing them down based on their potential and eventually testing promising candidates under more realistic field conditions. Researchers have begun early plant trials, with full-season trials planned in the coming years.

Oresnik adds that machine learning will play a role in predicting how these communities work and which organisms might fit. "Sequencing a bacterial

▲ *Plant screening (growth chamber paper roll).*

IMAGE COURTESY CHI DANG AND NI AN, UNIVERSITY OF MANITOBA.

community isn't that expensive anymore," he says. "Once you know the structure, you can start predicting which biologicals won't work at all and which ones have a good shot. That could go a long way toward figuring out how to use them effectively."

As part of this activity researchers are investigating how these microbes also interact with existing management strategies. For example, combining microbes that help plants take up nitrogen more quickly with chemical inhibitors that slow the release of nitrogen might offer a more integrated approach to improve nutrient uptake.

Activity 2. Developing rhizobium inoculants for dry bean

Building on earlier work supported by MPSG and the Sustainable Canadian Agricultural Partnership (SCAP), researchers have isolated and sequenced nearly 300 rhizobia from Manitoba that can fix nitrogen with dry beans.

From this collection, two promising candidates from Manitoba and two from Ontario were utilized in field plots in Carman in the summer of 2025. The focus is now on two key traits – their ability to fix nitrogen and competitiveness for nodule occupancy – with early results showing potential.

"In this case, we might actually be able to completely remove the need for nitrogen fertilizer for dry beans," Bakker says.

Activity 3. Optimizing microbes for industrial inoculant production

Led by Terrence Bell's team at the University of Toronto, this work screens microbes for traits important to commercial production, such as desiccation tolerance, growth in bioreactors and survival in diverse soils.

This work also ties into growing conversations around developing clearer guidelines for biological products, ensuring consistency and reliability.

Activity 4. Characterization of plant–inoculant interactions

Isolates from Activity 1 are screened in greenhouse trials to identify those that support plant nutrition, with the best-performing isolates moving to field trials in the future.

Bakker says one of the challenges is the gap between controlled tests and their performance in a field setting. "As soon as you move out of the lab, a single microbe gets added into a community of existing microbes," he says. "Will it still be able to provide the same benefits in that context? We don't have all the right answers, it's something we're still working on.

"We want to produce something that's useful in an applied context to farmers, but we also want new basic science discoveries about how plants and microbes interact."

IMAGE COURTESY CHI DANG, UNIVERSITY OF MANITOBA.

▲ *Isolates from Activity 1 are screened in greenhouse trials to identify those that support plant nutrition, with the best-performing isolates moving to field trials in the future.*

Activity 5. Environmental, economic and social dimensions of inoculants

This activity explores what it will take for bio-inoculants to become viable on farms. Researchers are assessing the economic thresholds that would make inoculants worthwhile, conducting lifecycle analyses and GHG modelling to measure environmental impacts and considering farmer adoption.

Nitrogen-fixing inoculants provide the clearest example of this balance, but the team is also exploring how other microbial functions could deliver similar benefits.

A lasting outcome of the project will be a collection of agriculturally relevant microbes isolated and sequenced from Canadian soils. "It's getting hard to be able to get your hands on microbes, especially if you need to cross a border," Oresnik says. "This collection will provide a unique resource for future research and could help guide how bio-inoculants are applied in different regions."

Through Project BENEFIT, researchers hope to improve nutrient uptake for wheat, barley, canola and dry bean. Bakker emphasizes that the goal isn't to replace fertilizer, but to improve efficiency. "Even small improvements could reduce waste and provide farmers another tool to combine with existing management strategies," he says.

The researchers are excited by the chance to deepen our understanding of soil microbial communities, while delivering practical solutions back to Canadian farmers. Their work aims to harness microbes to help farmers use nitrogen more efficiently, creating potential for more sustainable and profitable crop production. ●

Project BENEFIT began in 2024 and is funded for four years. To learn more, visit mbcropalliance.ca.

