MANITOBA CROP ALLIANCE

The Focal Point

Winter 2023 Edition

CEREALS

WHEAT BREEDING 101

EXPLORING THE VARIETY DEVELOPMENT PROCESS /17

SUNFLOWER

THE RESULTS ARE IN!

KEY FINDINGS FROM THE 2021 FERTILIZER USE SURVEY /14

PLUS

HEAT® LQ SUPPORTED AS PRE-HARVEST AID ON FLAX /12

THE BASICS OF AGRICULTURAL DRAINAGE /24

MESSAGE FROM THE CHAIR

***Robert Misko** — Roblin, Manitoba*

Welcome to the third edition of the Focal Point, Manitoba Crop Alliance's (MCA) annual research magazine. In just two and a half years, our research program has grown exponentially, with the addition of new projects in all crop types, as well as the development of our Whole Farm Research program. We are currently funding 94 active research projects and have invested $11,268,114 into these projects.

In this edition, you'll find information on the major research projects we're funding on your behalf and the researchers and scientists involved in the projects.

From all of us at MCA, we hope you find this information valuable and can use it to help support decision making on your farm.

Sincerely,

Robert Misko
MCA Chair

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CONTENTS

THE FOCAL POINT | WINTER 2023 EDITION

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

WHOLE FARM

MEET A RESEARCHER

Dr. Dilshan Benaragama

New research chair focused on expanding weed research capacity in Manitoba

PHOTO: SEUNGBUM STEVE RYU

For a long time, weeds in Manitoba have been competing with farmers' crops for valuable nutrients and resources, negatively affecting yields, crop quality and farm profits. After decades of using herbicides as the main tool for combatting weeds, farmers are now facing the challenge of managing herbicide-resistant weeds. One thing we know for sure about dealing with this challenge is that developing and implementing integrated weed management strategies will be critical.

Last year the Western Grains Research Foundation (WGRF), along with Manitoba Crop Alliance (MCA), Manitoba Canola Growers Association (MCGA) and Manitoba Pulse & Soybean Growers (MPSG), announced a $1.3-million investment toward funding a new Manitoba crop protection chair position in weed management at the University of Manitoba (U of M). The role is dedicated to expanding weed research capacity in Manitoba.

The idea for this position came from the recognized need for increased communications between researchers and farmers in Manitoba.

"As a farmer-directed research funding organization, it is critically important that we work with the field crop associations to understand and address farmers' crop production concerns with the appropriate research," said Garth Patterson, executive director of WGRF at the time of the announcement. "Public research institutions, such as the U of M and others, have tremendous research expertise that we need to support and leverage to remain competitive."

Weed management is a critical issue for western Canadian farmers. The U of M identified this need to build on its current strengths in crop agronomy research and continue to strengthen collaboration within the industry, says Nazim Cicek, associate dean of research at the U of M

"The Faculty of Agricultural and Food Sciences has really close ties with all our commodity groups, whether they're Manitoba based or based in the Prairies. With the new position, we want to ensure we are well aligned with our commodity organizations, so the research we are doing not only has academic or scientific value, but also benefits farmers. We will address the short- and medium-term problems that farmers have and extend our knowledge and research findings to farmers through the commodity organizations."

Dr. Dilshan Benaragama was chosen to take on this new

Researcher Bio:

Dr. Dilshan Benaragama was raised in Sri Lanka, where he earned his undergraduate degree in agriculture. He moved to Canada in 2008 to study at the University of Saskatchewan and joined the Department of Plant Science to do his master's degree and PhD. In May 2022, Benaragama joined the University of Manitoba in a new position as the crop protection chair in weed management. Benaragama now lives in Winnipeg with his wife Indika and their two children, Thenuki and Methum.

role in May 2022, based on his extensive experience in weed research specific to Western Canada and passion for advancing our knowledge in this area.

"I am thankful for the opportunity to join the U of M in this capacity and am eager to develop weed management and decisions-making strategies for farmers in Manitoba," he says.

Q&A with Dr. Benaragama

Where did you work before the U of M?

After I completed my PhD in 2016, I took a job as a senior lecturer at Rajarata University of Sri Lanka. In this role, I mainly taught, but I also worked on a bit of research in the Department of Plant Sciences. In July 2019, I returned to Canada and took up a post-doc position in the Department of Plant Sciences at the University of Saskatchewan with Chris Willenborg as my supervisor. I worked as a post-doc until I began my current role with the U of M in May 2022.

What got you interested in this area of work?

My interest in weed science and research mainly started through my master's training. I was learning about how problematic weeds could be and how we could use our knowledge to develop different weed management strategies. I think my master's project gave me a lot of insight into weed science and research, and continuing on with my PhD gave me further insight into weed ecology. That is when I realized I was interested in continuing to do research and building my career around weed science.

Tell us about your role at the U of M.

While my main focus is on research, I am involved in teaching and training graduate students in weed science and agronomy.

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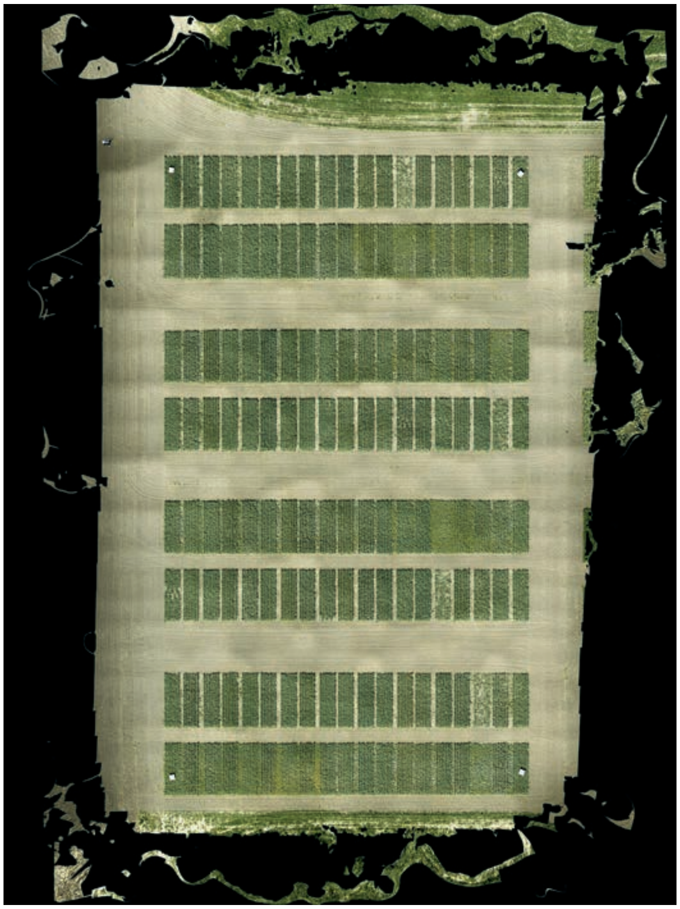

PHOTO: SEUNGBUM STEVE RYU

▲ *Drone view of crop variety screening for competitive ability against weeds using a remote sensing approach.*

PHOTOS: DILSHAN BENARAGAMA

▲ ***Above and opposite page:*** *Experiments being carried out in a long-term alternative cropping systems trial at Scott, SK.*

There are two areas of focus for my research program. The first is fundamental research: understanding the fundamentals of weeds (biology, ecology and adaptations) and how they behave under different circumstances. In order to develop strategies in a good integrated weed management plan, we need to understand the weeds, further taking into consideration factors such as weed seed bank, germination, adaptations and phenology.

When it comes to integrated weed management, I want to focus more on the long-term effects of the individual weed management strategies we currently have. How much longer can we use them sustainably? How can we manage weed persistence with these strategies?

I will be looking at the advantages of using different cultural practices and weed management together from a long-term perspective. I think once we realize more of the benefits of these integrated weed management strategies, we will further understand the importance of adapting them.

The second area of focus is to develop a digital base for weed management research by bringing in remote sensing technology (think drones and satellites). Precision agriculture is expanding and we need to utilize this technology in both research and in on-farm weed management. There is a major research gap in this area and I intend to fill it.

More precisely, I want to develop better decision-making tools for farmers using remote-sensing technologies. I think the proper evaluation of the scenario is critical for managing herbicide resistance, as well as implementing site-specific integrated weed management strategies and, finally, reducing the herbicide load in the environment.

Overall, my focus will be on how we can use digital technology to detect weeds and make precision weed management decisions. My objective is to develop research outputs for Manitoba farmers by identifying and prioritizing your challenges.

MCA'S CONTINUED INVESTMENT INTO U OF M RESEARCH

- **Contributed $500,000 towards the building of the Prairie Crops & Soil Research Facility (PCSRF) at the U of M (2021)**
- **The Canadian Wheat Research Coalition (CWRC), alongside WGRF and the Saskatchewan Winter Cereals Development Commission (SWCDC), committed over $3.5 million in funding to a five-year core breeding agreement with the U of M (2021)**
- **Contributed $158,333 to support five years of the Integrated Crop Protection Chair position (2022)**
- **MCA funds 19 active projects where a U of M researcher is the lead investigator. Total value of projects is $12,039,910 and MCA's contribution is $2,587,936 over the active project lifespan**

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

It is extremely important. I'd like to thank the farmers for contributing to this position and for all the work that has been done by the commodity groups. There is a need to expand the capacity of weed research because weeds are problematic for farmers every season. Herbicide resistance is escalating and farmers need solutions. I think by funding these types of positions, farmers will be able to develop better crop protection strategies in Manitoba and within Canada. There is a lot of value, and having two-way communication with the commodity groups will help us further develop our research program.

How does that farmer funding and support directly benefit farmers?

Through this research program, we are aiming to develop outcomes (knowledge, tools, strategies, etc.) that will directly benefit farmers. Farmers will benefit from both fundamental and applied research we conduct, as all these approaches focus on managing weeds in a sustainable way.

I want to acknowledge all the commodity groups and farmers involved in this process and the U of M for initiating this program and giving me the opportunity to join their institution. I will do my best to deliver results in the coming years.

How do you spend your time outside of work?

During my free time I like to go camping, enjoy nature, travelling and visiting other cities. I also like to play cricket.

Who or what inspires you?

My supervisor Steve Shirtliffe is the person behind my success as an academic. I worked with him for more than eight years and that really shaped me. Over the years, I saw how he was training and encouraging students and guiding them to become good scientists. I saw how he developed his career and research program and his overall influence on agriculture. Those things have inspired me. I want to follow his path and become a scientist like him.

What is a good piece of advice you've received?

Nothing in this world is free, you have to earn it. Money, reputation and happiness – you have to work hard and you have to earn it. Work hard to excel yourself.

For more information about this position and other MCA-funded research, visit mbcropalliance.ca.

MCA ANNUAL INVESTMENT: $31,667

CO-FUNDERS:

Manitoba Pulse & Soybean Growers
Manitoba Canola Growers
University of Manitoba
WGRF Advancing Agriculture through Research

RESEARCH ON THE FARM

Field-scale corn trials aim to determine impacts of increasing and decreasing normal planting rates across Manitoba

Corn is a great rotational crop to add to an operation if it fits the environment and climate. It is a deep-rooted crop that can seek out water and nutrients in the soil when under stress. As a glyphosate-tolerant crop, it cleans up fields with in-crop herbicide applications and has strong pre-emergent herbicide options for tough-to-control weeds.

Grain corn acres have expanded in Manitoba over the past decade with the availability of shorter-season hybrids. This has enabled grain corn to be grown in less traditional areas of the province, but also adds some stability in the locations more established at successfully growing grain corn.

Varying hybrid maturities across a farm can slightly break up harvest. They can also provide reliability if an early fall frost occurs, or if heat unit accumulation is below normal on a given year.

