MANITOBA Pulse Soybean GROWERS

pulse beat

Issue 92 • March 2021

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In This Issue

Manitoba Pulse & Soybean Growers 2021 Board of Directors and Staff

Cover photo by Laura Schmidt, MPSG

Message from Board Chair

Calvin Penner, Chair, MPSG

MANY PEOPLE WERE excited to put 2020 behind them and look forward to a better year in 2021.

While we're all affected by the pandemic to some degree, 2020 was not a terrible year for agriculture, especially in contrast to 2019.

It wasn't very long ago that it seemed that the markets didn't have much reason to be optimistic. The world seemed to have a huge surplus of grain and prices were stagnant at best. Trade wars and elections always seem to throw a shadow over agriculture and our established markets. I hope you weren't like us and sold most of your crop at what seemed like decent prices and missed the market run on soybeans. As I write this, at the beginning of January, soybean prices are in the teens. I hope this trend continues throughout the year.

If only we knew exactly how much new crop to forward sell and what price to lock in. Canola and other large-acre crops are experiencing a similar market uptick. There may be some jostling for acres among the larger crops, which may benefit some of the smaller ones. We'll see. All I can say for sure is that these are interesting times we are living in.

Manitoba Pulse & Soybean Growers (MPSG) held its AGM via a virtual format this year. Thanks to all the farmers who attended the event. It was a steep learning curve for all of us. Thanks to MPSG staff for helping put this on. It was strange to be addressing my laptop camera instead of a room full of familiar faces. But, again, these are interesting times.

I look forward to seeing all of you at CropConnect in 2022 (hopefully).

At the reorganization meeting following MPSG's AGM, I was re-elected as Chair of the Board of Directors. It's an honour to be able to serve this great organization. I would like to express a heartfelt thanks to outgoing MPSG director Hailey Jefferies for her service and dedication to the pulse and soybean industries. Her expertise and perspectives will be missed.

Bryce Pallister, of Portage la Prairie, filed his nomination papers for election to the board of directors. Bryce, along with incumbents Ben Martens and Brendan Phillips, were elected by acclamation. Welcome, Bryce!

It was established again at our AGM that we are a research-based organization. In his research and production report, Daryl Domitruk, reported on all the great ways in which MSPG is investing farmer dollars. MPSG's commitment to research remained strong in 2020. The organization has allocated about $6.7M to research projects since 2018, and MPSG continues to find ways to best leverage farmer dollars.

While being involved in policy is unavoidable, we'll limit our engagement, relying instead on our partners who have analysts, experts and budgets for such things.

We are working closely with Roquette and Merit Functional Foods, as well as keeping a close eye on other up and coming opportunities in the pulse and soybean industries. New pea varieties are entering the market and our agronomics are only getting sharper as we get more experience growing them. There is also increasing attention on faba beans and faba bean processing. There seems to be great protein-related potential in that crop.

We're excited for the day we can tour some of these processing facilities as soon as they're ready to have guests and once pandemic restrictions lift.

MPSG employees have been working from home for quite some time now, but the organization hasn't skipped a beat. I am impressed by their ability to continue to operate at a high level, despite the limitations of doing so during these strange times.

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Message from Executive Director

Daryl Domitruk, Executive Director, MPSG

BACK IN 2017, the discussion was "how high will soybean acres go?" A few dry years later and we've turned to "where will soybean acres stabilize?" Stable acreage is a product of several factors but demonstrated yield stability is among the most important.

For acres to be maintained, farmers need to have confidence their crop will yield above a reasonable threshold across the range of weather they expect to encounter. This is the decision on which soybean's fortunes are now resting.

The effect of yield stability on farmers' cropping strategies determines the ability of Manitoba Pulse & Soybean Growers (MPSG) to invest in research. The very nature of the check-off system means annual research investments correspond to the ups and downs of check-off revenues. To a small degree, we smooth the bumps by carefully managing financial commitments. However, we are prohibited from saving too much for a rainy day. Stable research funding will only be achieved if that research can produce a soybean crop that is a reliable option in our eastern prairie home.

Over 15 years of ramp-up in soybean production, wheat and canola acres remain remarkably stable. Like soybeans, these crops are global commodities. Unlike soybeans, these crops became what we might call staple crops for the prairie farmer. Canola and wheat have earned growers' confidence through many decades of adaptive development by farmers and researchers. Soybeans and pulses will have to accomplish the same level of adaptation in a fraction of the time.

Fortunately, we can set aside one concern. Demand for both soybeans and pulses is increasing. Think protein, health and sustainability. The market attributes of pulses especially, but also soybeans, have made these crops go-to products in the food and feed industries worldwide. To capture our share of this market, we need to meet the market's pull with a local production push. Indeed, the push was ignited by the introduction of early maturing soybean varieties. Progress will continue only by integrating stress-resistant genetics with improved crop management practices. Achieving this would result in crops that garner the confidence of growers year in and year out.

To move production to where it should be, MPSG is calling on itself to mount a strong and targeted response to gaps in the performance of our crops. Root diseases in pulses and susceptibility to drought in soybeans top the list. I'll get into the research this requires in my research report. Here, it's important to know a broad buy-in among stakeholders is required for our industry to reach its full potential.

Growers have stated their commitment through their check-off dollars. Processors like Roquette have demonstrated commitment by, in their case, funding pea breeding. Variety developers continue to play a key role. Small innovation companies are getting on board. Government has provided matching funds for research. Going forward, we will need these actors and more to join in a strategic effort to really anchor pulses and soybeans into the Manitoba landscape. Saskatchewan answered a similar call in the 1980s. It took decades of patience and perseverance but, that province's investment in pulse breeding has yielded billions of dollars.

If Manitobans wish to make a legitimate play for soybean crushing or to expand pulse processing, we will have to move pulse and soybean production to a higher, more stable level. MPSG will pursue this goal by fostering new partnerships and encouraging government to support strategic investments in technology and market development.

On other fronts, the winter of 2020–21 was engaging and thought-provoking. Participation in national organizations such as Soy Canada, Pulse Canada and Grain Growers of Canada gave MPSG a voice on business risk management, regulation of crop protection products and grain transportation. The policy agenda continues to expand as reviews of seed and variety registration legislation

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Farmers can look forward to another growing season of strong support from our *Bean Report*, our growing catalogue of production resources, *Pulse Beat* and *Pulse Beat: The Science Edition*, as well as information the On-Farm Network crew distributes.

Our On-Farm Network continues to grow. We use its results on our farm to make informed agronomic decisions. It's been a pleasure to watch the program progress along a trajectory of realizing its vast potential for growth.

Our Agronomist-in-Residence program at the University of Manitoba, along with the On-Farm Network, helps MPSG fill the gap between academic research and farm application of research results.

Please visit MPSG's website to view research, see how the organization is working for you and sign up for our various communications. Hopefully, I will see you in person soon. ■

manitobapulse.ca

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picks up alongside reviews of the Canadian Grain Commission's mandate. MPSG alone does not possess the resources to become fully immersed in these discussions. We are, however, fully capable of expressing the Manitoba pulse and soybean grower perspective through our national partners.

Somehow, amidst the scramble of policy activity, the subject of sustainability has risen to the surface. For the pulse and soybean industry, it may be time to put aside our guarded approach to the attributes of our crops. For one, reducing N-fertilizer turns the fuzzy concept of sustainability into something tangible. Raising the profile of legumes will expose their strengths but also weaknesses. Anecdotally, soybeans have required fewer pesticides, but their low post-harvest residue needs to be addressed to better protect the soil.

The sustainability discussion is too often dominated by non-farm voices declaring what they think a farmer should do with their land. It seems the narrative on sustainability is being carried by the non-farmers in the supply chain. By building on the attributes of legume crops, growers could speak more confidently about what they are doing to provide solutions and seize more of the sustainability narrative for themselves.

Lately, by filling the Westman production specialist position, we've re-committed to placing staff in the field to cover all corners of Manitoba. Part of adapting crops is to recognize the challenges crops are facing when and where they are grown. An office job with requirements to be in the field is subtly different from a field job that requires an office. Our staff have chosen the latter.

Finally, here's something I wish we knew how to capture value from— coloured beans have been shown to positively affect the tensile properties of human blood vessels. This is the claim of researchers at the University of Manitoba and St. Boniface Hospital Research Centre based on years of work partially funded by MPSG. Certainly, this is not a topic MPSG members consider on a regular basis. Maybe they should? The fact is vascular health is a big determinant of risk from several life-threatening diseases. So, in addition to their environmental attributes, it appears pulses can save us all money and distress by keeping us out of the health care system. Although the imagination runs wild with possibilities, it's frustrating that we can't seem to figure a way for farmers to profit from these incredibly valuable crop attributes. That said, as one who has a guarded attitude toward social license, I admit there may be potential to earn more public respect with results like these. ■

MANITOBA Pulse Soybean GROWERS

OUR VISION

Manitoba farms sustainably producing profitable, quality pulse and soybean crops.