MCA INVESTMENT: $100,000 OVER FOUR YEARS TOWARDS ACTIVITIES 1 AND 4

CO-FUNDERS:

25 YEARS Genome Canada

Manitoba Pulse Soybean Growers

Sask Wheat

COURTESY OF LOVELEEN DHILLON

MEET A RESEARCHER

LOVELEEN DHILLON

Agronomist in Residence sets special crops up for success

Manitoba is one of Canada's most crop-diverse provinces, thanks to a climate that supports a wide range of crops. This diversity allows farmers to strengthen rotations, reduce the risk of pesticide resistance, improve nutrient cycling, minimize disease, pest and weed pressure, and choose crop rotations that work best for their land. Beyond these agronomic benefits, crop diversity also helps farmers manage risk from the environment, shifting markets and fluctuating prices, protecting their fields and their bottom lines.

Flax and sunflower acres have declined in recent years. "Local research for special crops (sunflower, flax and corn) is outdated," says Morgan Cott, agronomy extension specialist for special crops at Manitoba Crop Alliance (MCA).

"In some cases, we need to look outside of Manitoba for specific information and assess if it's applicable in our province, our climate and on our soils. We know these crops still have great potential in Manitoba."

Most MCA-funded research in special crops is focused on agronomy to help farmers tackle diseases and fertility with updated data. Recognizing the limited capacity for research on these crops in Manitoba, MCA saw an opportunity to increase capacity through the creation of a new agronomist in residence for special crops position at the University of Manitoba (UM).

An agronomist in residence is a unique partnership between commodity groups and the university, allowing a research agronomist to collaborate and utilize university infrastructure to conduct applied research without holding a professor position. This concept was spearheaded by Manitoba Pulse & Soybean Growers (MPSG) with the hiring of Kristen McMillan as the pulse and soybean agronomist in residence in 2017.

Loveleen Kaur Dhillon joined the UM in February 2025. She grew up on a farm in Punjab, India, and has always been fascinated by what makes crops adapt and thrive across such varied soils, seasons and climates. Dhillon earned her bachelor's and master's degrees in agricultural biotechnology at Punjab Agricultural University, then completed her PhD in plant science at the University of Saskatchewan. After her PhD, she worked as a postdoctoral fellow on agronomy and plant breeding projects before moving to Winnipeg in 2024, where she now

ON YOUR FARM

More buzz around corn, sunflower and flax in Manitoba lives with her husband, two-year-old son and mother-in-law.

Cott says the new position has already filled agronomic gaps MCA had been trying to address for a few years. The work Dhillon has begun has been requested by farmers and covers areas no other researcher has been able to participate in, especially in all three of MCA's special crops. It also strengthens MCA's extension efforts to provide local agronomic data to farmers.

"We want improved crop diversity in Manitoba," Cott says. "Loveleen is helping with projects that answer the questions farmers have, such as the best herbicide window in flax. I hope this grows so that Loveleen and I can build a network for our special crops and acres will climb to historic numbers."

Applied research projects deliver quick, practical results for farmers. "Loveleen is conducting research across the province, and will be sharing her findings, resources and recommendations," says Katherine Stanley, MCA's research program manager for special crops. "She will be working closely with us to ensure the latest recommendations reach Manitoba farms."

By combining local research with hands-on expertise, this program aims to give farmers the information they need to make strategic choices, protect yields and build more resilient cropping systems. With research-driven insights and a focus on diversity, Manitoba's special crops are being set up for success.

What is the best part about your job?

My dad is a farmer and my grandfather was a farmer, so agriculture has always been a part of who I am. From an early age, I knew I wanted to contribute to advancing farming practices, and that's what excites me most about my job. I get to do exactly what I always dreamed of doing. During my PhD, I worked on promoting the adoption of field peas in Saskatchewan, and now I'm focused on special crops, supporting the adoption of these crops that can strengthen agriculture and promote sustainability. Every new project I take on is designed with farmers in mind. For me, the best part of this job is being able to use science to make a real difference in farmers' lives.