Planting rates play a critical role as well, as they affect the overall health and vigour

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Lead Researchers:

Daryl Rex and Jordan Karpinchick

Daryl Rex, a Research Trial Specialist, joined the National Sunflower Association of Canada in the spring of 2018. Prior to that, he was conducting small-plot research trials for a major seed company for close to 30 years in Western Canada. Daryl was raised on a Manitoba Century family farm in the Pembina Valley and has a bachelor of science in agriculture from the University of Manitoba.

Jordan Karpinchick, an On-Farm Trial Coordinator, has worked at Tone Ag Consulting Ltd. as a nutrient management specialist, focusing on field-scale research, with his wife Elizabeth since 2012 and purchased the business in 2019. Jordan grew up in Welland, ON, and has a bachelor of arts in geography and GIS from Brock University. Jordan is also a Prairie certified crop advisor and holds a 4R Nutrient Management certification.

PHOTO: MORGAN COTT

Harvesting at a Research on the Farm corn trial location.

of the crop. Singulation of each seed is necessary in a low population row crop like corn to achieve an adequate plant stand. Every individual kernel requires adequate room to grow and develop an extensive root system to discover water and nutrients in the soil. Uniform plant spacing is important.

In Manitoba, grain corn is typically planted at rates between 30,000-36,000 plants per acre. These populations have increased over the last decade or so because new genetics have improved several factors in corn development. This has allowed grain corn to be grown in denser populations, making the most out of every inch of real estate each plant is given.

As part of the Research on the Farm trial program, farmers from across Manitoba participated in field-scale trials to examine and determine the best corn plant populations under Manitoba growing conditions. Corn planting rate trials were conducted in 2020, 2021 and 2022. Farmers from the following rural municipalities participated in the on-farm trials over the last three growing seasons:

- Brokenhead
- De Salaberry
- Dufferin
- Glenboro-South Cypress
- Grey
- Hanover
- North Norfolk
- Rhineland
- Ritchot
- Springfield
- Stanley
- Wallace-Woodworth

The objective of the corn plant population study is to quantify the agronomic and economic impacts of increasing and decreasing normal planting rates in corn. Each of the participants' normal planting rates were increased and decreased by roughly 10 per cent (+/-3,000 plants/ac).

Trial participants followed the same requirements and worked with Manitoba Crop Alliance (MCA) and Tone Ag Consulting (Tone Ag) to set up the trials. Tone Ag performed the soil samples, did all the plant counts, weighed the individual harvested strips with weigh wagons and collected harvest samples, making it minimal work for trial particpants.

Conditions in 2020 began as warm and dry, and that pattern continued all growing season. Conditions in 2021 began very wet in the spring with high accumulation of corn heat units. The precipitation stopped, but corn heat units continued to accumulate and the soil dried out significantly. Then 2022 started off wet and cool, with below-average corn heat units accumulating in most of the province until mid-summer.

"The corn plant population study is based off of real-life conditions on each farm," says Daryl Rex, research trial specialist with MCA. "Through the trials we are mainly comparing the different planting rates/plant stands to see how they affect the final product, yield and the farmer's bottom line."

The 30 trials that were conducted in 2020, 2021 and 2022 seem to indicate that the current plant population recommendations are valid. Looking at the actual plants per acre in the trials, it seems that plant stands in the range of 30,000-34,000 plants per acre perform the best under these circumstances for yield.

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TABLE 1 | 2020 CORN SINGLE SITE ANALYSIS

			PLANT STAND @ V2 STAGE				YIELD				
Location	Planting date	Row spacing (inches)	Normal plant rate (check)	High seed rate	Check seed rate	Low seed rate	High seed rate	Check seed rate	Low seed rate	CV %	Statistically significant @ 95%
			Plants per acre				Bushels per acre				
North Norfolk	May 13	30	31,000	34,000	31,500	29,000	138.5	145.9	150.1	5.8	No
North Norfolk	May 11	30	35,000	35,250	32,500	30,750	155.0	155.4	152.0	2.3	No
Hanover	May 12	30	33,000	35,500	29,250	28,250	78.6	73.5	75.7	14.8	No
Wallace-Woodworth	May 7	30	36,000	31,250	29,250	23,500	108.1	104.4	101.4	3.4	**Yes**
De Salaberry	May 16	22	33,000	28,250	29,750	27,250	142.7	140.7	127.4	5.9	**Yes**
Rhineland	May 15	10	42,000	42,000	40,250	36,500	156.2	161.4	169.6	4.7	**Yes**
Stanley	May 16	30	34,400	36,800	34,500	30,300	182.9	183.6	186.6	2.9	No
De Salaberry	May 17	22	30,000	28,250	24,740	23,500	153.2	143.7	141.6	4.1	**Yes**
Dufferin	May 19	20	34,000	36,250	34,000	32,250	127.7	128.9	126.7	1.9	No
Hanover	May 19	22	34,660	36,750	34,000	30,250	147.4	147.6	145.1	1.8	No
Glenboro South Cypress	May 22	30	34,000	32,250	29,750	27,500	150.1	150.6	148.2	3.7	No

Four site years showed a significant yield difference between the three seeding rates (see Table 4 on Page 10 for economic analysis).

TABLE 2 | 2021 CORN SINGLE SITE ANALYSIS

			PLANT STAND @ V2 STAGE				YIELD				
Location	Planting date	Row spacing (inches)	Normal plant rate (check)	High seed rate	Check seed rate	Low seed rate	High seed rate	Check seed rate	Low seed rate	CV %	Statistically significant @ 95%
			Plants per acre				Bushels per acre				
Dufferin	May 8	20	34,000	36,500	35,000	31,500	149.5	150.0	150.2	2.5	No
Hanover	April 28	30	33,000	34,250	31,000	29,000	49.6	63.4	49.6	15.9	No
Brokenhead	May 3	20	32,000	29,000	29,000	26,500	109.5	108.0	106.5	4.2	No
North Norfolk	May 3	30	34,000	32,000	29,250	26,250	148.2	147.2	142.3	3.0	No
Grey	May 4	30	32,000	28,250	25,750	21,000	133.9	128.8	126.1	6.9	No
Stanley	May 4	30	33,800	33,750	32,750	28,250	138.4	132.4	128.4	7.1	No
Rhineland	May 4	10	38,000	34,250	35,500	35,000	135.0	130.0	122.3	5.5	No
North Norfolk	May 5	30	32,000	35,750	31,750	27,750	85.7	86.7	91.9	4.9	No
Springfield	May 5	15	35,000	38,000	33,000	32,500	105.0	102.7	103.1	8.5	No
Springfield	May 5	15	35,000	38,000	33,000	32,500	94.6	99.9	96.5	4.1	No
Brokenhead	May 7	22	34,000	35,667	33,667	30,667	86.1	90.2	89.7	6.8	No
Ritchot	May 8	22	34,269	35,250	33,000	29,250	96.7	99.3	101.8	9.2	No

None of the site years showed a significant yield difference between the three seeding rates, therefore an in-depth economic analysis was not performed.

PHOTO: MORGAN COTT

▲ *In Manitoba, grain corn is typically planted at rates between 30,000-36,000 plants per acre.*

TABLE 3 | 2022 CORN SINGLE SITE ANALYSIS

			PLANT STAND @ V2 STAGE				YIELD				
Location	Planting date	Row spacing (inches)	Normal plant rate (check)	High seed rate	Check seed rate	Low seed rate	High seed rate	Check seed rate	Low seed rate	CV %	Statistically significant @ 95%
			Plants per acre				Bushels per acre				
Dufferin	May 19	30	33,800	27,200	28,400	27,750	188.0	190.9	191.7	2.6	No
Dufferin	May 24	20	33,000	38,000	31,600	32,500	160.9	163.7	167.8	3.3	No
Grey	May 24	30	32,000	32,100	31,400	29,500	136.3	145.8	144.8	10.0	No
Hanover	May 26	30	33,000	29,000	33,000	29,250	142.6	144.1	144.4	1.9	No
North Norfolk	May 17	30	35,000	37,500	34,600	32,500	163.0	172.1	165.8	1.2	**Yes**
North Norfolk	May 17	30	32,000	30,800	28,900	26,700	160.4	158.1	153.4	4.2	No
Springfield	May 26	15	35,000	37,100	34,700	32,600	113.9	112.4	109.8	2.4	No

One site-year showed a significant yield difference between the three planting rates (see Table 5 below for economic analysis).

TABLE 4 | 2020 ECONOMIC ANALYSIS

		SEED COST PER ACRE			YIELD (BUSHELS PER ACRE)			NET PROFIT PER ACRE (SEED COSTS)		
Location	Normal plant rate (check)	High seed rate	Check seed rate	Low seed rate	High seed rate	Check seed rate	Low seed rate	High seed rate	Check seed rate	Low seed rate
Wallace Woodworth	36,000	$117.00	$108.00	$99.00	108.1	104.4	101.4	$423.50	$414.00	$408.00
De Salaberry	33,000	$108.00	$99.00	$90.00	142.7	140.7	127.4	$605.50	$604.50	$547.00
Rhineland	42,000	$135.00	$126.00	$117.00	156.2	161.4	169.6	$646.00	$681.00	$731.00
De Salaberry	30,000	$99.00	$90.00	$81.00	153.2	143.7	141.6	$667.00	$628.50	$627.00

TABLE 5 | 2022 ECONOMIC ANALYSIS

		SEED COST PER ACRE			YIELD (BUSHELS PER ACRE)			NET PROFIT PER ACRE (SEED COSTS)		
Location	Normal plant rate (check)	High seed rate	Check seed rate	Low seed rate	High seed rate	Check seed rate	Low seed rate	High seed rate	Check seed rate	Low seed rate
North Norfolk	35,000	$118.00	$109.00	$99.00	163.0	172.1	165.8	$1,512	$1,612	$1,559

Indicates statistical difference at 95% confidence interval.
Price of corn: In 2020, calculations were made with the price of corn at $5/bushel, and in 2022 at $10/bushel.

CV: *The statistical measure of random variation in a trial. The lower the value, the less variable the data.*

ON YOUR FARM

Corn planting rate recommendations still appropriate for Manitoba farmers

The results from the Research on the Farm corn plant population trials confirm that plant stands from 30,000-34,000 plants per acre appear to perform the best under Manitoba growing conditions. This isn't new information, but it confirms that farmers are planting in populations that are reasonable for our province, soil types and management practices.

"The goal of these trials is to determine the most economical planting rates on various farms and, as it turns out, most farmers are doing just that," says Rex.

As an agronomist with MCA, Morgan Cott appreciates the results because they show how easy it is to perform these projects with a farmer, enabling them to determine what works best on their operation with the hybrid(s) they have chosen.

"Some participants will probably be altering their planting rates because they saw they could capture a better ROI by making a small and very easy change," she says. "That took very little effort on their behalf."

Real practices on real farms give real results, says Dean Toews, who farms near MacGregor, MB, and participated in the trials.

"These trial results show us that we're not far off the optimum mark," he says. "It confirms our practices, and we can see what other guys are doing in different areas and how the different seeding rates respond in different soil types or climates."

Toews farms with his two brothers and their dad, and they have been growing corn since the early '80s. The Toews' have always done trials on their farm for their own interest's sake, but the Research on the Farm program allows them to compare their farm on a sliding scale with other farms in the area or in the province.

"It supports either what we've been doing, or what other guys have been doing as the better practice," Toews says. "It gives us a lot of comparison points and it benefits everybody."

Toews adds that the Research on the Farm trials are neutral and unbiased, unlike trials with seed or chemical companies.

These plant population trials confirm that seed companies and farmers are aware of what works best on each field and the hybrids they are growing.

"Ultimately, farmers get the best return on investment when they put forth the effort to do trials like this on their farms," Cott says. "The results tell them what works best for their operation, in a certain field, with a certain hybrid."