Manitoba Pulse & Soybean Growers 2021 Committees and Representatives

MPSG COMMITTEES – *The first named is chair*

Executive – C. Penner, M. Rattai, B. Phillips

Governance/HR – B. MacMillan, F. Prince

Policy – B. Phillips, B. Martens, B. Pallister, J. Preun, M. Rattai, E. Sirski

Finance/Audit – M. Rattai, J. Preun

Resolutions – B. Phillips, B. Martens, B. Pallister

Nominating – B. Phillips, B. Martens, B. Pallister

Communications/Member Relations – E. Sirski, B. MacMillan, B. Pallister, G. Sawatzky

Market Development – J. Preun, B. Martens, B. Pallister

Research – F. Prince, B. Martens, B. Pallister, B. Phillips, M. Rattai, G. Sawatzky

U of M Research Agronomist Advisory Committee – F. Prince, J. Preun

MPSG REPRESENTATIVES

Canadian Grain Commission Pulse Sub-Committee – G. Sawatzky

Grain Growers of Canada – B. Phillips
- **Trade and Marketing** – E. Sirski
- **Business Risk Management** – TBD

Keystone Agricultural Producers
- **General Council** – C. Penner
- **Pulse/Oilseed Sub-Committee** – Staff
- **Commodity Group** – C. Penner

MCVET – Staff

PGDC/PRCPSC – B. Martens, staff

Pulse Canada – B. Martens, G. Sawatzky
- **Sustainability** – F. Prince

Soy Canada – E. Sirski, M. Rattai

Western Canadian Pulse Growers Association
- **WGRF** – B. Dalgarno (MPSG) (term 2019–2023)
- **CGC Western Grain Standards Committee** – E. Sirski (exp. 2021)

MANITOBA Pulse Soybean GROWERS
AGM 2021
Annual General Meeting
02.10.21 • VIRTUAL PRESENTATION

Meeting Summary

The 2021 annual general meeting (AGM) and the special meeting of Manitoba Pulse & Soybean Growers (MPSG) took place virtually this year due to restrictions surrounding the COVID-19 pandemic. Incumbent board members Brendan Phillips and Ben Martens were re-elected by acclamation. Also acclaimed to MPSG's board of directors was Bryce Pallister from Portage la Prairie.

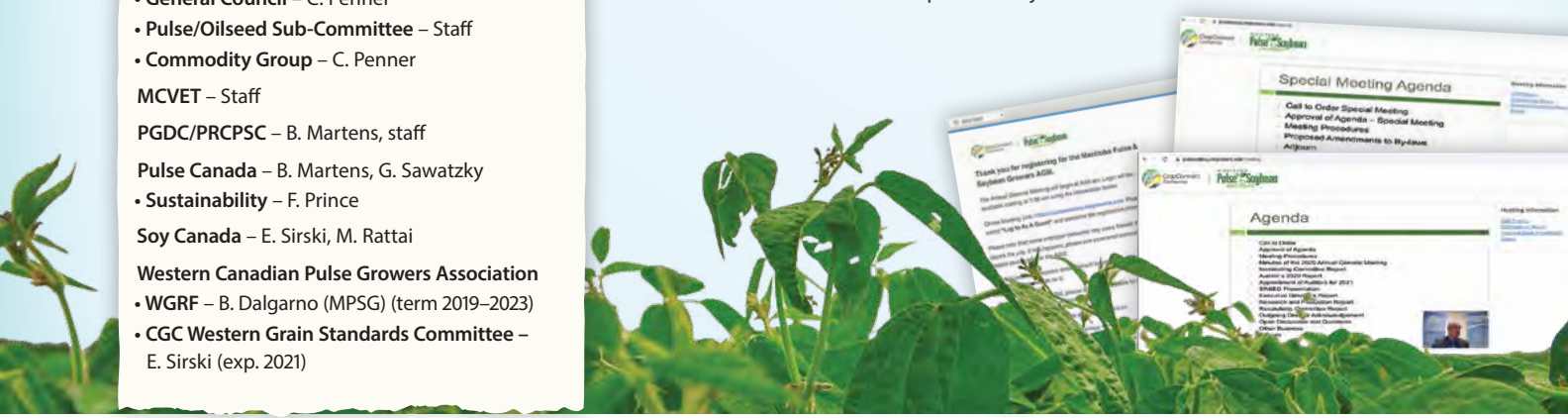
Hailey Jefferies did not seek another term. Board Chair Calvin Penner thanked her for her service to the pulse and soybean industries.

A special meeting was held in conjunction with this year's AGM to consider proposed amendments to MPSG's by-laws that would allow the organization to hold AGMs or any special meeting of the members electronically.

Advance registration for members and guests was required. Attendance was down slightly from previous years and engagement from members was minimal, likely due to the limitations of the platform.

The by-law amendments and acceptance of the 2020 financial report were passed, and George & Associates Chartered Professional Accounts Inc. was again appointed as MPSG's auditor for 2021. MPSG board chair Calvin Penner presided over the meeting and delivered his address. Daryl Domitruk presented his executive director's report, as well as his review on research and production. Melissa Denys-Roulette delivered the 2020 SR&ED presentation.

No new business was raised prior to adjournment.



Soybean Scout

What is the difference between these two cutworms?

Answers can be found on page 56


A


B

Agriculture in the Classroom

CALM goes virtual for 2021

Emily Hart, Ag in the Classroom

THIS YEAR, CANADIAN Agriculture Literacy Month (CALM) will look a little different in schools across Manitoba. Agriculture in the Classroom–Manitoba (AITC–M) is adapting to the challenges faced with running a hands-on experiential program during a time when social distancing is key.

This year, without the ability to do in-person visits, AITC–M is unable to work with volunteers—and virtual visits aren't always an option for classrooms because of technology requirements—but volunteers are crucial to CALM's success in the future. Many pulse and soybean growers have been volunteers for CALM year after year. The personal connection and impact these volunteers make on students is unmatched and will be missed in 2021.

"We couldn't do what we usually do without the over 170 volunteers it takes to run the program in Manitoba," Larissa Peitsch, Volunteer and Program Manager at AITC–M, said. "I will definitely miss working with them this year."

In a pre-COVID world, volunteers would be matched-up with schools near them to conduct in-class visits. These volunteers come from various agricultural backgrounds, including farmers and agriculture industry representatives, and play a huge role in educating students on the agriculture industry and how it works. AITC–M provides volunteers with brief training on what to include in their presentations and gives them the tools needed to engage with the classroom.

In March 2020, 210 schools, 408 classrooms and 8,278 students participated in CALM with the help of 173 volunteers. Over the past four years, AITC–M has almost doubled the number of students they reach through CALM.

"I view CALM on two levels," said Peitsch. "It's a connection for the agriculture industry to get into classrooms and share their stories, and for the students, it provides a link between the food on their plate and those in the industry who work hard to get it there."

In 2021, teachers can register their classroom for CALM online to help students learn about where food comes from and how it gets to their plates. The focus of CALM in Manitoba in 2021 is *Healthy Foods from Healthy Farms*. When teachers sign up, they receive an agriculture and nutrition themed book in French or English, the *Healthy Foods from Healthy Farms* student activity sheets in French or English, videos from Manitoba farmers and processors in English and a teacher guide to help implement these tools. CALM takes place in March and targets grade two to six students, although resources are made for kindergarten through grade eight.

University of Manitoba plant science student Samantha Clemis speaks to a class at CALM 2020.

Kira Rowat, Program Manager and Organizer for CALM, says she can see AITC–M running a blended online and in-person program in the future. This would allow them to have a larger reach province-wide, including northern communities and areas that require longer travel for volunteers. Although online activities and resources could be integrated into the program, Kira says the need for partnerships with AITC–M and volunteers for CALM is real. With larger reach comes a larger need for help.

Kira says CALM has been able to engage students with the agriculture industry in a way that many teachers feel they don't have the skill set or knowledge to deliver.

"As more and more Manitobans are distanced from where their food comes from and how their food is grown, there is an interest to connect students with their natural environment and teach them where their food comes from," said Rowat.

CALM is just one tool in AITC–M's toolbox helping to educate Manitoba students on the agriculture industry. Visit aitc.mb.ca to learn more about AITC–M, their programs and events, and how to get involved. ■

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Grain Growers of Canada Optimistic about Agriculture in 2021

Erin Gowriluk, Executive Director, Grain Growers of Canada

AS WE HEAD into a new year, I'm hopeful for positive changes on some of the issues we've long been working on at Grain Growers of Canada (GGC).

One of these issues is the existing carbon tax that unfairly penalizes Canadian farmers.

We have been re-iterating the message that this tax, which was issued in 2019 as part of the Greenhouse Gas Pollution Pricing Act, directly and unfairly punishes farmers using propane and natural gas to dry their grain.

Adding insult to injury, in the same year that the carbon tax was rolled out, Canadian farmers faced one of the worst harvests in decades, resulting in a significantly higher need to dry grain. As you all know, to date, there are no alternative energy sources available to do so—which the carbon tax intends to encourage.

The numbers we have, to date, prove just how much the carbon tax is costing and not being returned to us through rebates, as promised by Prime Minister Trudeau.

As reported by the *Toronto Sun* in January, revenues from the carbon tax were $454.9M last year, but in the major farming provinces of Ontario, Saskatchewan and Manitoba, residents paid 20 percent, 9 percent and 19 percent more in tax (respectively) than they got back.

The carbon tax was rolled out at a rate of $20/tonne of emission in 2019, with plans to max out at $50/tonne. However, the government has since announced plans to raise the tax by $15/year after 2022.

An article in the *Chronicle Herald* in early January stated that "by 2030, a typical 5,000-acre farm would have to shell out a significant sum of over $150,000 in new tax, based on some estimates, without any compensation."

At a time of thin margins and increasing costs, Canadian farmers simply cannot afford these additional operating expenses.

But there is hope.

Last February, Conservative MP Philip Lawrence introduced Bill C-206, which aims to remove carbon tax for fuel used for grain drying and heating barns.

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The World's Tremendous Appetite for Canadian Pulses

Jeff English, Vice President, Marketing and Communications, Pulse Canada

THE START OF a new year brings an optimism and energy, and for the Canadian pulse industry, 2021 is no different. While the fight against the COVID-19 pandemic altered much of our daily routines, demand for Canadian pulse crops remained strong. Around the world, we are seeing an increased focus on the importance of food security. And there is tremendous appetite for the functional, nutritional and sustainability benefits that Canadian pulses have to offer.