What got you interested in this area of work?

My interest in agriculture really initiated in Grade 12, when a guest speaker from an agricultural university came to our school. I was already used to talking with my dad about crops, and I had always been fascinated by how a tiny seed could push through the soil and grow into a plant. When I entered university, something just clicked, and I knew this was the field for me. I had the chance to learn from experts in rice and wheat breeding, and being from Punjab, where nearly 70 per cent of people are connected to agriculture, it felt like a natural path.

After moving to Canada, I saw another side of farming. The key difference I saw was irrigation. In India, irrigation is everywhere; in Saskatchewan and Manitoba, it's not as common. Those differences deepened my curiosity. Yet, despite the contrasts, the goals of farmers, whether in India or Canada, are the same: sustainability and profitability. As an agronomist, I love being the bridge between research and the field, turning science into practical solutions for farmers. That's what keeps me passionate about this work.

Can you tell us about your research program and your role?

Before developing my research program, I had discussions with experts from MCA, farmers and researchers who have worked with corn, flax and sunflower to get a sense of the research needed in these crops, since they were new to me. That helped me shape what research needs to be done and build a basic program. Right now, my focus is finding the critical period for weed control in these crops. I had trials running across different locations in Manitoba, working with the diversification centres, private contractors and trials at UM's research farm at Carman.

Apart from weed control, I'm collaborating with researchers from Agriculture and Agri-Food Canada Ottawa on corn cold tolerance trials. They've generated corn inbred lines that can be seeded in cold soils, which could be exciting for Manitoba because of our shorter, colder growing season. I'm also looking into different seeding windows for corn. Can we seed earlier to expand the growing season? I'm trying different seeding dates for different varieties to see what works best for Manitoba.

Research planning takes a lot of my time. Being new to my position at the university, I had to set up my lab, develop protocols and manage the administrative work while also being on the road most of the summer. Once the plants were out of the ground, I was busier than ever, but it was fun to be outside visiting sites and watching the crops grow. Because I work on weed emergence, I think I'm probably the only person that gets excited to see weeds! It's rewarding to see those planned experiments happening and to hope for good data that I can share to benefit special crops growers.

In winter, the focus will shift to extension, going to conferences, meeting farmers and communicating what we've found this summer.

What makes corn, flax and sunflowers interesting and important for Manitoba?

Our cropping systems are dominated by wheat and canola, but with changing climatic patterns and concerns around reducing the carbon footprint of agriculture, we need new crops in rotation. Manitoba is already the largest producer of sunflowers, and we're adapting new corn hybrids. Flax has one of the lowest carbon footprints compared to other crops. Together, these crops have high potential to diversify our cropping systems, improve soil biodiversity and promote long-term sustainability.

Because they've always been considered minor crops, there's a huge research gap compared to wheat and canola. Part of my role is to help narrow down that gap. I think if farmers adopt these crops, they can also gain entry to niche markets, an advantage when prices drop for more common crops. I've already met farmers who are very enthusiastic about growing them, and that's a big motivation for me.

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What have you accomplished so far, and what's next for your research?

As this was my first growing season, my main accomplishment was getting the trials I planned into the ground. Six trials were planted across Manitoba and the crops grew well. I'm excited to see the results and hope to have more to share once I analyze the data over the winter.

My research will always be farmer driven. I plan to evolve my program around the needs of farmers and keep in regular touch with them to understand the challenges in adopting these special crops. Most of the recommendations and practices we follow in corn and sunflower come primarily from studies in the U.S., and I think our environment is a lot different. Part of my focus will be updating production manuals and recommendations to reflect Manitoba's environment and give these crops a fresh start.

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

It's incredibly motivating to know that farmers are investing in my work. It tells me that they are open to exploring new possibilities for their farms, and it challenges me to deliver research that truly makes a difference. Farmers' support means everything and for that I am deeply thankful!

How does that farmer funding and support directly benefit farmers?