Hybrids are always improving, and while seed companies are doing the work to determine appropriate planting rates, it is also our responsibility to figure out what works best in the various environments in Manitoba, Rex says. "We encourage farmers to perform this research on their own farms, because only you know your farm and what works best from field to field."

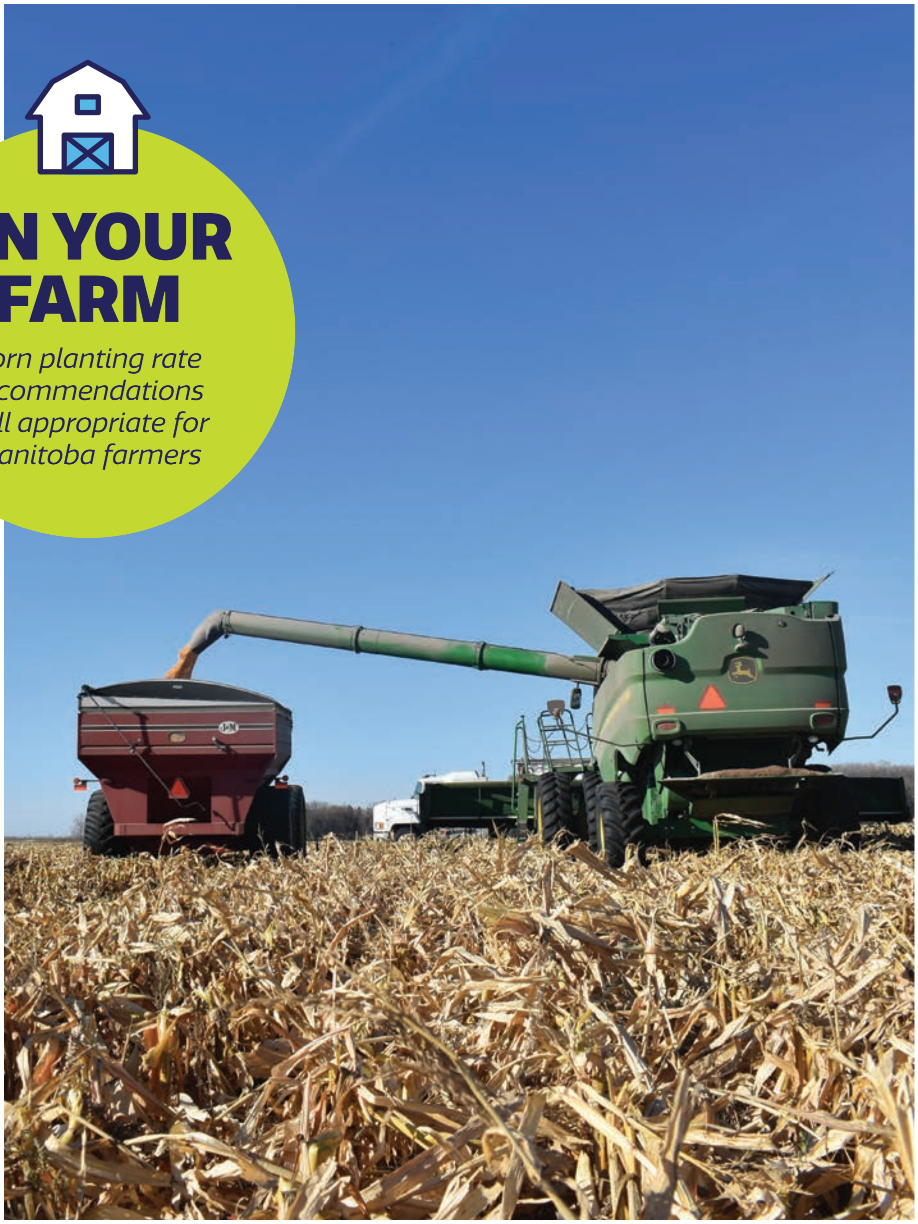


PHOTO: MORGAN COTT

The results from the corn plant population trials confirm farmers are planting in populations reasonable for our province, soil types and management practices.

All farmers in Manitoba who are members in good standing with MCA can participate in these and other Research on the Farm trials. For more information about the trials or to participate, contact Daryl Rex at daryl@mbcropalliance.ca.

MCA ANNUAL INVESTMENT: $30,980

HEAT® LQ SUPPORTED AS PRE-HARVEST AID ON FLAX

Manitoba flax farmers have one more tool in their arsenal, thanks to work by MCA and partners

Flax is a hearty crop that can adapt to a variety of soil types and climates. However, it also presents challenges, primarily harvestability and straw management. Flax stalks tend to mature unevenly and can remain green throughout the fall, making them difficult to manage at harvest and in the following spring. There are two types of chemistries available to assist with flax harvest management in Canada: pre-harvest herbicides (pre-harvest aids) and desiccants.

Pre-harvest aids are non-selective, systemic herbicides that provide late-season perennial weed control and may improve flax harvestability by reducing the amount of green material in the field. Desiccants are non-selective herbicides that rapidly dry down the crop and weeds to allow for an earlier harvest.

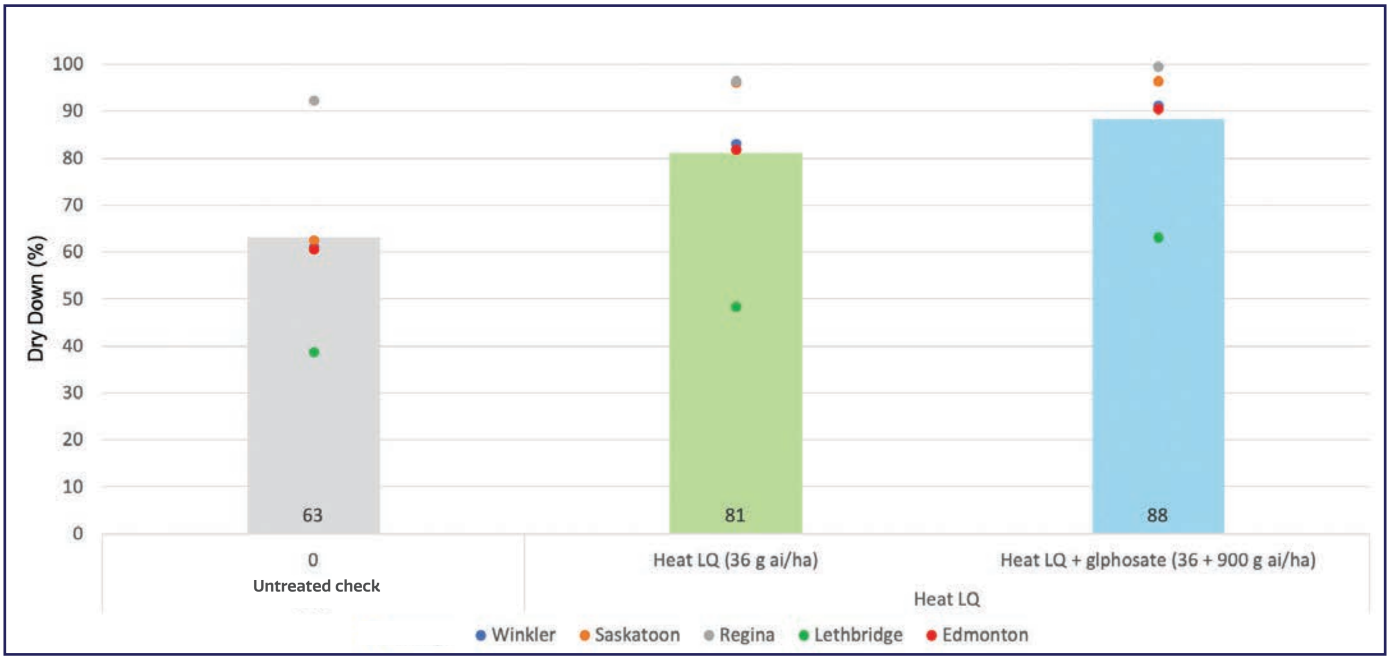
A desiccant or pre-harvest aid application benefits harvest by evening out stalk moisture or stay-green and "desiccating" or drying out that plant material. The goal is to have a plant that breaks down easily, does not wrap around moving parts of a combine and degrades in the field readily over fall and winter months.

There are three pre-harvest aids registered for flax in Canada: saflufenacil (Heat® LQ), diquat and glyphosate. Heat® LQ has been registered as a pre-harvest aid for flax for several years, but the application wasn't recommended due to knowledge gaps regarding the efficacy when applied alone (not tank-mixed with glyphosate) and acceptability of the flax seed in export markets.

"Canadian flax has a reputation for high quality, and we want to ensure farmers have the agronomy management tools to maintain the reputation we have for our flax," says Wayne Thompson, executive director of the Saskatchewan Flax

Lead Researcher: BASF

BASF Canada Agricultural Solutions, headquartered in Calgary, AB, has over 625 employees who work at one of three production facilities across Canada or one of several research farms across the Canadian Prairies. Agricultural Solutions is the largest division of BASF Canada Inc., working closely with the regional Agricultural Solutions team and collaborating on research and product development that benefits North American farmers. To find out more about BASF Canada Agricultural Solutions, visit agsolutions.ca or follow them on Twitter at twitter.com/BASFAgSolutions.



▲ *Per cent drydown/desiccation of the flax crop 18-25 days following an application of Heat® LQ and Heat® LQ + glyphosate compared to untreated flax. Heat® LQ applied alone provided similar flax drydown/ desiccation compared to the Heat® LQ + glyphosate treatment.*

PHOTO: BASF CANADA AGRICULTURAL SOLUTIONS

▲ *Flax pictured seven days after pre-harvest aid application. Heat® LQ providing very similar flax drydown/desiccation compared to the Heat® LQ + glyphosate treatment.*

ON YOUR FARM

Research confirms efficacy of Heat® LQ pre-harvest for flax across all export markets

Development Commission (SaskFlax).

The prior understanding was that Heat® LQ as a pre-harvest aid on flax would exceed maximum residue limits (MRLs) for the European market, an important market for Canada. In terms of herbicide residue limits, flax is classified in the same group as canola, which also complicated things, Thompson says.

"Historically the residue work was completed for canola, a much larger crop than flax, and flax residue information was based off that. More background work on flax MRLs was needed."

However, because the industry recognized that Heat® LQ could be a useful agronomic tool to improve flax harvestability, it came together to work on behalf of farmers. BASF Canada Agricultural Solutions (BASF), in partnership with Manitoba Crop Alliance (MCA) and SaskFlax, ran a field trial program with financial support from the two provincial organizations.

"Desiccants are important for flax harvest," says Mark Oostlander, senior research manager for herbicides at BASF. "When we were approached by the flax councils asking if we would support this application, more background work was needed to understand the implications on market access."

Two evaluation criteria were developed, he says. First, testing the efficacy of the product, (i.e., if Heat® LQ dries down flax when applied by itself at registered rates). Second, determining if there would be any concerns around market access with selling the seeds.

To address these questions, trials were conducted at nine BASF research sites across Western Canada.

Heat® LQ was applied pre-harvest to flax at the recommended timing of 30 per cent seed moisture (75-80 per cent of the bolls are brown). Desiccation efficacy was determined every 3-5 days until the flax was ready to harvest.

Trials were harvested and samples of each treatment were analyzed for residue to determine the suitability of the flax seed to enter export markets.

Results from extensive testing on five locations over two years concluded improved flax dry down when Heat® LQ was applied as a standalone treatment (not tank mixed with glyphosate) at labelled rates. In addition, the acceptability for the use of Heat® LQ pre-harvest at the labelled rate as a standalone treatment for flax across all key export markets was determined.

"This research gives flax farmers a viable tool to facilitate harvest while ensuring no limitations on market access for their product," Oostlander says. "It is also a great example of all partners working together to solve farmers' needs and to support the agriculture industry."