TRADE AND TRANSPORT

To ensure that we can meet the global demand for Canadian pulses around the world, stable market access and consistent, predictable transportation services are essential. Canada continues to face market access barriers that are not based on science nor the rules-based system that we've come to value so greatly. As a result, Pulse Canada continues to work diligently to find creative ways to resolve priority issues in key markets.

While unconstrained access to India remains a challenge, we have recently seen a willingness from officials in India to come to the table with a potential solution to our longstanding fumigation issue. We are working constructively with the federal government and relevant ministers to push for this much-needed fix within an agreed time frame. It is not in the interest of pulse growers, the pulse trade or consumers to contend with trade policy volatility on top of the standard variability in global markets, which is why we're focused on advancing solutions that create greater predictability and transparency for all.

Transportation has once again taken centre stage this winter as the global demand and competition for containers has never been stronger. With 30 percent of Canadian pulses being exported via container, the pulse industry is disproportionately impacted by this rise in demand and by the lack of predictable and timely rail freight service through to port. While the global demand for containers due to COVID-19 is unprecedented, Canada's struggles to obtain reliable rail service is not. Pulse Canada, through our leadership at the Ag

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Throughout the last year, we have heavily pushed for support of this bill in Ottawa. This was one of our focuses during our last November's Grain Week.

Our messaging on this was clear and directive: Canadian farmers are partners in the fight against climate change, not an enemy to be punished.

Bill C-206 came up for debate in a parliament session in December and all opposition parties indicated they would likely support it, which in a minority Parliament means the bill could pass. However, it would be a slow process.

A costing report from the parliamentary budget officer (PBO) last year concluded that costs would be $47M for 2021–2022 for Alberta, Saskatchewan, Manitoba and Ontario and $59M, $60M and $60M over the following three years. However, that report operated under the assumption of the tax remaining $50 tonne/year.

Based on the PBO costing results, we have internally speculated the bill for on-farm fuel use could be $180M a year by 2030—$180M a year straight out of farmers' pockets.

And that's not counting the additional carbon tax costs passed onto the farmer for inputs and transportation.

Canadian farmers are impacted significantly by climate change. Because they deeply understand the need to do their part to reduce emissions, maintain healthy soils and be part of the solution, they have voluntarily adopted innovative and sustainable technologies and practices at large rates in recent decades.

The government has failed to fully recognize and acknowledge this.

Last fall's Throne Speech mentioned that farmers and ranchers would be recognized as key partners in fighting climate change, reducing emissions and building resilience.

We were pleased with this verbal support. But to date, that sentiment has not been reflected in actions.

So, what do we do now? We will continue to push for all political parties to support Bill C-206.

Additionally, as we try to better quantify the impacts of the escalating carbon tax, we will continue to engage with government to show why expanded exemptions are necessary and changes are required in a more expedited manner.

It's an uphill battle, but in the spirit of a fresh start to a new year, I am optimistic that we're in a good position. We've done the background work. We've laid the foundation. We've gotten our message across and shown the impact this tax has had to date on Canadian farms of all sizes (and will have in the future).

We know this is an issue that the government can't ignore and GGC will ensure it stays on the front burner.

Wishing you all an optimistic start to the year. ■

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Transport Coalition (ATC), continues to monitor and communicate on daily and weekly performance of both CN and CP. As we emerge from winter, a very high number of orders have gone unfulfilled compared to previous years. This is concerning and something that both Pulse Canada and ATC members continue to bring to the attention of industry and relevant decision-makers in government.

To provide ongoing awareness into rail transportation, Pulse Canada launched a weekly podcast, *Grain by Train*, where we break down the previous week's performance in under 10 minutes. This podcast is focused on delivering farmers the latest in what is going on without having to comb through detailed daily charts and can be found wherever you listen to your podcasts. Efforts like these have helped keep rail logistics top of mind for groups with a stake in moving grain from the field to the customer.

Pulse Canada staff will continue to play an active role on behalf of MPSG and all member partners to ensure that farmers and the industry overall have the attention they need to ensure every member of the supply chain is pulling their weight and getting our products to market on time and growing our exports.

MARKET INNOVATION

As we look ahead to the opportunity for farmers and our industry, we remain guided by the pulse industry's 25 by 25 strategy. This focus—to create new demand in new use categories for 25 percent of the industry's productive capacity by the year 2025—continues to drive the work of Pulse Canada staff, our provincial members and like-minded industry partners.

It's important to note that the diversification strategy is not specific to the market of a single country. It is centred around getting more Canadian pulses included as ingredients into food and feed products. Whether it is working with a pasta company to help them roll out a new product line using 100 percent yellow pea flour or executing our strategy to encourage bean consumption here in Canada, our Market Innovation team is working to ensure that increased interest in plant-based food and feed translates into increased value throughout the pulse supply chain right back to the farm gate.

In closing, MPSG members will notice that we look a little different this year. While we have unveiled a new brand and website that are more reflective of the bold, innovative and energetic approach of our organization and its members, growers can rest assured that our focus remains on maximizing value in the marketplace and improving efficiencies associated with growing, moving and marketing pulses.

We want to wish you, your family and farm a prosperous year ahead as you head into seeding. If you have questions related to any initiative being undertaken at Pulse Canada, please don't hesitate to get in touch. ■

Over 300 independent, on-farm trial project details and results available at manitobapulse.ca

Laura Schmidt, Production Specialist – West

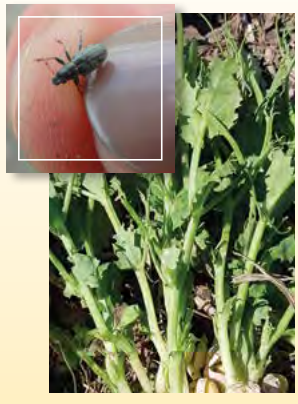
PAYING ATTENTION TO THE PEA LEAF WEEVIL

Our neighbours to the west have been battling the pea leaf weevil for some time now, while we in Manitoba have been operating outside of this pest's range. In the last few years, however, the weevil's march eastward has brought them into our borders with the first confirmed sighting near Swan River in 2019. In 2020, we found them near Gilbert Plains and Dauphin too.

Peas and faba beans are both at risk of damage from this weevil. The characteristic leaf notching of adult feeding is easy to spot, but rarely causes economic damage. The true culprit is the larvae that feed on root nodules, resulting in reduced nitrogen fixation and poor plant growth. This also leaves the plant susceptible to more severe root rot infections as pea leaf weevil and Fusarium have a mutualistic relationship.

Check for leaf notching in peas and faba beans at the end of May and early June. Adults are soil-coloured and can be tough to spot. I've had luck by pulling notched plants and watching for movement on the soil as the weevils scamper away. Sometimes they'll play dead, so shifting some soil around can help make them move.

There are other weevils out and about munching on peas, so reach out to John Gavloski (MARD) or one of MPSG's production specialists for confirmation if you suspect you have this pest in your field.



As I've participated on several cross-provincial priority setting calls this winter, it's become apparent just how significant a pest the pea leaf weevil has been to our western counterparts. Let's take note to monitor for, and manage this pest now, while its impact is not severe.

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Manitoba has Greatest Potential for Soybean Boom

Ron Davidson, Executive Director, Soy Canada

IN 2012, SOYBEANS became Manitoba's third most valuable field crop, a ranking that has been sustained for nine consecutive years. Moreover, for seven of the past eight years, Manitoba surpassed Quebec as this country's second-largest soybean-producing province.

As soybeans constitute a tier-one option among the province's crop rotation choices, Manitoba's perspectives and priorities must be considered when agriculture, trade and regulatory decisions are being discussed. This objective is assured by the multiple roles of Manitoba Pulse & Soybean Growers (MPSG), as a founding member, with dual representation including the current Chair on the Board of Directors of Soy Canada.

The creation of Soy Canada in 2014 reflected a recognition that policy and regulatory decisions taken by governments at both the national and international levels: a) may offer positive or negative implications, b) increasingly reflect perspectives championed by interests with limited or inaccurate understanding of the sector and c) it could be improved by well-substantiated and persistent engagement by value chain organizations.

Founded on the principle of a "lean" organization, Soy Canada's three staff members' preferred approach is to undertake analysis and advocacy activities in collaboration and partnership with other organizations that share common interests. This option is particularly productive in the context of lengthy consultation processes associated with broad-based multi-commodity policy or regulatory framework initiatives. Nevertheless, whether advocacy is pursued collectively or individually, Soy Canada is responsible for determining potential or experienced implications for the soy sector and ensuring they are taken into account during government policy and regulatory decision-making processes.

The following are several examples of the range and diversity of topics on which Soy Canada engages:

RESEARCH AND INNOVATION

Continuous research and innovation have been and remain critical to enabling the expansion of soybean production. Due to the ongoing commitment to research, Canadian soybean production increased progressively from 5,900 tonnes in one region of one province in 1941 to 6,358,500 tonnes in seven provinces in 2020. Soy Canada supports research proposals oriented to Manitoba's requirements, including the importance of greater yield stability/drought tolerance, increased protein and enhanced pest resistance. Recent Soy Canada activities include:

- the organization of a national, in-person, Soybean Research and Innovation Workshop in 2020 during which soybean scientists from the public (federal, provincial, academic) and private sectors across Canada exchanged perspectives on collective research achievements, challenges and future priorities
- participation in a COVID-era video-conference with soybean scientists to address proposed production-related research priorities for the next five-year soy sector application by the Canadian Field Crop Research Alliance for federal government-industry shared-cost funding and

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- management of the industry component of a "Collaborative Research and Development Agreement" with Agriculture and Agri-Food Canada for shared-cost research funding on the quality of individual identity-preserved varieties for use in the manufacture of specific soy-based foods.