Farmers invest in this research because they see potential in these crops and want answers to the challenges they face. My role is to take those questions about weeds, fertility or management and turn them into practical solutions. It really is a partnership: farmers provide the support and we work to deliver research that helps improve their operations. That funding directly translates into recommendations on what fertilizer works best, when to apply it or how to manage weeds more effectively. I'm deeply grateful for their trust, and I hope they continue to grow these special crops. They're called "special" for a reason — they can bring real value to their farms.

What are you excited about for the future of agriculture?

What excites me most is how fast agriculture is evolving. We're updating the basics, yes, but also stepping into a future shaped by plant breeding breakthroughs, faster cropping systems and AI-driven tools. These innovations are transforming farming in ways we couldn't have imagined a few years ago. Agriculture has always been resilient, and I believe its future is brighter than ever.

Who or what inspires you?

My greatest inspiration comes from the farmers themselves. The trust they place in me through MCA, and even a simple letter from a farmer sharing their excitement about this agronomist role, remind me that this work matters. Their support, both personal and financial, drives my commitment to stay honest, dedicated and focused on research that serves them. In many ways, their confidence is what drives me to give my very best.

MCA INVESTMENT:
$1,347,492 OVER FIVE YEARS

Sunflowers grown as part of a research trial to identify the critical period for weed control.

UNDERCOVER CROPS

Manitoba research assesses potential cover-cropping strategies

Lead Researchers:

Anne Kirk* and *Joanne Thiessen Martens

COURTESY OF DEV RATHORE AND TIENHSIN (CHRISTINE) CHIU, UNIVERSITY OF MANITOBA.

Anne Kirk is the cereal crop specialist with Manitoba Agriculture. The focus of her work is cereal crop extension.

Joanne Thiessen Martens is an assistant professor in the Department of Soil Science at the University of Manitoba. Her research focuses on nutrient dynamics in agricultural systems, especially those based on ecological crop production practices.

Cover cropping is gaining interest around the world for its potential to improve soil health and add nitrogen to the soil. Despite interest in Manitoba, there are several practical barriers to adoption due to a shorter growing season and relatively low moisture availability after harvest.

Recognizing the importance of assessing practical cover-cropping strategies for Manitoba growing conditions, researchers have started two studies. One looks at spring wheat and the other at winter wheat, offering a chance to compare systems where cover crops are established either in the spring alongside the crop or in the fall after harvest.

"The benefit of the winter wheat system is that it's harvested sooner, which gives the cover crop more time to grow after harvest," says Joanne Thiessen Martens, an assistant professor of soil science at the University of Manitoba. "The downside is it requires an additional pass over the field to seed the cover crop."

In the spring wheat system, the cover crop is planted at the same time as wheat. "But because spring wheat is harvested later in the summer, there's less time for those cover crop benefits to build up in the fall," Thiessen Martens says.

"There's always a trade off with the investment into the cover crop versus the benefits that can be gained. That's how the two establishment systems may fit differently into a farmer's crop rotation, depending on their equipment and what their needs are."

The winter wheat project, led by Manitoba Agriculture cereal crop specialist Anne Kirk, looks at the potential of relay cropping with winter wheat, giving farmers a chance to incorporate legume cover crops without sacrificing a whole season of grain production. "Winter wheat is typically harvested in late July to early August, leaving time for cover crop growth prior to frost," Kirk says.

Established at the Manitoba Diversification Centres in Arborg, Carberry, Melita and Roblin in September 2023, the project is evaluating the establishment and biomass accumulation of legume cover crops, their nitrogen fixation potential, and any effect on winter wheat yield and canola performance the following year.

Winter wheat was planted in September 2023. Subsequently, cover crop treatments were seeded either in the same row as the winter wheat in the fall of 2023 or broadcast in the spring of 2024.

Treatments include four different legume cover crops (white clover, red clover, sweet clover and alfalfa), a non-legume cover crop (perennial ryegrass) and no cover crop. Established cover crops continued to grow in 2025, and canola was seeded directly into the trial area in mid-May.