For the 2022 growing season, 40 acres/case was recommended for application when 75-80 per cent of bolls were brown and had less than 30 per cent seed moisture. This recommendation was in place for the 2022 growing season and remains the same for 2023.

For 2023, the existing recommendation remains in place to avoid tank mixing with glyphosate. However, work to assess this use pattern is still ongoing.

Furthering our knowledge around products for Canadian crops is extremely important, and the industry will continue to support work in this area, Thompson says. "Being a small crop, we are continuously looking for more options, so farmers have the tools they need to grow and manage a good flax crop."

A general reminder for flax farmers: Always refer to the product label for application rates and pre-harvest intervals when using any crop product. In addition, always contact your buyer to ensure they will accept treated flax before making your pre-harvest application decisions. ●

For more information on Heat® LQ visit agriculture.basf.ca/west/products/solutions/heat-lq.html.

MCA ANNUAL INVESTMENT: $5,000

CO-FUNDERS:

SaskFlax

BASF We create chemistry

SUNFLOWER

THE RESULTS ARE IN!

Key findings from the 2021 Fertilizer Use Survey and what they might mean for your farm

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Since 2014, Fertilizer Canada has conducted its annual Fertilizer Use Survey to gain a better understanding of fertilizer management in Canadian crop production and to learn how farmers make decisions about fertilizer applications.

Each year, the survey captures data about corn, soybean, winter wheat, spring wheat, flax, sunflower and canola crops in Canada. In 2021, there were 39 sunflower participants in the Fertilizer Use Survey. Manitoba Crop Alliance (MCA) has broken down some of our key takeaways from this data to share with our farmer members.

FERTILIZER APPLICATION TIMING

In 2021, about 45 per cent of sunflower farmers applied the bulk of their fertilizer in the spring before planting.

- **Nitrogen (N):** 36 per cent of sunflower acres were treated in the spring before planting
- **Phosphorus (P):** 28 per cent of sunflower acres were treated in the spring before planting
- **Potassium (K):** 13 per cent of sunflower acres were treated in the spring before planting
- **Sulphur (S):** 21 per cent of sunflower acres were treated in the spring before planting

Myles Kubinec farms about 2,000 acres near Holland, MB, with his wife Anastasia, who is an agronomist, and his father-in-law. They operate a pedigreed seed farm and grow a little bit of everything.

From the results of a 2020 soil test, the Kubinecs determined their optimal N, P, K and S rates for 2021.

"We knew we were going to put Edge™ on the field, so we applied a custom blend of fertilizer at the same time," Kubinec says.

The Kubinecs tend to set up fields both in the fall or spring, and it varies field by field.

"We are limited by machinery," he says. "We have a single shoot seeder, and our planter does not apply fertilizer. All our nitrogen has to be on before our crops that we use our seeder for, and all of the fertilizer has to be on before the planter, or after."

FERTILIZER PLACEMENT

Below are the amounts of each fertilizer type that were applied either in the spring before planting or at planting using each placement. Note, this does not include fertilizer placement from the previous fall.

N placement in the spring before planting

- 3 per cent broadcast on soil surface with no incorporation
- 28 per cent broadcast on soil surface followed by incorporation
- 4 per cent pre-plant banded

N placement in the spring at planting

- 7 per cent broadcast on soil surface with no incorporation
- 22 per cent mid-row banded at planting

P placement in the spring before planting

- 3 per cent broadcast on soil surface with no incorporation
- 21 per cent broadcast on soil surface followed by incorporation
- 4 per cent pre-plant banded

P placement in the spring at planting

- 1 per cent side banded at planting
- 12 per cent mid-row banded at planting
- 13 per cent seed placed

K placement in the spring before planting

- 10 per cent broadcast on soil surface followed by incorporation
- 3 per cent pre-plant banded

K placement in the spring at planting

- 3 per cent mid row banded at planting

S placement in the spring before planting

- 20 per cent broadcast on soil surface followed by incorporation
- 1 per cent pre-plant banded

S placement in the spring at planting

- 4 per cent broadcast on soil surface with no incorporation
- 7 per cent mid-row banded at planting
- 6 per cent seed placed

**These percentages represent the proportion of total sunflower acres treated with each macronutrient in a specific method.*

"It is always interesting to see how the bulk of fertilizer is applied, as it cannot be placed with the seed," says Morgan Cott, MCA's agronomy extension specialist for special crops. "Many farmers don't have the ability to mid-row band their fertilizer with their planter and so much of the fertilizer is broadcasted then incorporated, which is no surprise."

In 2021, a few sunflower farmers applied some of their nitrogen in-crop – one per cent broadcast into standing crop with no incorporation (top-dress) and three per cent surface banded below the crop canopy (dribble). In-crop nitrogen applications are not common practice in sunflowers, but it can certainly be done effectively and safely. These may have been rescue applications because the farmer was unable to apply their nitrogen upfront due to certain environmental conditions. Further to environmental conditions at planting, these farmers may not have had confidence in the crop pulling through the conditions and didn't fertilize with the seed, so this was another version of a rescue application.

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PHOTO: MORGAN COTT

In 2021, about 45 per cent of sunflower farmers applied the bulk of their fertilizer in the spring before planting.

earcher:

zer Canada

da represents manufacturers and wholesale butors of nitrogen, phosphate, potash and ers. The fertilizer industry plays an essential s economy and is committed to supporting rough innovation, sustainability, stewardship, rity.

PHOTO: MORGAN COTT

▲ *It appears sunflower farmers are most likely to put all their nitrogen down at once, rather than splitting the volume up between fall, spring and/or in-crop.*

AVERAGE FERTILIZER RATES PER PRODUCT

The average N rate in sunflowers in Manitoba was 91 lbs/acre and 65 per cent of N volume was applied between 75-105 lbs/acre. It appears sunflower farmers are most likely to put all their nitrogen down at once, rather than splitting the volume up between fall, spring and/or in-crop.

As mentioned above, three farmers applied up to 86 lbs of N after planting/in crop. This is an interesting practice and could be due to environmental conditions or other factors. Kubinec thought it could be due to a few reasons: the farmer was concerned about timing due to weather or labour constraints; the farmer fertilized for historic sunflower yields or soil test yield predictions, but in season the crop looked good, so they decided to top dress; the farmer was concerned about excess moisture and drowning the crop early on; or there were financial constraints early in the season, which caused a delay in fertilizing.

The average P rate in sunflowers in Manitoba was 27 lbs/acre, and 71 per cent of the volume was applied between 25-30 lbs/acre. Ten farmers (25 per cent of respondents) didn't apply P at all.

The average K rate was 10 lbs/acre, and 77 per cent of farmers did not apply any K in 2021. There were four farmers who applied K quite heavily, which could be due to soil test results.

As for S, most farmers don't apply in sunflowers, as the crop is a very low user of S. It's a good practice to put down a little S with each crop, but not uncommon to apply it every few years or load it when seeding a S-loving crop.

Over half of sunflower farmers (54 per cent) say they apply a blanket blend for all their sunflower fields, rather than tailoring it per field. Treating most fields similarly unless they have outlying yield potential is commonplace among many farmers and crops. It is good practice, however, to treat each field individually when possible.

ON YOUR FARM

Fertility rates remain unchanged in sunflowers

Most sunflower farmers (62 per cent) also set their fertility rates by field based on expected yield of that field. This is the case for the Kubinecs.

For each nutrient type, most sunflower farmers said they used their soil test report to decide the amount of fertilizer to apply to their crop in 2021.

"It's always good to learn how farmers are making their fertility decisions," says Cott. "The agriculture industry is interested in this data because it gives us a good idea where research can be done, or isn't needed, to possibly improve common practices."

CONSISTENCY CRITERIA FOR SUNFLOWERS

Spearheaded by Fertilizer Canada, the 4R Nutrient Stewardship program (Right Source @ Right Rate, Right Time, Right Place®) offers a guideline of best management practices (BMPs) to help farmers optimize fertilizer use efficiency, minimize losses and improve crop productivity.

To have acres counted under the 4R Nutrient Stewardship Framework, a farmer must work with a 4R-designated agronomist who submits aggregated 4R acres under their advisement. To be a 4R designated agronomist, you must be a P. Ag or Certified Crop Advisor.

Participation in this voluntary program builds capacity of our industry partners to rapidly implement 4R Nutrient Stewardship, develop sustainable nutrient management plans with trusted advisors and demonstrate that Canadian farmers are at the forefront of BMPs in commercial fertilizer use. Visit fertilizercanada.ca to learn more about the 4R designation process.

In 2021, 72 per cent of sunflower acres assessed within the survey were confirmed to be meeting the recommendations for implementing 4R BMPs, as defined by Fertilizer Canada. An additional 39 per cent of sunflower acres also received recommendations from a 4R-designated agronomist.

"These numbers are an indication of farmers' participation and support towards the program," says Cott. "This is a progressive and positive note for the future of agriculture in Manitoba."

The survey also indicated the reasons why a farm may not have met the 4R consistency criteria. The top reasons sunflower acres did not comply included non-compliance with N timing criteria, N placement criteria, N rate criteria, P placement criteria or P rate criteria.

Fertilizer rates have not changed in sunflowers much over the years. The data from the Fertilizer Use Survey tells us that farmers effectively apply their sunflower blends in spring, either pre-plant or at planting, and soil test to determine appropriate N, P, K and S rates.

Most fertilizer decisions are being made by a member on the farm, but this is an excellent opportunity to bring in an advisor and get advice on a per-field basis. ●

For more information about the Fertilizer Use Survey and MCA research projects, visit mbcropalliance.ca.

MCA ANNUAL INVESTMENT: $8,850

CO-FUNDER:

FERTILIZER CANADA

BREEDING 101

Exploring the variety development process

▲ *Dr. Santosh Kumar explains the need for adaptation testing to identify varieties with high yield potential across multiple environments.*

We all know that plant breeding is the process of developing new crop varieties with a set of desired characteristics or traits. But have you ever wondered how exactly the process works? It's a fascinating story.

The basic phases of plant breeding are:

1. Identify the traits that are important
2. Identify genetic sources of the desired trait
3. Create genetic variability (often by making crosses)
4. Make selections based on desired traits
5. Assess performance relative to existing varieties
6. Distribute seed to farmers

All plant breeding relies on genetic diversity. Without

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Lead Researcher:

Santosh Kumar, PhD

Santosh Kumar is a research scientist at Agriculture and Agri-Food Canada's Brandon Research and Development Centre. Kumar completed his master's degree at the Indian Agricultural Research Institute in New Delhi before moving to Canada for his PhD program. As a PhD student at the University of Manitoba, Kumar worked on barley physiology and genetics. He currently lives in Brandon, MB, with his wife and two children.

PHOTO: SANTOSH KUMAR

genetic diversity at the beginning, you have no room to make selections or breeding advancements. Think of it like this: if you want to develop a shorter wheat variety, but the only wheat you have is tall, you won't be able to make progress. This diverse germplasm (genetic material, often in seed form) can come from a variety of places:

- **Canadian varieties or lines**
- **Varieties or lines from other countries**
- **Wild relatives of wheat**
- **Related species**
- **Genetic modification**
- **Gene editing (for example, by CRISPR)**

How does a breeder determine which traits are important? Breeders need to be looking at least 5-10 years into the future and ask themselves, "what is changing?" Climate, disease pathogens, droughts or floods, and even early or late seeding dates affect the length of the growing season. All these factors play into a breeder's goal of developing a variety that can tolerate varying situations.

Santosh Kumar, research scientist at Agriculture and Agri-Food Canada's (AAFC) Brandon Research and Development Centre (Brandon RDC), says communication with farmers, industry and other researchers about their concerns helps define the target traits for his research.

"In one area lodging could be a concern and, in another, diseases like Fusarium, wheat midge or stripe, stem or leaf rust could be the challenge," he says. "There is also the potential for new disease threats coming from other countries – take Ug99 wheat stem rust for example. All these types of situations factor into developing a variety that farmers will want to grow."