INTERNATIONAL TRADE POLICY

Two-thirds of Canadian soybean production must be exported annually to more than 50 countries worldwide. During the past three years, Soy Canada has analyzed and advocated soybean sector interests pertaining to import quotas, import tariffs and technical market access barriers concerning numerous free trade agreement negotiations:

- Canada-United States-Mexico Agreement (CUSMA) — Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP)
- Canada-Association of Southeast Nations Free Trade Agreement (ASEAN 10)
- Canada-Pacific Alliance Free Trade Agreement (Chile, Colombia, Mexico, Peru)
- Canada-Mercosur Free Trade Agreement (Argentina, Brazil, Paraguay, Uruguay, Venezuela) and
- potential accession or bilateral free trade agreement negotiations with Bangladesh, Indonesia, Philippines, South Korea, Taiwan, Thailand and the United Kingdom.

MARKET ACCESS

Trade in agricultural and agri-food products is impacted and frequently threatened by a continually evolving plethora of national, regional or international regulations and technical requirements. These include regulatory requirements applicable to, among other things: the approval of traits for genetically modified varieties; genetic enhancements achieved using plant breeding innovation; maximum residue limits for pesticides; and phytosanitary restrictions. Soy Canada is responsible for becoming aware of proposed new or modified technical requirements and analyzing whether the proposed specifications could be problematic or prohibitive for the export of Canadian soybeans. It is also responsible for seeking Canadian government intervention with their foreign counterparts on behalf of soybean sector concerns and advising Soy Canada members of new requirements.

The grains, oilseeds and pulse sector has developed a "Market Acceptance of Pesticide Use Policy" that established a framework for proactively evaluating the MRL-related trade risk of individual chemistry/crop use patterns with new or amended pest control product registrations. Soy Canada is responsible for conducting initial and annual risk assessments, including completing a worksheet for each chemistry/crop use pattern assessed. Should representatives

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from the value chain determine that the potential for experiencing an MRL-related trade disruption is unacceptable, Soy Canada is charged with developing a recommendation on the particular chemistry/crop use pattern for the applicable crop year and its communication throughout the soybean value chain.

Members of the Western Grain Elevator Association (WGEA) maintain an annual Declaration of Eligibility for Delivery, which includes a "declaration" by producers to the effect that they have not used any products on a specified list of registered pesticides. The WGEA consults with Soy Canada if any of the proposed entries on the list of WGEA-prohibited pesticides could be of importance for soybean producers. Instances have occurred in which Soy Canada's analysis of product use characteristics has modified WGEA's initial proposals.

MARKET DEVELOPMENT

Soy Canada

- creates multilingual promotional materials for both crushing/processing and identity-preserved/food grade soybeans; contracts with third parties to undertake foreign market research
- organizes outgoing trade development missions
- responds to a constant flow of incoming requests connected with Canadian exporters of a full range of soy sector products.

Recent destinations of outgoing market development missions have included several member countries of the European Union, Japan, Taiwan and Vietnam. In the context of COVID-related travel constraints, a virtual trade mission is scheduled to be completed between the preparation and the publication of this article.

INDUSTRY PROFILE

Until the early 2000s, soybean production in Canada was perceived primarily as an endeavour to be undertaken in the St. Lawrence River basin. The rapid expansion of production in Manitoba from 2001 onward, the province's vault to number two producer in 2013, and the concurrent elevation of soybeans to Canada's third most valuable field crop resulted in a substantive change in the sector profile from regional to national prominence. Soy Canada continues to update both government and media representatives on the evolving profile of soybean production in Canada and the substantive and increasing contribution of soybeans to Canadian agricultural production, trade and farm revenue.

GOVERNMENT RELATIONS

Soy Canada interaction with government representatives on one or more of the topics listed above occurs on virtually a daily basis. In addition, subject-specific political advocacy campaigns have been initiated on topics such as the inclusion of soybeans in the CN and CP Maximum Revenue Entitlements for grain transportation; the quest for a matching compensatory payment to Canadian soybean producers in the context of virtual exclusion of Canadian soybeans from the Chinese market during 2019 and 2020; and the concurrent payment of large government subsidies to U.S. soybean producers.

MEDIA RELATIONS

Soy Canada's limited resources do not permit the execution of an aggressive media outreach program. Nevertheless, the organization responds on a timely and comprehensive basis to a flow of incoming queries from both the agriculture sector and general economic journalists. A major exception to this statement occurred from April 2019 to mid-2020, during which Soy Canada participated in numerous national television, radio and print interviews.

In summary, although soybeans are a comparatively recent entrant to crop production alternatives in Manitoba, the rapid production successes of the past two decades have resulted, first, in the elevation of soybeans to consistent occupation of the third rank in provincial farm cash receipts and, second, their inclusion as a key component of crop rotation options. It can be reasonably projected that continued investment in regional research and innovation by both the public and private sectors will result in progressively greater profitability per acre, increased and more predictable annual production and a strengthened business case for further investment in domestic crushing capacity.

MPSG is already a primary partner and contributor to the Canadian soybean sector at the national level. Soy Canada looks forward to a further intensification of collaboration that reflects not only the heightened contribution of Manitoba to the Canadian soybean sector, but also its position as the province that offers the greatest potential for increased soybean production and soybean processing/crushing capacity in the coming years. ■

Clancey's Stats

Competition for acres could become one of the dominant features of pulse markets during the first few months of 2021.

Brian Clancey, Senior Market Analyst and Publisher, STAT Communications

SINCE MAY, GLOBAL prices for pulses have steadily lost ground compared to grains or oilseeds. At that time, the global price index for pulses was 95% of the average index for grains and oilseeds. By August, it had dropped to 75% and slipped further to 66% in December.

Changes are more pronounced compared to oilseeds than grains. The global price index for pulses averaged 90% of oilseeds in 2019 but dropped to 80% in 2020, while it only slipped from 78% to 77% versus global grains over the two years.

VALUES IN CANADA

Values in Canada have held up better. Comparing prospective gross returns for pulses versus grains and oilseeds, peas, lentils and chickpeas are still performing better than their previous three-year average versus wheat, barley and canola.

There is a fairly strong relationship between prospective returns for the current marketing year and what happened during the previous three. When prospective gross returns rise above their previous three-year average, farmers tend to maintain or increase land in those pulses which are doing well. When they drop below, farmers tend to decrease land in under-performing pulses.

Since 2001, this was the case 76% of the time for lentils versus wheat, 71% of the time versus durum and 76% of the time versus barley and canola. The relationship with peas is not as strong at 59% of the time versus wheat and barley, 71% versus durum and only 53% of the time versus canola.

The implication is that there is a good chance land in pulses in Canada will not change very much. At the moment, it looks like land in all pulses could slip from 9.243 to 9.218 million acres, just above the previous five-year average of 9.153 million. However, if yields are only average, production could drop from 8.17 to 7.52 million metric tonnes, compared to the previous five-year average of 7.48 million.

Through March, prices and movement for all crops will significantly determine where area ends up. For classes of pulses, farmers have trouble moving what they grew last year. Land in those stands a good chance of dropping, whereas classes that continue to see good prices and movement could increase as growers who have not finalized this year's seeding plans respond to market conditions.

GLOBAL PULSE PRODUCTION

The same factors play out globally. But, the picture does not look as favourable as in Canada and parts of the U.S. The implication is global pulse production in net exporting countries could ease in 2021, with some of those losses offset by efforts by net importing countries to encourage farmers to plant more pulses.

Government efforts to encourage increased pulse output in countries like India and Pakistan are having some success. Efforts are also underway in the

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European Union to create what they view as more sustainable and environmentally friendly agriculture. Serious efforts are underway in some member states to expand the types of crops used in livestock feed, emphasizing those that can be grown in the region.

CONSUMER INTEREST IN VEGETABLE PROTEIN

Another major trend is still taking shape in the world. Consumer interest in vegetable protein options is steadily rising in many countries, resulting in the ongoing expansion of the global fractionation industry. The U.S. agricultural attaché reported one interesting development for China, who noted that while meat consumption in the country has expanded because of economic expansion, "Chinese consumer preferences are rapidly changing, especially among urban and younger consumers.

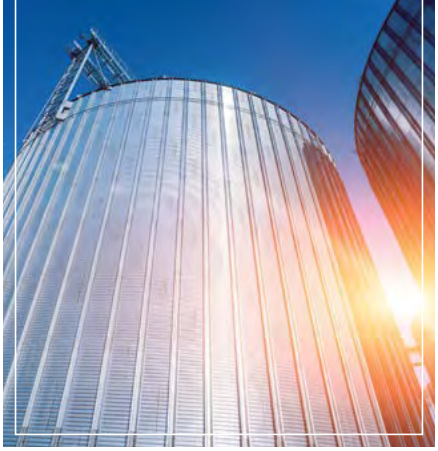
"They grew up frequently eating meat during China's economic expansion and do not hold the same importance to meat as a symbol of financial success and stability. These consumers tend to mirror peers elsewhere in the world who believe eating less meat is healthier and better for the environment or animal welfare. Consumers interested in natural, organic and healthy foods tend to be interested in plant-based meat alternatives. While eating a plant-based diet might signal economic struggle a mere 20 years ago, today plant-based meat alternatives are viewed by many urban younger consumers as novel and trendy."

Peas are the cheapest ingredient available to fractionation plants and the pet food sector. Even so, several companies continue to develop products using dry edible beans, chickpeas and lentils. The net effect is that base demand for all classes of pulses by the human and pet food sectors is growing. But, the quantities used may never rival demand from China's livestock feed sector or traditional uses.

At the moment, the most valuable fraction from pulses in those new markets is protein. Efforts are underway to develop higher protein varieties of peas, while some companies pay protein premiums. That will make it possible for some farmers to obtain better returns for some or all of their production without creating direct competition with price-sensitive uses such as livestock feed.