Cover crop establishment was better with spring broadcast compared to fall seeding. Kirk believes seed depth was a factor because the fall seeded cover crops were planted at the same depth as winter wheat, which is deeper than standard seeding recommendations for forages.

"Deep seeding may have aided emergence if the fall had been dry, but in a year with adequate precipitation, it likely hindered emergence," she says.

At Arborg, biomass yields also favoured spring establishment, as more plant matter was produced in this system.

Higher-than-normal precipitation in May and June likely contributed to the spring cover crops' success. With different weather, results could have been the reverse. Additionally, cover crop establishment was better at Arborg than other trial locations, likely related to timing of seeding and precipitation, surface residue and soil conditions. This emphasizes the need to study these systems at multiple locations across multiple years.

Winter wheat grain yields were not affected by the cover crops, regardless of when the cover crops were established. The study intended to evaluate the canola the next year, but due to extremely dry conditions at Arborg this spring, the canola emerged very late, and the stand was thin. "We don't have yield data yet, but the dry conditions seem to have resulted in poor canola growth," Kirk says.

When asked about advice for farmers considering cover cropping, Kirk noted that the challenges are highly dependent on environmental conditions. "It's hard to make specific recommendations because we have very few years of this study," she says. "Success depends on seeding rate, timing and moisture availability. In a dry year, cover crops could use moisture the main crop needs, and in a wet year, they help manage excess water."

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ON YOUR FARM

Practical cover-cropping solutions for Manitoba conditions.

However, she says winter wheat is a good fit because its earlier harvest gives the cover crop more time to grow, potentially increasing biomass for livestock feed or nitrogen fixation.

The second project, led by Thiessen Martens and her M.Sc. student Jessica Frey, looks at integrating legume cover crops into spring wheat rotations. The research aims to evaluate legume cover crop establishment and biomass production, the effect on spring wheat grain yield and nitrogen uptake, and the impact on canola performance the following year.

"The overall goal of this research is to try to establish a cover crop with the least amount of hassle and expense to a farmer, but still produce tangible benefits," Thiessen Martens says. "In the first year, the goal was to have no negative impact on the wheat, while generating some benefits after the wheat crop going into the next year."

This project was also conducted at the Manitoba Diversification Centres. Field trials were established in May 2023 and 2024 for a total of six site years. Cover crop treatments, including white clover, red clover, sweet clover, alfalfa and a non-legume cover crop control (perennial ryegrass), were seeded with the wheat, in the same row and at the same depth.

Weather was the biggest challenge, as the spring of 2023 was dry and it was difficult to establish any kind of crop. "Most did OK, but in Arborg, for example, the cover crops didn't emerge until we applied about half an inch of irrigation," Thiessen Martens says. "There had been almost no rain that spring."

At Carberry, the white clover and red clover established successfully in spring but did not survive the whole season, likely due to the dry conditions. At Melita, the cover crops did not survive the in-crop herbicide application in June.

The following year brought excess moisture, delaying spring seeding. "Despite these extremes, we had remarkably good establishment for some of the cover crops," Thiessen Martens says.

IMAGE COURTESY JESSICA FREY, UNIVERSITY OF MANITOBA

▲ *Seeding canola into alfalfa established the previous year (2024).*

Cover crop establishment varied among site years, but alfalfa generally had the greatest plant populations and sweet clover also performed well. Wheat yields were not significantly affected, positively or negatively, by the cover crops at any of the sites.

Cover crop biomass was low during wheat growth but increased after wheat harvest in most cases. The fall biomass of all cover crops grown with spring wheat was relatively low compared to the cover crops in the winter wheat experiment. Of the four legumes tested, alfalfa and sweet clover were the most consistent across the variable conditions at the five site-years, especially in terms of growth in the following spring. By the following June, alfalfa and sweet clover produced about 2,500 kg/ha of biomass at Roblin and 3,600-3,800 kg/ha of biomass at Carberry.