Climate change models must also be considered, he says. "We look at predictions of how the environment will change over the next five, 10 and 15 years. We need to start incorporating those traits now so when the variety is ready in ten years, we are meeting those requirements."

Once the traits of interest have been identified, the breeders can start making crosses. Keep in mind that a breeder must balance many traits all at once. For example, it does no good to have a variety that is resistant to an important disease if it takes so long to mature that it cannot grow in our short season. Breeders must balance agronomic traits, yield, disease resistance and other factors.

BREEDING IS A NUMBERS GAME

"In any given year, I would make between 90 and 100 crosses," says Kumar. "I am looking at very different targets and making crosses to stack desirable traits, then I make more crosses to stack other traits and then I make even more crosses to bring all of it together to get the desired combination of traits."

After making crosses, a breeder will end up with many genetically different plants in the later generations. They must then narrow down these plants to find the ones that are superior, based on their breeding goals.

There are many different strategies to make selections. Often, this is done by funneling progressively fewer potential varieties through progressively more evaluations. For example, the first year of evaluation may start with thousands of potential varieties at a single location, with only single rows of each potential variety. The breeder would select those they think have the most potential and the seed would be planted the next year in several locations, potentially in larger plots. Over the years, there would be fewer and fewer potential varieties, but they would be more rigorously evaluated at many years and locations.

For wheat, breeders must then enter potential varieties into the official variety registration recommendation trials. The potential varieties are assessed at many sites across Western Canada and many agronomic, disease and quality traits are evaluated. At the end of the evaluation process, if the potential variety passes, the breeder can request that the Prairie Recommending Committee for Wheat, Rye and Triticale recommend the variety for registration to the Variety Registration Office and Canadian Food Inspection Agency.

In the case of wheat, once a variety has been recommended for registration, seed companies can bid for the right to market that new variety. From there, they can increase the amount of seed from the relatively small amount a breeder has and distribute it to farmers.

From start to finish, breeding was traditionally a decade-long process, in which 10,000-50,000 lines got whittled down to one. At the Brandon RDC, Kumar has integrated field breeding techniques with biotechnology tools. For example, doubled haploids ***(Figure 1)*** can reduce the number of generations it takes to ensure the variety is uniform and will remain consistent if farmers save their seed using strict crop management practices. Marker-assisted selection allows a breeder to evaluate potential varieties for desirable traits based on DNA "markers" while the plant is still young, which can have a large impact on the efficiency of the breeding program.

Using these approaches, they have been able to reduce that process from anywhere between six and 10 years.

Through core funding (supported by farmer-member check-off), new wheat varieties are continually being developed for production in Manitoba conditions, and these varieties have proven to be of tremendous value to farmers and our industry.

According to a study from March 2022 by Katarzyna Bolek-Callbeck and Richard Gray, varietal development of wheat and barley in Western Canada is performed largely by public breeders at AAFC and universities. Through breeding agreements, farmers have funded approximately 46 per cent of varietal research and development.

ON YOUR FARM

Promising new wheat varieties available for Manitoba farmers

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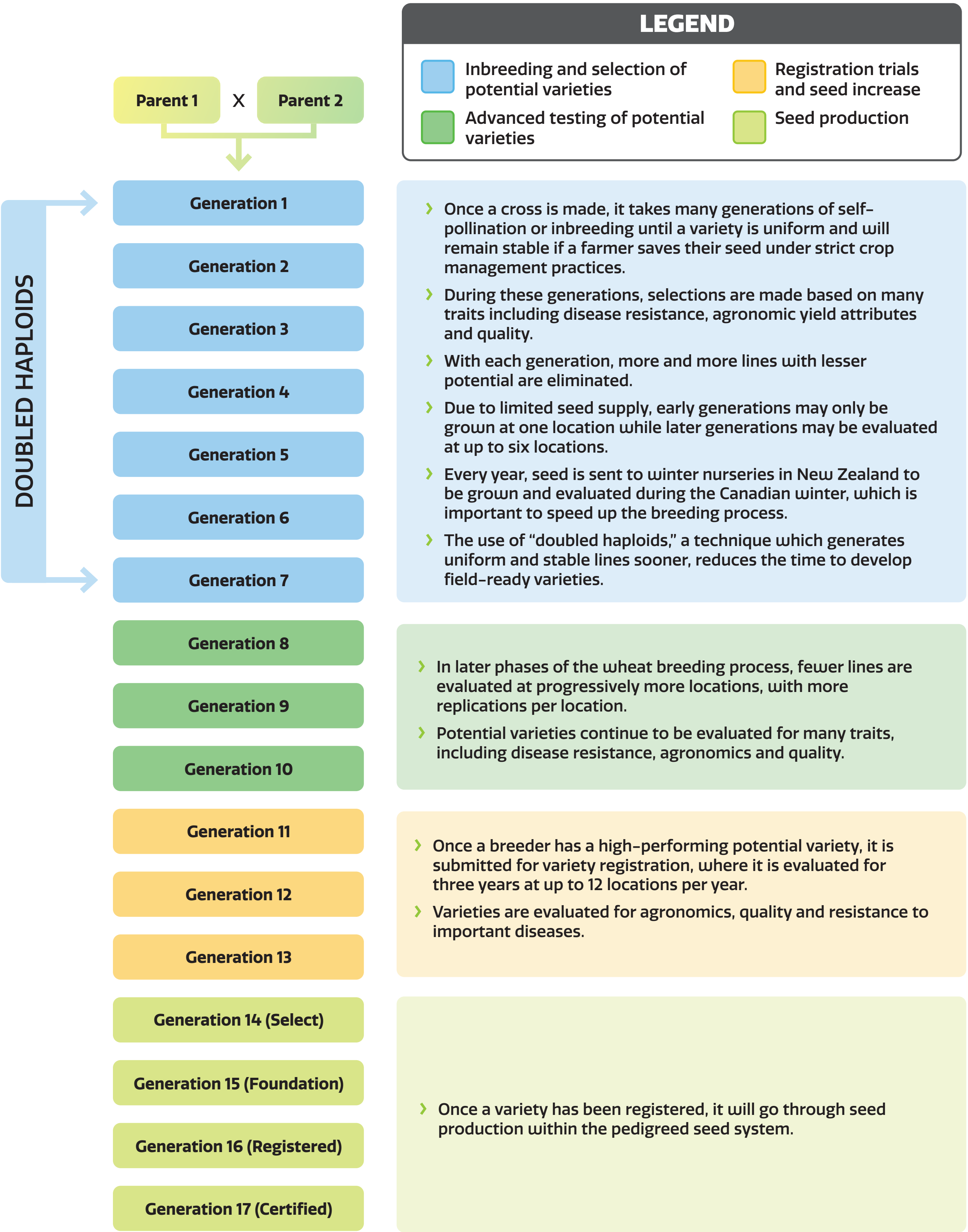
FIGURE 1 | WHEAT BREEDING SCHEME



Source: Dr. Santosh Kumar, Dr. Gavin Humphreys, Dr. Andrew Burt and Dr. Kirby Nilsen

Since Kumar joined the Brandon RDC in 2014, they have registered six wheat varieties (AAC Cameron, AAC Warman, AAC Magnet, AAC LeRoy, AAC Redstar and AAC Hodge) in addition to three new varieties registered for this year (AAC Dutton, AAC Darby and AAC Hassler).

AAC Darby and AAC Hassler are the earliest-maturing Canada Western Red Spring (CWRS) varieties on the market to date.

"We developed these varieties that farmers can grow in the Parkland region, for example, and not worry about losing quality because it began to rain or snow and they couldn't harvest," Kumar says. "They can get these varieties out of the field sooner."

AAC Hodge is the highest-yielding variety that will be available to farmers this year (it's also midge tolerant in the CWRS class).

"Nothing beats it," Kumar says. "It's a very high yielding variety with resistance to common bunt, leaf spots (tan spot, spot blotch, septoria leaf disease complex), stem rust, leaf rust and stripe rust, and it's moderately resistant to Fusarium head blight and has optimum quality."

For the southern Prairies, AAC Hodge and AAC Magnet are available for farmers who wish to choose between a midge-tolerant CWRS line and a non-midge-tolerant CWRS line. AAC Dutton is a promising new line that will be available to farmers in the next couple of years.

For the northern Prairies, AAC Darby (midge tolerant) and AAC Hassler (non-midge tolerant), are available.

"Farmers now have a choice between growing a midge-tolerant wheat variety to get better yields or, if they don't have a midge problem, something not midge tolerant," says Kumar.

Kumar emphasizes that an important part of the program is giving farmers choices for different regions and climatic conditions in Manitoba.

"Breeding is not a small boat you can turn around quickly," he says.

"It's a large ship that takes time to move and set different priorities, and it takes time to then deliver on those priorities."

MCA ANNUAL INVESTMENT:
$1,310,693 *(Core funding for wheat)*

CO-FUNDERS:

CWRC Canadian Wheat Research Coalition

WGRF Advancing Agriculture through Research

Agriculture and Agri-Food Canada

PHOTO: SANTOSH KUMAR

▲ *Dr. Santosh Kumar explains the marker-assisted selection methods for developing durable resistance against wheat diseases.*

▲ *The wheat nursery at Agriculture and Agri-Food Canada's Morden Research Development Centre.*

FUSARIUM HEAD BLIGHT RESEARCH ROUND UP

Fusarium can cause diseases in several crops in Manitoba. Fusarium head blight (FHB) is one of the top disease concerns for cereal farmers, with the potential to reduce yields and dramatically impact quality.

Because of this, it's a top-priority disease for wheat and barley breeding programs in Canada.

The first occurrence of *Fusarium graminearum* causing FHB in Manitoba wheat was observed in 1984 by Randall M. Clear (Canadian Grain Commission, Grain Research Laboratory, Winnipeg) and David Abramson (Agriculture and Agri-Food Canada [AAFC], Winnipeg). Since then, there has been significant research and progress made on FHB management in cereal crops.

However, in wheat, FHB has proven to be more difficult to manage than other diseases.

"Several factors complicate the management of FHB and the development of wheat varieties with resistance to FHB," says Maria Antonia Henriquez, plant pathologist in wheat diseases with AAFC.

Some of these factors include the strong variation according to the environment and the fact that FHB resistance depends on several modes of action added together. As well, FHB incidence and severity does not always correlate with deoxynivalenol (DON) content and observing FHB genetic resistance in breeding lines is both time consuming and labour intensive, says Henriquez. Because of this, more genetic markers, classified by the way they induce resistance, are needed.

Researchers have also learned there seems to be a negative correlation between FHB resistance and good agronomic traits, such as plant height in wheat.

Henriquez is working to enhance genetic resistance and management strategies towards FHB. Her research crosses areas from classical plant pathology to advanced molecular techniques. She is also studying the genetic diversity and toxin potential of FHB pathogens, identifying new and superior sources of resistance to deploy against FHB, and machine-learning tools.

Henriquez says with the use of high-end genomics technologies like sequencing, researchers are now able to speed up identification of novel genes. Henriquez and Curtis Pozniak from the Crop Development Centre at the University of

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Saskatchewan are leading the project TEN-TG: A TILLING and genome resource for FHB improvement. TILLING (Targeting Induced Local Lesions in Genomes) is a powerful tool for the detection of useful genetic change in crops.

In this research, the team is planning to sequence the genome of AAC Tenacious to identify FHB resistance genes for breeding. AAC Tenacious is the only FHB-resistant spring wheat variety registered in Canada. The team is anticipating good data from this research and the genetic resources developed through this project will have a very positive impact on future wheat variety development in Canada.

"Digital agriculture may improve FHB management practices and the discovery, characterization and deployment of genetic resistance to help build better, elite wheat varieties," says Henriquez.