DIVERSIFICATION

Diversifying demand is necessary. Canada relies on China to consume the bulk of its pea crop, with most going into hog feed. High prices for soybeans and other oilseeds will result in expanded global production. This is reflected in new crop futures markets for soybeans and meal, suggesting new crop prices for peas will need to be significantly lower to remain competitive in livestock feed rations. The implication is growers should take advantage of chances to move old crop peas. However, pulses are an interesting commodity group. While low prices tend to discourage production, it also encourages expanded uses, resulting in a new base level for global demand. ■



A Structural Element of Canada's Agricultural Scaffolding

Canadian Grain Commission

Canadian Grain Commission | Commission canadienne des grains

Toban Dyck, Director of Communications, MPSG

THE CANADA GRAIN ACT *was passed in 1912, following decades of lobbying pressure from farmers suspicious that private companies were taking advantage of them.*

The history of how this uprising was initially perceived when it began in the 1890s to the state of things when government bent to the pressure, and Prime Minister Robert Borden passed the Act, is something I'll leave the reader to investigate.

Without having investigated this specific history myself, I'm choosing to draw from it a lesson in the efficacy of the long-game approach to applying government pressure, but I could be wrong.

That was 1912. My farm was just being handed off to the second generation and the frontiers of the Canadian west were becoming more and more populated, a trajectory that a loss of faith in the country's agricultural value chain could jeopardize and a trajectory that was key to building Canada's economy.

The Canada Grain Act was the basis for the creation of the Board of Grain Commissioners for Canada and for what we know today as the Canadian Grain Commission (CGC).

That very same Act, which has undergone many revisions since its inception, is currently under review again. The details of the Act sets the mandate and gives strategic direction for the Commission and people like Doug Chorney, the newly appointed Chief Commissioner.

It was in the spirit of farmer protection that the CGC was conceived. Today, that same sentiment gives it speed. In the interest of transparency, however, it should be noted that the CGC has itself become a target of the same farmer-led suspicion of unfairness that led to its formation. This article is not about CGC's accounts receivable/payable or its reserves. It's about the CGC as a structural element of Canada's agricultural scaffolding.

The CGC is run by Chief Commissioner Doug Chorney, Assistant Chief Commissioner Patty Rosher and Commissioner Lonny McKague. Chorney, who has a direct line to Minister of Agriculture and Agri-Food Marie-Claude Bibeau, along with Rosher and McKague, implements the CGC's strategic direction and establish policies under the authority of the Canadian Grain Act.

The CGC settles disputes between companies and farmers, is the final word on crop grading, issues warnings to farmers who may be affected by mismanaged grain handlers and administers a payment security program.

Most companies that handle grain in nearly any capacity are likely under the CGC's purview, meaning they must be licensed by the commission in order to operate. "There are about 500 licensees that we oversee in Canada," said Chorney. "Every month, every licensee has to report what they have purchased and what's outstanding to producers to the CGC."

These submissions are analyzed by CGC staff and are flagged if unusual patterns are detected in their books. In addition to this detailed analysis of licensees, the commissioners meet regularly to discuss follow-up strategies with respect to companies whose activities have been identified as irregular or suspicious.

"We meet every month to discuss and review licensees and possible enforcement," said Chorney. "It's impressive from an operational standpoint. It's CGC looking after farmers."

The CGC has a lofty name, and its operations are similarly high-level, but Chorney would be the first to say that the CGC is also meant for individual farmers.

"At Ag Days in Brandon, a farmer stopped me to ask about a cheque he was supposed to have received after a company he had been dealing with filed for bankruptcy. As a result of that conversation, we were able to identify the issue and get him his cheque. Farmers, if you are worried about getting paid, call us at the CGC," he said.

In some cases, following the revocation of a license or a bankruptcy filing, the CGC will contact every affected producer.

There are currently 20 official grains regulated under the CGC. They're currently working on adding another, which, according to Chorney, involves a long, thorough process of consulting with stakeholders, conducting financial impact assessments and investigating the cost and benefit to the overall industry.

Harvest Sample Program

Underpinning a lot of what CGC does is its Harvest Sample Program. They receive about 15,000 samples from Canadian farmers on an annual basis. "These samples help us assess overall quality, conduct analysis for markets interested in Canadian grain and equip diplomats with beneficial information for trade missions."

The CGC's Grain Research Laboratory (GRL) is another vehicle through which it serves the greater agricultural industry, and in this area, some specific attention is being given to the pulse and soybean industries. Scientists in the GRL are looking at pulse fractionation and determining

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new end uses for the resulting proteins, starches and fibres. "This data is made available to groups utilizing pulses," said Chorney.

Amid a cultural landscape in which use of the word protein is increasing at a rate exceeding the public's understanding of it, this kind of research and its subsequent extension is quite important, if not critical, curtailing seamlessly with the work we do at Manitoba Pulse & Soybean Growers.

"The CGC is also monitoring protein levels in soybeans in western Canada and determining trends, if there are any," said Chorney.

Market access is foundational to CGC. It works with the Canadian Food Inspection Agency to ensure the departure of grains at our ports is to standard and under the respective maximum residue limit (MRL). These inspection approvals are manifested as statements of assurance issued to various markets interested in Canadian grains.

According to 2019 CGC data that Chorney emailed to me, "We issued over 4,300 Statements of Assurance with results from our analysis of pesticides, mycotoxins and heavy metals in grain exports during the 2018–19 crop year. Statements of Assurance are official CGC documents that are used by many grain importers operating within a food-safety quality-management system. They need evidence that their processes effectively control food safety risks of their products, starting at where they source grain. Grain buyers use our Statements of Assurance as evidence that Canadian grain meets their specifications."

The *Keep it Clean* advisory for farmers and grain companies to make sure their practices and/or recommendations are in-step with the current glyphosate MRLs for a specific crop is available at keepingitclean.ca.

The CGC represents one of many pieces to the Canadian agricultural puzzle. The needs of farmers may be different now than they were in 1912, but as I read about the commission's history, I was struck by how the suspicion that private companies are taking advantage of farmers is always present. Safeguards are important.

For more information on what the Canadian Grain Commission does, visit **grainscanada.gc.ca**. Canadian Grain Act review submissions are to be sent to **aafc.cgareview.aac@canada.ca** by April 30 of this year. ■

MANITOBA Pulse Soybean GROWERS

OUR MISSION

To provide research, production knowledge and market development support to Manitoba pulse and soybean farmers.

Elevating Canada as a World Leader in Pulse-Based Protein

New state-of-the-art protein facility in Manitoba relies strictly on western Canadian producers.

Dan Kraft, VP of Operations, Merit Functional Foods

WALKING THROUGH THE grocery aisles the past several years, you've likely noticed plant-based products more and more frequently appearing on shelves. From meat alternatives to plant-based milks and beyond, consumers are purchasing plant-based products at a staggering rate.

While there are plenty of plant-based protein products on the market these days, there's one aspect that we kept coming back to as we tried them: they didn't taste as good as we thought they could. That's part of what motivated our team at Merit Functional Foods to enter this blossoming market.

Quite simply, we wanted to do plant protein better. We wanted to uproot what consumers and the food and beverage industry think of plant-based protein by introducing them to pea and canola protein solutions that offer unmatched purity, exceptional taste and excellent solubility.

And in September 2019, we broke ground on our state-of-the-art production facility, a major step toward bringing our vision to life. In December 2020, just 15 months later, we moved into our new, 94,000-square foot facility. Today, we are in the midst of commissioning and optimizing.

Our pea and canola production has significant raw material requirements. Our plant will initially require about 25,000 tonnes of pea and canola, and with the potential for future plant expansion, our requirements could rise to more than 120,000 tonnes per year.

Already anticipating future demand as the plant-based trend continues to gain momentum, we have taken measures to ensure our facility is agile and able to significantly increase capacity when the time is right. Our customers will rely on us for consistency in their supply chain as they scale up their plant-based production, and we intend to make their growth as seamless as possible.

We're committed to sourcing all of our pea and non-GMO canola from Canadian growers, providing the food and beverage industry a made-in-Canada solution. From farm to facility, we're excited for the opportunity to partner with western Canadian producers to build traceable and value-added supply chains for yellow peas and canola. Together, we can establish Canada as a global leader in plant protein.

The Canadian government has provided us instrumental support throughout our facility's construction, with Prime Minister Trudeau announcing major financial funding over the summer.

"This facility will be a world leader in plant-based proteins and will create good jobs in a fast-growing field," he said in his June 23 remarks. "And by using 100 percent Canadian inputs, we will also support the farmers who produce canola and yellow peas used in Merit's products. Standing up for hardworking farmers, creating good jobs, setting up Canada for success on the world's stage—these are things that our government will always get behind."

Our facility features patented technology that enables us to produce multiple soluble protein fractions, resulting in functional properties that have higher sensory characteristics than other plant proteins currently available today. This makes our proteins a perfect fit for categories like protein bars, ready-to-mix and ready-to-drink beverages, meat alternatives and dairy alternatives, such as plant-based milk and ice cream.

Over the past year, we have established supply agreements with growers to ensure we have a supply of high-quality yellow peas and non-GMO canola. Our producer partners are some of the most critical contributors to Merit. So, the next time you enjoy a scoop of plant-based ice cream or bite into a plant protein bar, know that the work you're doing is helping those treats taste better than ever before.

While we are close to reaching our 2021/2022 contracting capacity for yellow peas, we're currently looking to contract additional acres of organic yellow peas and non-GMO canola. If you are interested in joining us, please visit our website and get in touch. ■

A Career of Heart and Collaboration

Dr. Debra McLaren

Presenting on MPSG's soybean root rot survey and pulse research.

Toban Dyck, Director of Communications, MPSG

DR. DEBRA MCLAREN *lives in south-western Manitoba on a small acreage with her twin brother, who has Parkinson's disease.*

She was in the middle of packing up her office when we chatted. The email address she had since 1998, when she began her career as a plant pathologist with Agriculture and Agri-Food Canada (AAFC), would only be valid for a few more days.