In the following canola phase, the team intended to test a living mulch system, but management challenges limited success. Herbicide application and canola seeding were delayed due to wet conditions, and at most sites the cover crops overwhelmed the canola. "That highlighted how important it is to have a good plan for the next year," Thiessen Martens says.

Both projects seem to indicate that cover cropping in Manitoba is promising but complex, with no one-size-fits-all solution.

"We've seen now we can establish these systems, but we still don't know whether the benefits make it worthwhile for grain-only operations," Thiessen Martens says. "The hope is that legumes will contribute nitrogen so you could reduce fertilizer the next year, but we still can't answer that question very well."

Other benefits from cover crops, such as having living roots in the soil and soil cover in the fall and spring, are harder to measure. "We don't know how big those benefits are or how tangible they are in terms of a benefit to the crop or an economic benefit to the farmer," Thiessen Martens adds. "More research is needed on the agronomic and environmental benefits."

For now, both Kirk and Thiessen Martens encourage farmers to think about practicality first when considering cover crops. "If it's easy to implement, you don't need a huge benefit to make it worthwhile," Thiessen Martens says. "In many cases, the main cost is the seed."

Kirk adds that reducing soil erosion alone is a reason to consider cover crops. "This spring we saw many windy days and a lot of soil blowing," she says. "Having winter wheat in the rotation, or even cover crops, can be very beneficial to reducing some of that soil erosion and keep living roots in the ground longer, contributing to soil health."

While more research is needed and more answers are still to come, these trials show that cover-cropping systems are possible in Manitoba. For farmers, the key takeaways are to choose crops that suit your operation, plan carefully for the following season and consider how cover crops could work for you, whether as forage, for soil protection or for other potential benefits still being investigated.

For more information, visit mbdiversificationcentres.ca.

MCA'S INVESTMENT: $108,490 OVER TWO YEARS

MANITOBA CROP DIVERSIFICATION CENTRES

Manitoba Crop Diversification Centre
Carberry, MB

Parkland Crop Diversification Foundation
Roblin, MB

Prairies East Sustainable Agriculture Initiative Inc.
Arborg, MB

Westman Agricultural Diversification Organization
Melita, MB

Anne Kirk (centre) discusses cover-cropping research in front of the trial site in Arborg on July 30, 2025.

IMAGE COURTESY MCA.

MANITOBA CROP ALLIANCE

MCA RESEARCH

by the numbers

156 Active research projects

(as of July 31, 2025)

- **90** Barley & Wheat
- **27** Whole Farm
- **11** Corn
- **9** Increasing Capacity
- **8** Sunflower
- **7** Flax
- **4** Winter Wheat

Lifetime value of 156 current projects: **$212,622,768**

Total MCA contribution: $17,113,766

MCA leveraging rate in 2024–2025:

For every farmer member $1 → MCA leveraged to $8

MCA invested $536,045 in Manitoba Diversification Centres to increase research capacity in the province.

Total MCA contribution by centre:

Centre	Contribution
MCDC	$198,697
PCDF	$64,237
PESAI	$122,000
WADO	$63,860

MCA total investment in research and production in **2024–25** fiscal year: **$5,368,662**

Research and production budget for **2025–26** fiscal year: **$6,435,359**

RESEARCH ON THE FARM

2025 Research on the Farm

- 14 protocols
  - 2 Barley, 4 Wheat, 1 Corn, 2 Sunflower, 3 Flax, 1 Winter Wheat, 1 Whole Farm
- 76 trial locations

Since 2015, our commitment to farmer-led research has produced

432

ROTF trial locations, featuring all MCA crop types

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.

43.56%

In the 2024–25 fiscal year, 43.56 per cent of the MCA check-off was eligible to earn an investment tax credit.

Variety Performance Trials

MANITOBA CORN COMMITTEE:

10 locations

616

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

SUNFLOWER VARIETY PERFORMANCE:

3 locations

76

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

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

MANITOBA CROP ALLIANCE

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Manitoba Crop Alliance

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