She is also currently working with Christopher Henry and Christopher Bidinosti from the University of Winnipeg to develop machine-learning models and automated systems for real-time, automated methods of in-field and greenhouse data collection to describe, diagnose, quantify and predict FHB disease.

"Working with high-end genomics technologies in FHB research, or with these machine-learning studies, improves farmers' disease management strategies and provides better varieties to protect production of wheat crops with high-quality grains, keep existing markets and expand to new international markets," says Henriquez.

In barley, FHB became an issue for western Canadian producers in the mid 1990s and quickly became the most important disease for the crop. Initially, it was considered a rare disease, but in only a few years, it became very commonly detected.

Barley generally possesses a high level of resistance to FHB spreading from point of initial infection within a head. Symptoms may commonly appear as singular, diseased kernels (brown discolouration), which may not appear on every plant. Barley kernels may also appear to be healthy, but that does not mean the pathogen or mycotoxin is not present. For barley, quantification of the mycotoxin is a critical priority, as the visual symptoms in barley are not always reliable.

Resistance in barley is a combination of smaller genes that together add up to a certain level of resistance. These smaller genes aren't necessarily robust, and they may work in one environment and not in the next. This poses a challenge for barley breeding, where incorporating resistance involves incremental gains over time.

Xiben Wang and James Tucker, research scientists at AAFC, have been working on FHB in barley. Wang is focused on the pathogen side of the disease, studying the *Fusarium* fungi and *Fusarium*-barley interactions, and Tucker is focused on the barley side of the disease, looking at genetic resistance against *Fusarium*. Through teamwork and collaboration, these researchers are supporting each other in combating this complex disease.

When Wang first joined AAFC, he wanted to determine which *Fusarium* pathogens caused FHB in barley. At that time, the common perception was that *F. graminearum* was the main pathogen affecting the hull and DON the main mycotoxin of focus.

Over the past few years, Wang and his associates have been conducting surveys in Manitoba, collecting samples from farmers and looking at the *Fusarium* species complex in the field.

"What we found is actually *F. poae* is the prevalent *Fusarium* species infecting barley, and *F. graminearum* is second," says Wang. "We were also able to detect the mycotoxin produced in barley grain samples collected from the producers' fields. DON was detected, but we also found common occurrence of nivalenol (NIV).

"This indicated that for the *Fusarium* species complex affecting barley, there are at least two main players – *F. graminearum* and *F. poae*. Unfortunately, *F. poae* seems to produce NIV, a mycotoxin four times more toxic than DON."

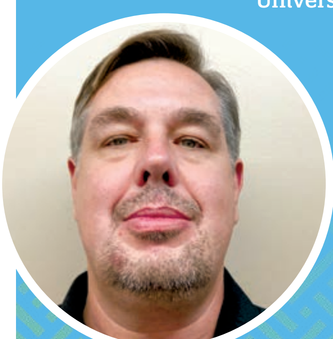
There is still much to learn about these two causal agents, but Wang and fellow researchers have studies underway looking at the resistance in different barley varieties to both pathogens and the disease virulence in barley.

His research also looks at the effect of fungicides on the two pathogens.

"We are seeing quite a significant difference between the sensitivity levels of these two pathogens to different fungicides," says Wang. He is hopeful to develop a more comprehensive screening system of *Fusarium* isolates to continue this research.

Researchers:

Maria Antonia Henriquez is a research scientist at Agriculture and Agri-Food Canada's (AAFC) Morden Research Development Centre (RDC). She completed her bachelor's degree in agronomy and master's degree in plant breeding in Colombia and received her PhD in plant pathology and molecular plant pathogen interactions from the University of Manitoba (U of M).



James Tucker is a research scientist at AAFC's Brandon RDC. He grew up in Winnipeg and holds a master's degree in quantitative genetics from Concordia University and a PhD in plant science from U of M.

Xiben Wang is a plant scientist at AAFC's Morden RDC. Wang was raised in China and completed his bachelor's degree in plant pathology at Nanjing Agricultural University, his master's in the Department of Plant Science at McGill University and his PhD at U of M in the Department of Plant Science.

PHOTO: JAMES TUCKER

▲ *Fusarium head blight on barley.*

ON YOUR FARM

Investing in Fusarium head blight research for the future

When Tucker first started looking at FHB resistance in barley 20 years ago, resistance levels for Canadian barley were largely unknown.

His work is focused on ensuring barley remains competitive for farmers in Manitoba. Farmers get paid for the yields they produce, but also based on grain quality and associated premiums. It is important to ensure farmers have access to varieties that have been developed with resistances that will minimize the risk to production. A long-term goal has been to increase yield, while safeguarding grain grade through enhanced resistance.

"Now we are moving from intermediate resistance to moderately resistant varieties," says Tucker. "Susceptible varieties are not acceptable anymore, and there are now a lot of adapted genetics out there that breeders can use to incorporate with the other traits they are trying to enhance."

Tucker works closely with breeders to develop varieties that can be grown for malt in Manitoba. The hog industry is also very susceptible to mycotoxins. Although cattle can withstand a slightly higher level of mycotoxins, it is important to maintain quality in the grains.

Tucker is optimistic that with new tools available, he will be able to continue making things easier for breeders.

"Using genomics-assisted breeding, we can possibly eliminate some of the lines before they hit the field so a breeder could submit more crosses. This is a way to do things more efficiently," he says.

"We are in a learning phase, but I think we're becoming more comfortable setting the foundation for the next generation of plant breeding. We continue to maintain communications with breeders and industry partners to ensure all goals are met."

Resistance genes identified so far are all quantitative, meaning they have a small, cumulative effect as opposed to providing complete resistance. No completely resistant trait has been identified. In addition, fungicides currently available provide suppression, not control of FHB, and must be applied during very narrow time periods to be effective.

Over the past two decades, a lot of progress has been made, but there is still a long way to go. Our goal at Manitoba Crop Alliance (MCA) is to invest in research that will make every farmer member more productive and sustainable, which is why we invest in research projects like the ones featured here, says Lori-Ann Kaminski, research program manager for cereal crops at MCA.

"While they help tell the story of what we've learned in terms of FHB management, they also tell us where we have room to grow," she says. "Supporting research like this is critical to making even more progress for farmers."

Since 2015, MCA has funded a total of 18 projects related to FHB management, investing a total of $1,048,905. There are nine different collaborators (research institutions) as well as 15 co-funders involved in these projects, allowing us to significantly leverage our investments.

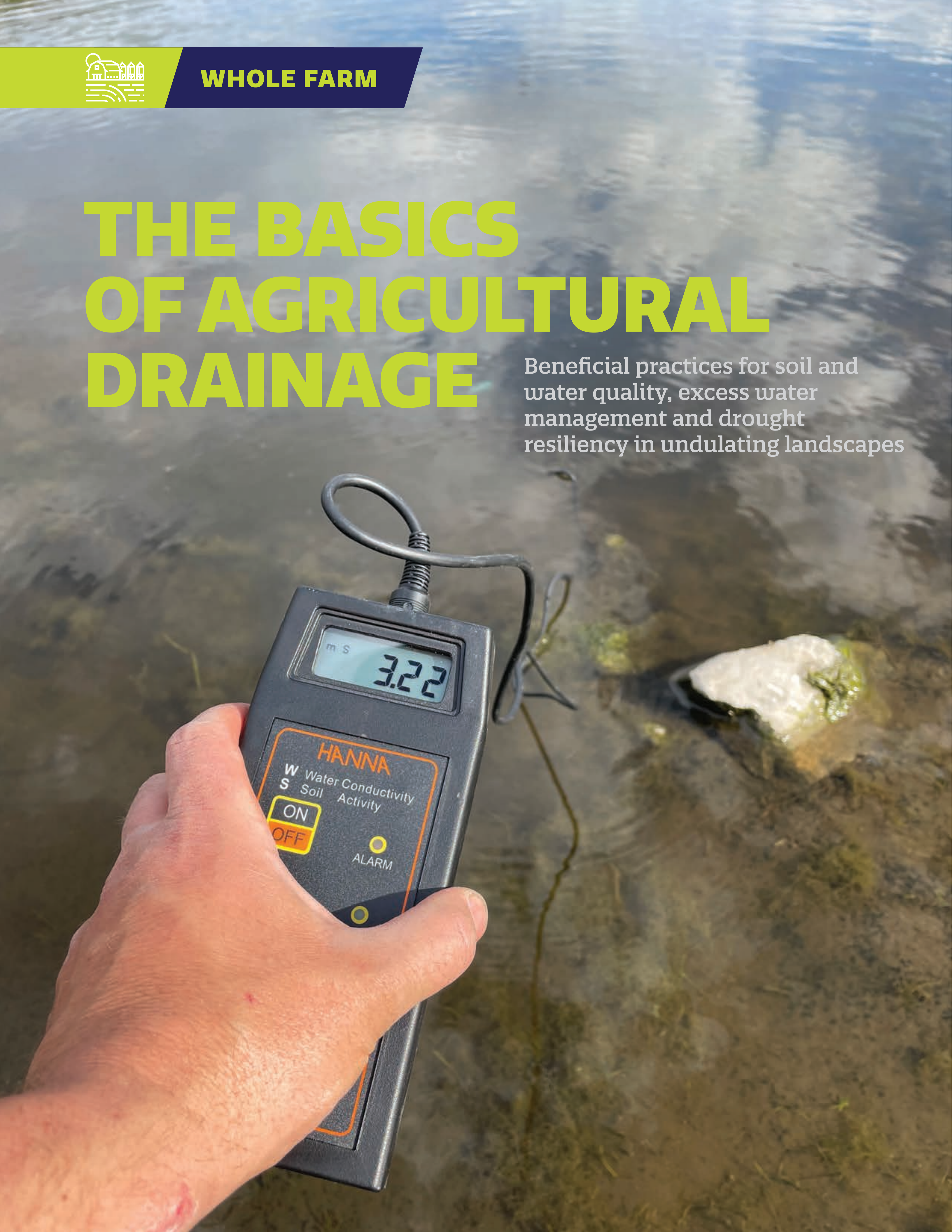
We know it takes multiple approaches and a collaborative effort to solve such a complex disease and we will continue to support this approach until we have solved the problem for farmer members. ●

Visit mbcropalliance.ca to learn more about the FHB research we are funding.

MCA TOTAL INVESTMENT FROM 2015 TO PRESENT: $1,048,905

THE BASICS OF AGRICULTURAL DRAINAGE

Beneficial practices for soil and water quality, excess water management and drought resiliency in undulating landscapes



Agricultural drainage is the practice of removing excess water from crops to maximize their productivity. There are two components of drainage: surface drainage, which we can see happening above the soil, and subsurface drainage (tile drainage), which happens below the surface.

Surface and tile drainage are complementary practices. Surface drainage allows the water accumulating at the surface to be drained off the field, while tile drainage removes excess water in the crop rooting zone by lowering the near-surface groundwater table.

Typically, when farmers are looking at solving excess water problems, surface drainage is the first step, followed by tile drainage if necessary.

The primary benefit of drainage is reducing excess water in what are considered imperfectly to poorly drained soils, where the water tables in the ground are within the crop rooting zone.

Salinity reduction is another major benefit where salt in the soil is limiting crop production. Tile allows water to flow through the soil profile and carries the water with dissolved salts through the tile outlets. It is important to recognize that tile drainage is not necessarily a quick fix to salinity. It can take many years to reduce salt content in the soil, but it is an effective practice.

Some of the other benefits include improved trafficability and access to fields, particularly early in the season, as well as improved nutrient-use efficiency in areas affected by excess soil moisture.

"There are situations, particularly in variable landscapes, where nutrients and other inputs are applied to areas of the field where crop productivity is limited by excess water and farmers get nutrient residuals left behind," says David Whetter, owner and consultant at AgriEarth Consulting.

"Tile can help improve productivity in these marginal areas and allow the crop to more effectively use up those inputs."