She hadn't intended to retire this year. It was supposed to happen in March of 2023, but concerns related to her own health and the unbreakable commitment she made to support her brother changed things for her.

"I had to make the decision to retire," she said. "There is just too much going on with my health. And then looking after my brother—I determined that I will always be around for him. We're really close. We've always done the weird twin things over the years. We'll pick the same cards out for people. I lived in Lethbridge, and he lived in Winnipeg and we'd buy the same bottle of wine. I would do everything I can for him."

If you could hear McLaren say this the way I heard it over the phone, you'd be struck, like I was, with how earnest, caring and smart, she comes across.

She understated her impact on the industry. Everyone I spoke to about Dr. Debra McLaren couldn't say enough about the exceptional work she has done in so many aspects of pathology research. It will be impossible for the next few hundred words to properly dissect her career as a sought-after pathologist and coveted collaborator.

McLaren is an award-winning photographer, a highly regarded plant pathologist, a lover of 1955 Chevy cars and she brimmed with excitement when she told me the ranch next to her acreage is expecting 11 foals this spring.

"I absolutely love horses, but I can never have one of my own," said McLaren. "So I'll be there. I'll be there with my mask on, but I'll be there."

McLaren's career began in animal science, motivated by her love of horses and animals, in general. She was determined to be a veterinarian.

"I'm only a couple of courses short of an animal science degree," said McLaren.

She was aware of her allergies going into the program, and when they started intensifying, she knew that being a vet was not in her cards.

She grew up in a creative environment. Her mother, who turned 99 the day we spoke, was a nurse and photographer.

"We grew up with a darkroom in the kitchen," she said. "We'd cover everything, windows and doors. We had the trays and a developer and we'd just put the paper in the trays and watch the nose, the eyes and the hair appear. It was really awesome. We'd have strings across the kitchen and we'd have these pictures drying off on them. It's kind of a lost art, I think. We've got a well-documented childhood, believe me."

She shifted trajectories from animal science to horticulture, pursuing her love of plants and flowers. Following her undergraduate degree, she worked for a few years at the Agriculture Canada Research Station in Morden as a technician.

"I worked for Dr. Henry Huang, who was a plant pathologist there. I was always kind of interested in pathology, but also horticulture," she said. "But once I worked for Dr. Huang, that was it. I was hooked on pathology."

McLaren completed most of her graduate work in Lethbridge, Alberta, under Dr. Huang's supervision, before doing a post-doctorate at the Beaverlodge Research Farm. She returned to Manitoba, worked for the province for a few years and then, in 1998, "was lucky enough to get the position at Brandon and has been there since."

McLaren, along with Dr. Richard Bélanger and recently retired Dr. Bob Conner, started to investigate the hypothesis that Phytophthora stem and root rot present in well-established soybean production areas in eastern Canada may start presenting themselves here in Manitoba.

"Phytophthora is a pathogen that has a number of races," said McLaren. "We started to work collaboratively on this, looking at what races were present in Manitoba and western Canada. Generally, there is just one race that is most prominent and causes the most losses."

"We developed a screening process and a set of protocols for this system to work and we were able to identify races in Manitoba and western Canada. We've been able to look at Phytophthora isolates that we get every year and determine what races we have," said McLaren. "Manitoba Pulse & Soybean Growers has been great at bringing in samples. So has Manitoba Agriculture along with support from provincial, federal and industry colleagues out west. It's been really great working with them over the years."

McLaren's commitment to farmers shone through in every point she made related to the job she was about to leave. The advancements in disease detection that occurred while she was with AAFC must have been exciting to her as a scientist with a curious mind, but her account of these moments was through the lens of how farmers would benefit.

In her position at AAFC, McLaren was a scientist, yes, but also a civil servant and she took that role to heart. Her research provided disease management strategies for farmers and that is exactly what motivated her.

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"It's interesting to see how the pathogen evolves because we are seeing more complex races developing, which is common for this pathogen. It's done this in North Dakota and down east. There are so many things that come into play, but it's been really rewarding to be able to identify what Phytophthora races are out there so that we can provide the best information to the growers. They can pick the best variety that will be suitable for them depending on what races they have. There are more varieties out there now that have some of the genes in them that will be more effective against some of the races. It's been rewarding to see the development of varieties that contain a better gene package. It's very encouraging."

One replicate of the study showing lines of dry bean varieties and their tolerance/susceptibility to Sclerotinia sclerotiorum *(white mould).*

McLaren's research has also been instrumental in developing protection against Sclerotinia, helping breeders identify varieties that will help farmers put together strong disease management plans on their farms.

"Sclerotinia can be very devastating, depending on the year and the weather," she said. "It was encouraging to see that there are lines out there that were more tolerant. It was good to see that something will be available to farmers down the line for better disease management."

I asked her if she considered herself more of a classical or molecular pathologist, a question that, judging by her response, she appreciated.

"I consider myself more of a classical pathologist, but moving ahead and embracing the new technology as it comes along. Moving forward, the molecular research is very important. I've gotten into some of that area myself, but I've hired people with expertise in molecular techniques and they have a lot of experience in the field, so they have a really good combination of skills," said McLaren. This includes Drs. Maria Antonia Henriquez, who is now a research scientist at Morden, and Yong Min Kim who is currently in the pathology program at Brandon. "A lot of the disciplines are embracing molecular techniques. Although DNA research is revolutionizing plant disease detection, it must be used with conventional plant pathology. It is essential that plant pathologists have one foot in the furrow. You need to be able to go out in the field. You need to see what is happening out there. That is extremely important."

Currently, Phytophthora can only be identified if you have the cultures. However, according to McLaren, molecular detection tools are being developed and she's hoping that such a test will be commercially available to farmers soon.

A molecular test would allow for the detection of pathogens at lower limits and alert the farmer if their soil is low, medium or high risk.

"This is the way research is going—fast and precise with quick delivery back to the farmer," she said. "The grower was my client and I always felt very strongly about that."

McLaren recalled working with Dr. Conner on the Prairie Grain Development Committee and witnessing plant breeders developing new varieties that will benefit farmers based on their research, including cultivars with no or reduced disease levels.

As with many scientists, McLaren has vivid memories of entering the lab on a given day and discovering something new.

"When you place this diseased tissue on this agar and you expect something, but instead you get something you haven't seen before," she recalled. "Then you have to take that culture, purify it and confirm what you have. We found a new *Fusarium* species that hadn't been detected before that was pathogenic. There have been a couple of things like that along the way. It's quite exciting."

An award-winning photo of mammatus clouds taken by Debra following a tornado event north of Brandon in the early 2000s.

As McLaren considers what's next for her, her mind and heart bend towards caring for animals, supporting her brother and, perhaps, volunteering her time with the Parkinson's Society. Oh yeah, and photography.

In the early 2000s, McLaren took a photo of mammatus clouds following a tornado event just north of Brandon. She showed the photograph to her mother.

"My mom was adamant that it should be entered into this Canadian Geographic photo contest, and I said 'no, just don't.' Well. My mother did without telling me and I won this award. She actually got the picture framed for me and I have it up on the wall in the house. She is a sweetheart."

McLaren wants to strengthen this hobby now that she may have some more time on her hands to do so, but she is also exploring the possibility of taking her Labradoodle, which has brought her and her brother so much joy, to nursing homes so that others can enjoy her company.

"I have loved every minute of my career," said McLaren. "It has been really rewarding. I have worked with such great people. One of my technicians, Tom Henderson, has been with my program almost since the day I started. I've been blessed to have him as my senior technician. I can't say enough about him."

But McLaren's final mention goes to her partner, George. "He has been an anchor for my brother and me, and so helpful on our acreage. He's awesome with a chainsaw. I wouldn't be where I am today without his love and support." ■

Your Investment at Work

MANITOBA Pulse Soybean GROWERS

2021 Research and Production Outlook

Daryl Domitruk, PhD, PAg, Executive Director, MPSG

THE START OF 2021 found us starting to set objectives for the next five-year federal-provincial ag policy framework scheduled to begin in 2023. Traditionally, renewal of inter-governmental agreements provide top billing to business risk management (BRM) programs. Importantly, they also signal the renewal of commitments to research and other topics collected under the rather bland heading of "non-BRM."

It is these programs that stretch check-off dollars invested in research and extension. They also help Canadian agriculture capture opportunities to expand and become more sustainable. In fact, some policy makers believe the next federal-provincial framework may be an opportunity to elevate agriculture to its rightful place as a strategically critical sector for Canada.

Given where MPSG stands in stewarding the development of our crops, the activities undertaken through the next framework could prove critical to the future of pulse and soybean crops in Manitoba.

That's not to leave the impression everything important in crops happens through producer-government projects. In fact, private companies account for the vast majority of innovation in crop agriculture. Perhaps, though, that is the very reason why government funding of producer-driven research is more important than ever. If we're going to fully adapt pulses and soybeans to Manitoba, we'll need to complement the latest varieties and chemistries with better informed purchase and use.

Digital ag technologies have promise in this regard, but there's some distance to go before they're fully verified. Digital ag has certainly become a competitive market with new technologies and services revealed weekly. MPSG is evaluating some of these new tools to reduce pest control costs. Even compared to biotechnologies, the digital space is very exciting and we remain hopeful the digital wave will roll in ag's favour.

In fact, our main challenge remains to increase and transfer knowledge. Pulses especially can be temperamental and unthrifty when exposed to pests and inclement weather. Given market sensitivities and razor-thin margins, it's not feasible to seek technological solutions alone. A better understanding of pests and crop stress at the genetic level is required.

In this edition of *Pulse Beat* we see examples of this type of knowledge being developed. Bryan Cassone at Brandon University is figuring out how to trap, identify and count wireworms. We have treatments for this pest, but we don't really know when it pays to use them. Likewise, soybean cyst nematode's inevitable arrival has been confirmed. We don't know its extent or intensity, so, as an article herein shows, effective sampling is key.

A big boulder we hope to roll out of the way in the next round of funding is the adaptation of soybean to stress from drought and soil salinity. As we repeat at every opportunity, prairie farmers grow soybeans in a manner unlike anywhere else in the soybean world. This means our varieties don't come with built-in stress tolerance. In a recent workshop hosted by the Canadian Field Crop Research Alliance, the research consortium reported remarkable progress in our understanding of the genetic basis of crop maturity. We asked if the same workers could now turn their skills in genetics and physiology to understanding drought tolerance. The public plant breeders were there to hear the call.

Canadian soybean research capacity is still centred in Ontario and Quebec. Drought tolerance isn't something those labs are accustomed to addressing. Still, there's a keen awareness drought stress is becoming an issue in the east as climatic patterns shift.

Addressing drought tolerance is complicated. Much like yield, it's considered a "quantitative" trait with many genetic origins. MPSG has its work cut out, sorting through and targeting research that will most likely get us to our adaptation goals. We are less likely in the next round to fund general breeding programs. We must be more precise in setting and pursuing targets.

Back to the reality that what a soybean experiences in Manitoba is different from their Ontario or Iowa brethren. Here, we can still get away with asking the simple questions. Row spacing, plant populations and early season optimization of plant stand; when you rotate soybeans among the many crops from which Manitoba farmers choose, the basic questions keep returning. As the enclosed articles attest, we think programs like the On-Farm Network, Agronomist-in-Residence and agronomy research at Agriculture and Agri-Food Canada and University of Manitoba will continue to be the best routes for answering these simple yet complex questions. We will seek support in the next framework to continue this work.

We've heard growers' perspectives and witnessed first-hand the need to develop pulses and soybeans into resilient go-to crops. The process of building partnerships toward that goal is underway. ■

Do you have a production question related to pulse or soybean crops? Email us!

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Pest Priorities for 2021

Cassandra Tkachuk, PAg, CCA, MSc, Production Specialist – East, MPSG

The Bean Report
Your source for soybean and pulse crop agronomy and research.

KEEPING TRACK OF *pests in pulse and soybean crops is something we prioritize at MPSG. We collect information through annual disease surveys, targeted insect monitoring, cyclical weed surveys, field scouting and by talking to our fellow experts in the field. Gathering up the facts, here's what we would like you to know heading into the 2021 growing season.*

DISEASES

Root Rots

Root rots remain a top concern for soybeans, peas and dry beans for 2021. This includes Fusarium, Rhizoctonia and Pythium root rot for all of these crops, Aphanomyces root rot in peas and lentils, and Phytophthora root rot in soybeans. Based on provincial surveys over the past few years, root rot was found in virtually all fields, but not necessarily at high levels, according to our observations. This is a good thing, and our goal is to keep root rot levels low to minimize the impact on yield. Find detailed root rot survey results on page 35.

The main defence against root rots is a diverse crop rotation, including at least four different crop types in sequence. Fungicide seed treatment is another defence if your field has a history of heavy root rot pressure, soil is saturated in spring and/or the rotation has been tight. MPSG's On-Farm Network (OFN) has been comparing treated vs. untreated soybeans since 2015 on multiple farms and has found that yield responded positively to seed treatment 20% of the time (8/41 site-years). Note that trials were a culmination of fungicide-only or fungicide plus insecticide treatment vs. untreated.

With the rise and growing interest in pea production in Manitoba, Aphanomyces—named the most destructive pathogen of peas—is one to keep a keen eye on. Like other root rots, it prefers wet soil and can really take off if peas are grown too often in rotation. Current recommendations are to grow peas once every four years as a baseline practice and only once every six to eight years or longer if your field has tested positive for Aphanomyces. We recommend submitting plants for lab-testing if you suspect this disease.

APHANOMYCES ROOT ROT *(A. EUTEICHES)*
Main symptoms – Browning and pinching of roots, reduced root mass. Stunting, chlorosis and necrosis of above-ground plant tissue.
Scouting timeline – Early June to late July.

SCN and SDS

The up-and-comer, soybean cyst nematode (SCN), ranks high on the priority list because of its positive identification in four Manitoba municipalities in 2019 and potential impact on yield. At this time, levels of detected SCN (found through the survey led by Dr. Mario Tenuta) are thankfully low. This means we can prevent it from becoming the problem it is in other soybean growing regions. Focus your scouting efforts in the low-yielding areas of the field. Random root investigation for cysts is also a good idea, as SCN can be lurking with no above-ground symptoms.

Starving SCN of its host crops (soybeans, dry beans, field peas and some forages) through rotation is the best way to keep the population low. Varietal resistance is another line of defence. But note that as this pest has moved in from other regions, we may also be inheriting its evolved ability to overcome the main source of genetic resistance (PI 88788) used for more than 20 years in the U.S. Rotating sources of resistance (e.g., with Peking) is highly recommended by our southern counterparts.

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SOYBEAN CYST NEMATODE (*HETERODERA GLYCINES*)

Main symptoms – Possible above-ground yellowing or necrosis, resembling other conditions. Tiny, lemon-shaped cysts on the roots that are much smaller than nodules.

Scouting timeline – July through September. Post-harvest scouting must be done before any tillage.

Sudden death syndrome (SDS), considered a stem and root disease, now makes the priority list of soybean diseases. Though its presence has not yet been confirmed in Manitoba, we are certain we've seen it on rare occasions. This pest seems to use the buddy system and has been reported in regions around the same time as SCN. It also closely resembles brown stem rot (BSR)—another disease not yet identified in Manitoba. So, we recommend vigilance and lab-testing of any suspected cases in 2021. We would love to hear from you if you think you've found SDS or BSR.

SUDDEN DEATH SYNDROME (*FUSARIUM VIRGULIFORME*)

Main symptoms – Leaf mottling resembling viral symptoms in early stages. Interveinal chlorosis and necrosis in later stages.

Scouting timeline – Early to mid-reproductive stages (July through August). Most noticeable at full pod.

White Mould

White mould (Sclerotinia) remains a disease priority for dry beans in 2021. Your main defences against this one are rotation with non-host crops (e.g., cereals) and foliar fungicide if disease pressure is anticipated. Rainfall leading up to flowering is often the greatest influencer over development of the disease. This means there may not be a need for fungicide every year. Start looking for apothecia on the soil surface in late June/early July and follow our fungicide decision worksheet to determine if white mould will develop. Also, consider using a petal test at early flower to see if Sclerotinia DNA is present. These tests are offered by different companies for a cost but could end up saving you a lot of money.

OFN trials conducted from 2016 to 2020 (16 site-years in total) testing dry beans with and without foliar fungicide have revealed no yield differences to date. In most cases, the lack of response to foliar fungicide can be attributed to low white mould pressure. The OFN is set to continue testing fungicide in dry beans with a focus on economics.

Ascochyta/Mycosphaerella Blight

The Ascochyta/Mycosphaerella blight complex is high on the list of pea disease priorities. According to pea surveys, it is the most prevalent foliar disease in Manitoba and can have a significant impact on yield, making it the main target of foliar fungicide. Other lines of defence are crop rotation, varietal resistance and sourcing disease-free seed. Scout for purplish-brown flecks on leaves and pods and purplish-brown or black lesions on stems during the late vegetative stages through flowering (mid-June to late July). It will progress upward from the base of the canopy.

Pea yield response varies among farms when it comes to fungicide. OFN trial results from 2017 to 2020 have shown that single fungicide applications (vs. none) increased yield at 4/16 site-years and double applications (vs. single) increased yield at 3/7 site-years. When looking at economics, sometimes a double application pays, sometimes it does not. Our best recommendation right now is to follow the fungicide decision checklist for this disease, which accounts for symptoms and environmental conditions. And continue to monitor disease pressure to see if a second application is necessary 10–14 days later.

INSECTS

Soybean aphids make the insect priority list each year for soybean crops, whether or not they were a major pest the previous year. They move in from the south, making it difficult to gauge if they will be a concern for us in the coming year. If populations flare-up in 2021, read over our *Soybean Aphids: Identification, Scouting and Management* fact sheet to refresh your memory. This resource has been waiting in the wings since the last major flare-up in 2017, with information that is still up to date.

A very different type of aphid—the pea aphid—is a high priority for pea crops. Unlike soybean aphids, it doesn't take very many pea aphids to do significant damage because of where they feed on the plant—the uppermost, yield-producing parts. Start looking for pea aphids at early flower and continue to monitor through pod formation and elongation. If the

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LAB-TESTING OPTIONS

- **Crop Diagnostic Lab** – all plant diseases, insect and weed identification
- **20/20 Seed Labs Inc. and SGS Biovision Seed Labs** – Aphanomyces in peas and lentils
- **PSI Lab** – glyphosate resistance in kochia, waterhemp identification
- **AgQuest** – herbicide resistance in weed seeds
- **Agvise** – SCN in soil samples

continued from page 25

threshold is reached (two to three aphids per plant tip or 90–120 per 10 sweeps), insecticide options are available and ideally applied at the early pod stage.

Other insect priorities heading into 2021 are cutworms and grasshoppers in all pulses and soybeans, pea leaf weevil in field peas and potato leafhopper in dry beans. For a full insect outlook and details on these, refer to John Gavloski's article on page 48.