However, while there are a whole host of benefits to drainage, it is also important to understand some of the trade-offs.

Tile changes the way water moves through the soil and off the field. It encourages more infiltration and percolation of water through the profile and intercepts that water, allowing it to bypass the groundwater system. It discharges that water, which enters the surface water system at the edge of the field.

There are some benefits and costs to this change when it comes to nutrients. Very generally, tile drainage can increase the nitrates in the runoff from the field and it can decrease the phosphorus runoff, but there is a lot of variability, Whetter says.

"It's not necessarily better or worse when we consider downstream environmental impact, it's just different," he says.

Tile will also result in salt leaving the field in tile drainage water, in areas that are impacted by soil salinity. Initially, those concentrations in tile discharge are higher and reduce over time as salts are removed from the profile.

Historically, in Manitoba there has been limited research on drainage. Tile drainage is a relatively new practice in the province compared to other jurisdictions like southern Ontario and the United States Midwest, where it's been practiced for many years.

A few organizations have begun to study drainage in more of the flatter landscapes and heavier textured soils in Manitoba, beginning about 15 years ago. However, research of drainage in the undulating landscapes where the slopes are irregular and complex is also needed.

In 2022, Whetter and Bruce Shewfelt established a field-scale tile drainage research and demonstration site near Hartney, MB, to evaluate best management practices for soil and water management in undulating landscapes. The initial study will run for two years but the researchers hope to get long-term funding to keep monitoring and evaluation going, Whetter says.

"To our knowledge, there hadn't been this type of research established in the undulating landscapes in the southwestern region of the province," he says. "We think the landscape we are in is fairly representative of the broader western prairie regions in Manitoba and further west."

Whetter and Shewfelt are looking at the contribution of drainage from different zones in the landscape, including the lower slope, the mid-slope and the upper-slope positions. They are interested in understanding what those different positions are contributing in terms of water flow or runoff, as well as water quality for nitrogen and phosphorus. Salinity is a major limitation in the region and is another component of their work.

From a landscape perspective, there is a level of complexity, as there is water moving all over in different directions. From a soil perspective, there is a good range in variability from well- to poorly drained and textures from coarser sandy loams to moderately fine

continues on next page ▶

◀ Measuring the electrical conductivity of surface water and tile discharge provides information on the effect tile drainage of saline soils has on downstream water quality.

PHOTO: DAVID WHETTER

Lead Researchers:

David Whetter and Bruce Shewfelt

David Whetter is the owner of AgriEarth Consulting Ltd., a company focused on adding value and providing environmental solutions for agriculture across the Canadian Prairies and beyond. As a soil scientist and professional agrologist, he has been providing innovative and practical agricultural-environmental solutions to industry for over 20 years. Much of this work has been focused on soil-water management, largely for irrigation and drainage projects.

Bruce Shewfelt is president at PBS Water Engineering Ltd. He is a water resources engineer and has been providing leadership and innovation to the agricultural water management industry in Manitoba and across Canada for close to 40 years. Shewfelt has consistently been innovative in his approach to driving sustainable water management in Manitoba and beyond.

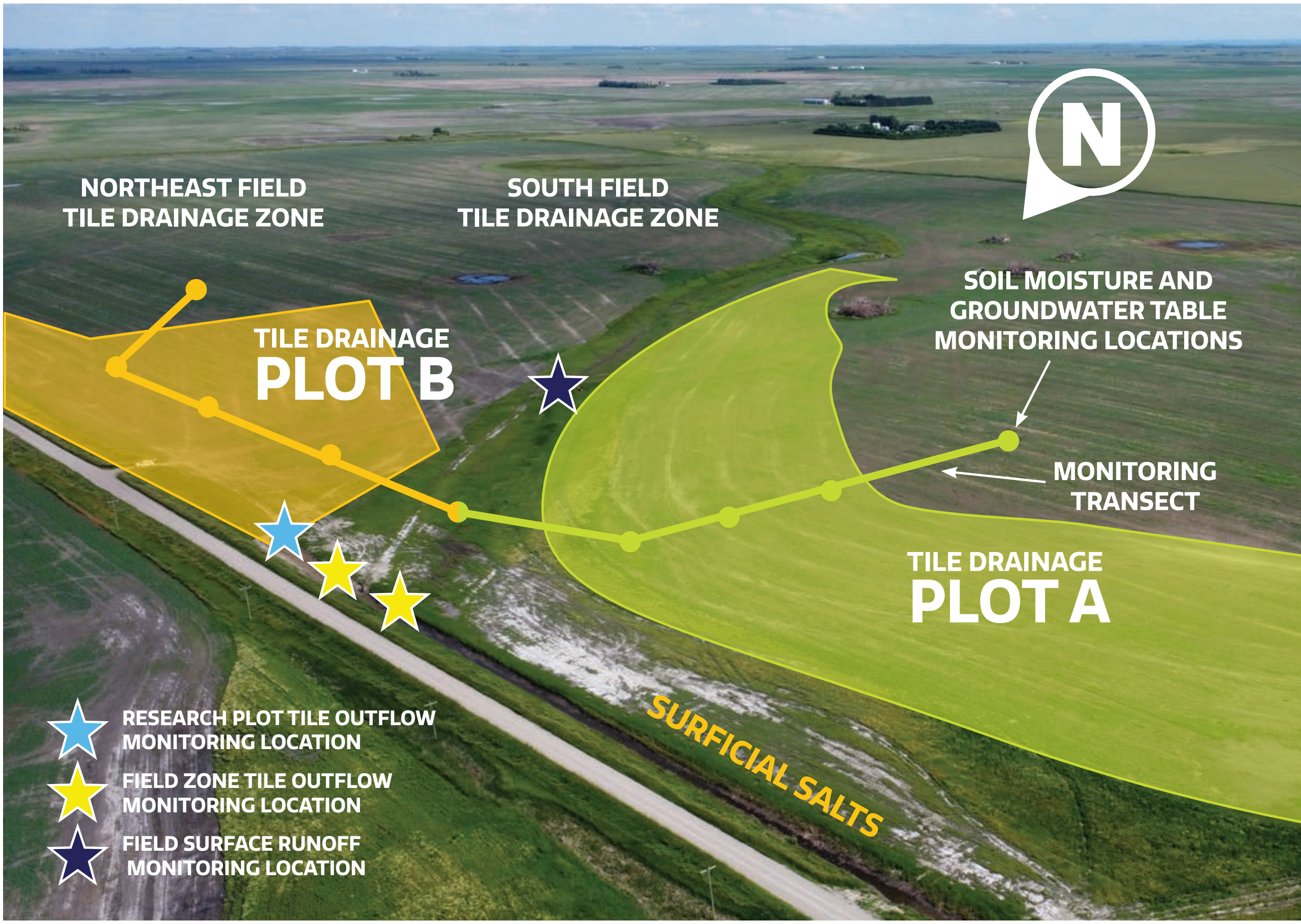


PHOTO: DAVID WHETTER

▲ *In 2022, David Whetter and Bruce Shewfelt established this field-scale tile drainage research and demonstration site near Hartney, MB, to evaluate best management practices for soil and water management in undulating landscapes.*

clay loams. The variability of both topography and soil needs to be considered when making decisions about drainage.

Implementing tile changes the timing and amount of water leaving the field, as well as the quality of the runoff, Whetter says.

"It's important to understand what these differences are so we can begin to determine if there are beneficial practices we can apply to optimize agronomy, environment and economic performance," he adds.

A few components being studied in this project:

- **Soil moisture down to four feet**
- **Water table dynamics**
- **Tile and surface runoff quantity**
- **Water quality (salinity, nitrogen and phosphorus concentrations) of both surface field runoff and subsurface field runoff, including downstream loads**

After the first year, the team saw some interesting preliminary results, agreeing they were fortunate to see several major rainfall events following a dry season the year prior.

"We saw good relationships following the rainfall events," says Whetter. "The soil moisture levels got really high and the soils were inundated. Then the water tables rose and where we have tile, we saw the tiles pull those water tables down pretty quickly and bring that soil moisture back down, which is exactly what they're supposed to do."

As for the different landscape positions, the team saw higher flows come from the lower slope compared to the mid- and upper-slope positions.

"We looked at one rainfall event in July and from the upper slope to the mid-slope we got about twice as much flow and then about twice as much, again, from the lower slope compared to the mid-slope," Whetter says. "That gets pretty important when we're thinking about tile design and layout in these landscapes."

Whetter and Shewfelt are interested in learning if there is a point in these landscapes where tile drainage won't provide a return on investment (i.e., it's not draining enough water away for it to make sense). If tile drains aren't intercepting a water table close to the crop root zone, they won't be draining any water.

In terms of salt concentrations, they saw relationships with

ON YOUR FARM

Not all fields are created equal — it's important to understand variability in fields before making tile-drainage decisions

the landscape position as well. The nutrient results have not yet been analyzed, but they hope those results will also show some patterns.

"We hope to learn about not just the volume and rates of flows, but also the water quality to be able to tie those into looking at drainage system design and beneficial management practices," says Whetter.

"We are excited to be implementing some edge-of-field water quality treatment practices to evaluate practical and effective ways to reduce the amount of nitrogen and phosphorus leaving the field in runoff water."

Tile drainage has recently become a prominent practice in southwestern Manitoba for the purpose of improving crop productivity and profitability while reducing risks of drainage limitations due to extreme rainfall events.

That is part and parcel of what Whetter and Shewfelt are trying to accomplish with this research.

"Hopefully, we can build new and region-specific knowledge that the industry can utilize to make more informed decisions for these particular environments," says Whetter.

After the first year of research and before all the monitoring data is evaluated, both Whetter and Shewfelt feel it's too early to comment on specific recommendations and that more research and analysis is needed.

"We are seeing evidence of an intuitive relationship between landscape position and the amount of water in that portion of the landscape," Whetter says.

This type of information is helpful to help farmers decide how far up the slope to drain and whether to do variable tile spacing or change their drainage coefficient in different locations of the field where it's practical, he adds.

But fields can be complex.

"Sometimes it would be nice to do variable spacing, but the field is too complex to do that in a practical or a cost-effective manner," he says.

Results from drainage modelling being completed at the study field will provide predictions about how drainage will perform over the long-term (e.g., 20-30 years), including water table dynamics, runoff volumes and soil salinity.

The researchers hope that the preliminary modeling results will be compared against longer-term monitoring results in 3-4 years to confirm initial findings, and that these results can help confirm best practices in these landscapes.

Not all fields are created equal. Farmers and contractors should do their homework to understand the variability in their field before making their tile-drainage decisions and landing on a layout and design.

There is a lot of design information, as well as tools, available to help farmers determine tile-drain spacing and depth and how that interacts with different soil textures, but understanding that variability in the field is an important first step. Investing some time and money upfront to better understand soil variability and groundwater table dynamics should pay dividends when it comes to making costly decisions around tile systems.

Thank you to the co-operating producers at Whetter Farms Ltd., as well as the groups providing in-kind support, including Souris River Water District, Agri Drain Corporation and Manitoba Agriculture.

This research is one tool in the Extremes of Moisture toolbox for Manitoba farmers, which aims to expand the range of tools available to farmers to mitigate the risks and manage issues associated with excess moisture and drought conditions.

To learn more about the Extremes of Moisture initiative visit mbcropalliance.ca/research

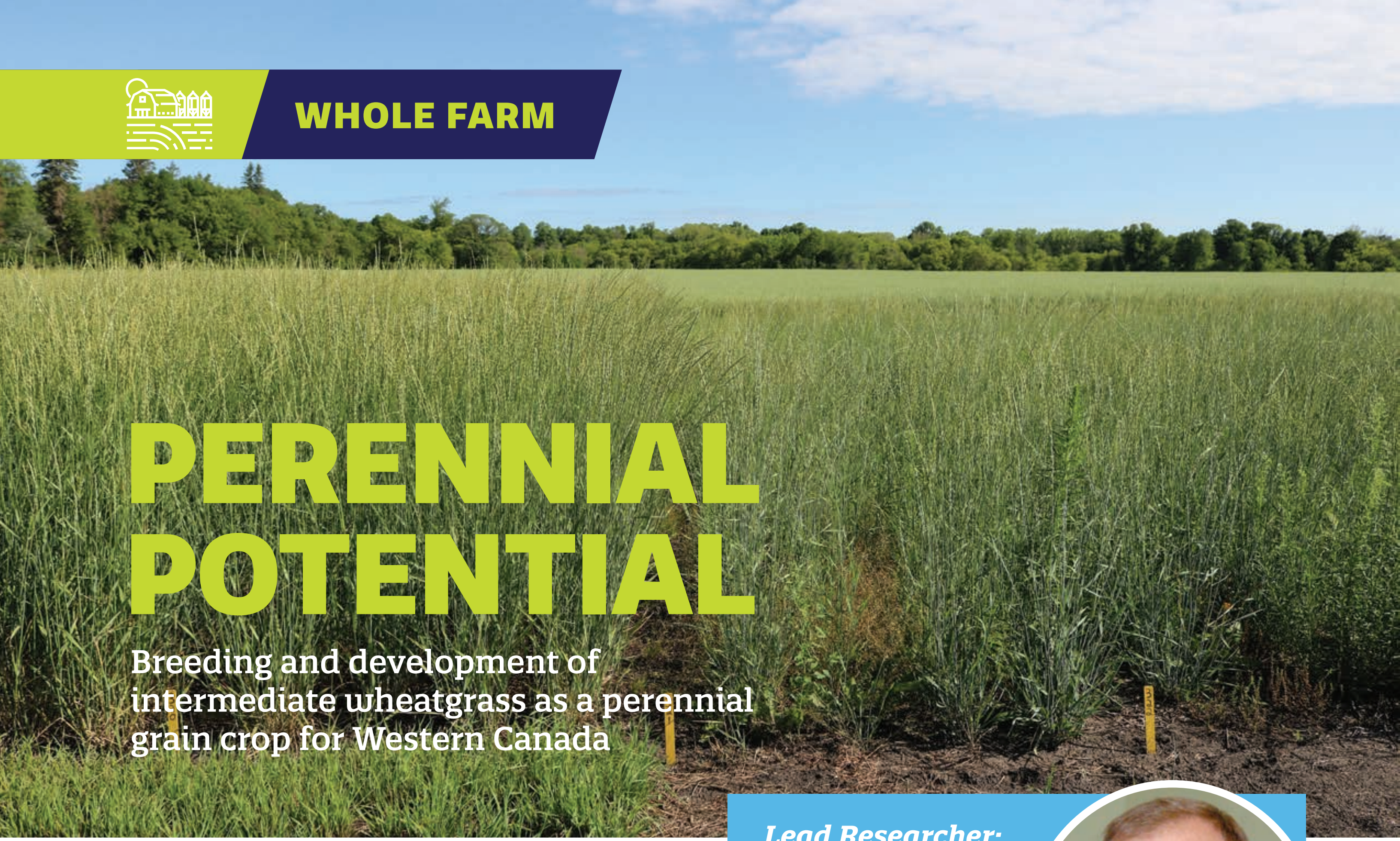
MCA ANNUAL INVESTMENT: $10,667

CO-FUNDERS:

Canadian Agricultural Partnership

Manitoba Pulse Soybean Growers

Manitoba Canola Growers



PERENNIAL POTENTIAL

Breeding and development of intermediate wheatgrass as a perennial grain crop for Western Canada

▲ *Spring seeding (left) vs fall seeding (right).*

PHOTO: DOUG CATTANI

Lead Researcher:

Doug Cattani

Assistant professor in perennial crop breeding, Department of Plant Science, University of Manitoba

Doug Cattani is the perennial grains breeder and agronomist at the University of Manitoba, with over 35 years of perennial grass breeding and perennial grass and legume seed production experience in academia, private industry and government.

Intermediate wheatgrass is a perennial grass native to Europe and Western Asia and has been grown as forage grass in Western Canada for decades. Once established, perennials provide season-long ground cover, water use and erosion control — presenting both a potential commodity and forage source in one crop. Attempts have been made to develop and integrate perennial grains and oilseeds into northern agricultural systems to enhance ecosystem services and increase soil health.

Current research by Doug Cattani and Dr. Matthew Bakker at the University of Manitoba is looking at the potential of adding intermediate wheatgrass as a perennial grain into western Canadian cropping systems. Earlier work brought about the selection of adapted materials for Western Canada and the current research looks to move the breeding along to traits with agronomic importance to sustainable production systems.

Though breeding, crop development and selection help increase grain yields, there are additional plant traits important for successful crop production. For this research, there are two traits of interest: seed size and disease tolerance.

The first part of this research looks at the genetics related to Fusarium head blight (FHB) resistance and to seed size. Is there FHB tolerance in intermediate wheatgrass that may be transferable to wheat? Historically, wheatgrass species have been used as donor species for resistances to diseases in wheat.

Cattani and Bakker are looking at the tolerance of intermediate wheatgrass to FHB and identifying superior lines. This should lead to the identification of the genes responsible and determination of whether they are novel to wheat. If so, genes may then be moved over to wheat for incorporation into wheat breeding programs. Results to date indicate that improvement can be made for FHB tolerance in intermediate wheatgrass.

The second part of this project is looking at agronomic production systems for integration of intermediate wheatgrass into a "typical" crop rotation in Western Canada. Practices identified for integration are especially promising for Manitoba, where precipitation tends to be higher than Alberta or Saskatchewan.

Cattani and Bakker looked at underseeding to wheat versus seeding alone. The benefit of underseeding to a spring wheat crop is an economic return in the year of seeding the perennial grain. The perennial grain is somewhat like winter wheat, where a winter is needed in order to make the plant reproductive and produce seeds. Underseeding to a cereal crop in the year of establishment may not be as feasible in lower precipitation environments, such as Alberta and Saskatchewan.

"Here we looked at growing intermediate wheatgrass in conventional systems where we could use pesticides and herbicides, versus organically where we needed to use something like mowing to control weeds in the establishment year," explains Cattani.

The pair also studied spring versus fall seeding. "One thing to note is that we've been through rather trying years. Drought and heat for the first two years, and excess moisture for the most part of last year," says Cattani. "We've grown it under varying conditions."

Intermediate wheatgrass was seeded in two years at two locations, Carman and Winnipeg area, to determine the success of spring versus fall seeding.

Spring seedings were all relatively successful. There were reasonable levels of production at both sites and treatments were relatively consistent. Flooding that took place in 2022 before the crop began growth didn't have a major impact, whereas flooding that took place after growth had resumed and was flooded for more than two and a half weeks led to the loss of the crop. This is not uncommon with crops, as they have a high demand for oxygen in their root zone once regrowth has been initiated.

Fall seeding has not been as successful. The data to date shows that the intermediate wheatgrass had only been successful in one of four years with an August seeding. That is predominantly due to the conditions prevalent during fall seeding.

The drought impacted how quickly the seedlings emerged in the fall and ultimately how big the plants were heading into winter. After having the first year fail at one site and be successful in the other, the researchers started a study looking at seeding dates in the fall to determine the ideal fall seeing dates.

"Our work appears to indicate that an early August seeding date is required to provide farmers with a reasonable expectation of a harvestable crop the following year," says Cattani. "Adequate plant size needs to be reached before freeze-up to result in sufficient and uniform flowering the next year."

Given the results to date, spring seeding appears to be more successful than fall. Low soil moisture resulted in uneven emergence timing, which resulted in uneven flowering and maturation.

In another study, Cattani and associates are looking at the impact of fertility rates to prolong the productive life of the stand. The cropping history of the research sites is different, so the group is hoping to see some differences in the ability to retain the productivity of the stand.

In 2022, Cattani and Bakker harvested the fifth production year on one of the sites and yield was much higher than 2020 and 2021, when the crop was suppressed due to drought. Their estimate in November (at time of writing this report) was that yield was increased by approximately 60-80 per cent higher in 2022 versus 2020 and 2021 (800-900 kg/ha versus 500 kg/ha in 2020 and 2021). This bounce back is a good sign of intermediate wheatgrass's ability to be productive over long periods of time, provided, as with most crops, adequate and timely precipitation.

Graduate student Alexa Peterson will continue working on this research through the end of 2023 and the group intends to have a good idea which individuals are showing FHB tolerance in the coming months. The next step will be identifying potential genes that play a role in FHB tolerance.

Intermediate wheatgrass may be a viable way to incorporate a perennial into your annual crop rotation. Not only does it exceed any annual crop in the ability to sequester carbon, but when underseeded with wheat, it allows you to maintain profitability in the year of establishment. When added to an annual rotation, intermediate wheatgrass could be a valuable tool in farmers' toolbox to diversify rotations and build resilience.

ON YOUR FARM

Is there a place for perennial grain in western Canadian cropping systems?

Chelsi Malach, a grain farmer from Hartney, MB, and technical agrologist designate and producer representative on the Manitoba Forage & Grassland Association Board, sees the value in this research for farmers in Manitoba.

"This research allows farmers to maximize their farm's potential and build resilience in many ways. By understanding the species growth requirements, tolerances and adaptabilities, we can work with the land and use it as a tool where it is most suitable." says Malach.

"Varying soil types, erosion, carbon and nutrient capturing — these are all things that this research can be used to help understand and address on your farm. Soil health starts at the surface, and by building resilience at the surface level, we in turn increase productivity below ground level."

According to Malach, "it is important to expand your knowledge regarding cover crops, forage species suitability, grazing methods and soil health. All things that can maximize the potential of your farm, present day and for the future."

Cattani is optimistic the novel genetic and genomic tools developed in crops like wheat and canola are also applicable to the advancement of perennial grains.

He is hopeful that one day in the near future the group will have accumulated enough data, both within Canada and potentially around the world, to look at some of the climatic factors that affect productivity and how we make selections down the road.

"The willingness of Manitoba Crop Alliance (MCA) and other co-funders to fund this work (really in its infancy) is greatly appreciated," says Cattani. "If you don't try new things, you will never find out the potential."

MCA ANNUAL INVESTMENT: $3,750

CO-FUNDERS:

Canadian Agricultural Partnership

WGRF Advancing Agriculture through Research

Manitoba Forage Seed Association

Deruyck's Top of the Hill Farm

MANITOBA CROP ALLIANCE

MCA RESEARCH
by the numbers

94 Active research projects
(as of July 31, 2022)

- **2** Flax
- **58** Barley & Wheat
- **27** Whole Farm
- **5** Corn
- **2** Sunflower

Lifetime value of 94 current projects:
$125,248,307

Total MCA contribution:
$11,268,114

69

In 2021-22, MCA contributed ***69 per cent*** of annual expenses to research and production.

In 2022-23, MCA has budgeted ***64 per cent*** of total annual expenses to research and production.

50+ active partners to co-fund research

MCA leveraging rate in 2021-2022:

For every farmer member $1 → **MCA leveraged to $11**

MCA total investment in research and production in **2021-22** fiscal year:
$5,277,705

Research and production budget for **2022-23** fiscal year:
$4,062,581

2022 Research on the Farm

- 9 protocols
- 5 crop types: barley, wheat, corn, sunflower, flax
- 46 trials
- 39 participating farms

Whole Farm Research

3 projects funded from 2021 call for proposals

TOTAL MCA CONTRIBUTION: $476,470
TOTAL INVESTMENT: $1,506,047

52.07%

In 2021–22 tax year, 52.07% of the MCA check-off was eligible to earn an investment tax credit.

Scientific Research & Development (SR&ED) Tax Credit

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

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