Weeds

A couple of our top weed concerns for pulse and soybean crops heading into 2021 are tall waterhemp and kochia. According to the Noxious Weeds Act, tall waterhemp is a tier 1 noxious weed, meaning all plants must be destroyed if found. It was first identified in 2019 in four different municipalities in Manitoba. This weed is number one on our list because of its resistance to at least seven different herbicide groups in the U.S. and the fact that it is such a prolific seed-producer (average of 250,000 seeds/plant). The PSI lab now has a DNA test for identifying tall waterhemp in 2021.


Tall waterhemp plant in a soybean crop.

Photo: Tammy Jones

TALL WATERHEMP
(*AMARANTHUS TUBERCULATUS*)

Description – Oval to lance or spearhead-shaped, waxy-looking leaves. Resembles redroot pigweed when young but has a hairless stem. Typically 4–5 feet tall but can reach 10 feet.

Scouting timeline – Early spring through maturity (before harvest). Investigate surviving weeds 14–21 days after herbicide application.

Kochia also ranks high on our priority list because of its resistance to group 2, 4 and 9 (glyphosate) herbicides and its prolific seed-producing ability (14,000–30,000 seeds/plant). Plus, it's a downright survivor—also known as tumbleweed, kochia was one of the only plants available for livestock to eat in the '30s. This weed can thrive in saline patches in which pulses and soybeans cannot. It is also an early germinator, meaning plants are larger and tougher to kill at spray timing. Check out page 33 for tips on how to control it.

To guide you through, we have insect and disease scouting calendars for soybeans, dry beans, field peas and faba beans (brand new resource on page 32). These calendars give you a timeline of when to scout for each pest, the crop development stages it corresponds with and what its impact could be on production and quality. Find these and other resources mentioned at manitobapulse.ca/production.

Happy scouting! ■

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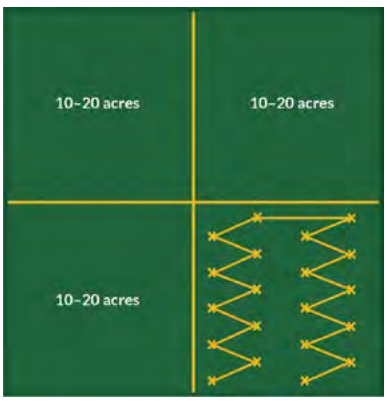
TWO WAYS to scout for SCN.

1 Dig roots and look for females. (Dig, don't pull.)

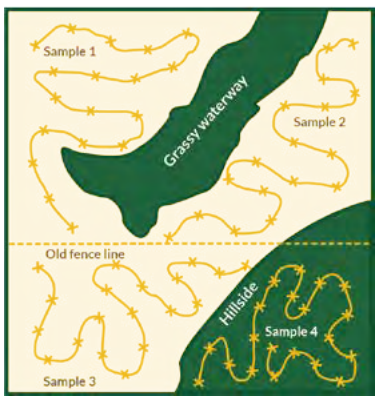
2 Collect soil samples for testing.

THREE APPROACHES to collecting soil samples.

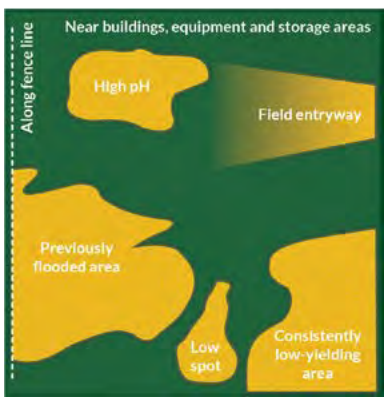
Collect 15–20 (or more) 1-inch-diameter cores, 8 inches deep, for every 20 acres. Mix the cores well, put the mixed soil into a soil sample bag and send it to an SCN testing lab.



1 Collect soil cores using a zigzag pattern.



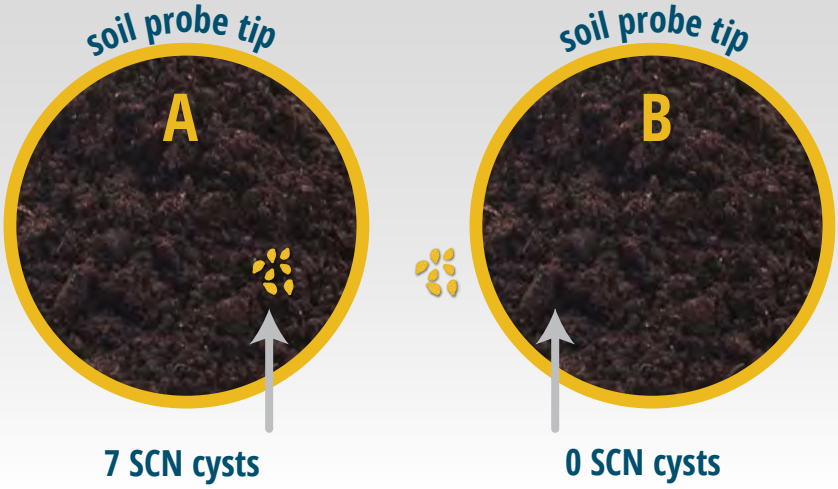
2 Collect soil cores from logical areas or management zones in the field.



3 Collect soil cores from high-risk areas in the field where SCN might first be discovered.

WHY SCN SOIL TEST results are variable.

It all depends on where you put the probe. A ½-inch difference can mean the difference between zero and 1,500 eggs. (Each cyst can hold 200 to 250 eggs.)



7 SCN cysts

0 SCN cysts

WHEN to sample.

- Fall in a non-host crop.
- Fall in soybean stubble.
- Spring before a soybean crop.
- During the season in the soybean crop root zone.

Visit *TheSCNcoalition.com* for more information.

Applying the 5% Rule to Soybean Production

An update from the soybean and pulse agronomy research program

Kristen P. MacMillan, MSc, PAg, Agronomist-in-Residence, Department of Plant Science, University of Manitoba

SOYBEAN AGRONOMY RESEARCH has come a long way in Manitoba over the past decade—more than a dozen agronomy topics have been studied and now contribute to best management practices. Over the past four years, I've studied soybean seeding dates, variety choice, seed depth, fungicide use and iron deficiency chlorosis. Other Manitoba researchers have studied supplemental N fertilizer, P and K fertilization, weed control, preceding crop, row spacing and seeding rates. Inoculants and seed treatments have been explored in the MPSG On-Farm Network.

Amidst the findings, there are few "silver bullets" to increasing soybean yield—that is, single practices that consistently deliver double-digit yield increases (unless you forget inoculant in a new soybean field or spray weeds that are taller than your boots). But each practice has led to small, incremental findings that together result in greater profitability. A good way to describe the value of good agronomic practices is by applying the 5% rule—a well-known concept that has been popularized in farm management.

"A 5% increase in yield, a 5% decrease in costs and a 5% increase in price received will produce more than a 15% increase in net returns. The effect is cumulative, multiplicative and compounding."

—Danny Klinefelter, retired farm economics professor, Texas A&M University

These days, we've far surpassed the 5% increase in price received. And since this is about agronomic practices, we'll focus on yield responses and cost savings. Table 1 summarizes agronomic yield response outcomes for soybeans that have been well studied in Manitoba over the past decade. This provides the opportunity to assess your soybean

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Table 1. Expected yield responses from agronomic practices based on Manitoba research.

Practice	Average Yield Response	+/- Profit Response of Practice	Probability of Response
1. Seeding date	+3%	+$13/ac	Medium
2. Seed depth	+8%	+$33/ac	High
3. Variety selection	+2 bu/ac	+$24/ac	Medium
4. Narrow-row spacing	+2 bu/ac	+$12/ac ($24/ac response but may increase seed or equipment cost)	Medium (40%)
5. N fertilizer	None	Add back the cost of fertilizer if normally applied for yield response	Low
6. P fertilizer	None		Low (5%)
7. Single inoculant	None	+$10/ac (savings of granular inoculant)	Low (7%)
8. Seed treatment	+0.5 bu/ac	-$9/ac ($6/ac response – $15/ac product cost)	Low (11%)
9. Timely weed control	+2 bu/ac	+$12/ac ($24/ac response but increased cost of diversified herbicide program)	High
10. In-crop fungicide	+0.7 bu/ac	-$7/ac ($8 response – $15/ac product cost)	Low (15%)

[1,2] New research results available in the Soybean and Pulse Agronomy Research Lab's annual report to be released March 2021.

[3] Soybean and Pulse Variety Evaluation Guide.

[4] Mohr, R., B. Irvine, G. Finlay, M. Sandercock, C. Linde, P. Halabicki, R. Burak, J. Kostiuk and S. Chalmers. 2014. Effect of row spacing and seeding rate on soybean growth, yield and quality in Manitoba. Poster. Manitoba Agronomists Conference. Winnipeg, MB. Online.

[5] Brar, N. and Y. Lawley. 2020. Short-season soybean yield and protein unresponsive to starter nitrogen fertilizer. Agron J. 112:5012-5023. doi.org/10.1002/agj2.20378

[6] Bardella, G., D. Flaten and J. Heard. Phosphorus fertilizer management strategies for soybeans. manitobapulse.ca/2015/03/phosphorus-fertilization-strategies/

[4, 7, 8, 10] Manitoba Pulse & Soybean Growers On-Farm Network online database, manitobapulse.ca

[9] Endres, G. "Timing of initial weed control," North Dakota State University (8 site-years).

BEST AGRONOMIC PRACTICES FOR SOYBEANS IN 2021

1. Seed in the first half of May, on average.
2. Seed between 0.75 and 1.75", no shallower and no deeper.
3. Be intentional about variety selection.
4. Use narrow-row spacing.
5. Don't add supplemental N fertilizer.
6. Apply P fertilizer as a maintenance or build-up strategy, but not for yield enhancement.
7. Use single or double inoculant (or none) depending on field soybean history.
8. Skip the seed treatment in absence of known risk.
9. Timely weed control - general rule of thumb is before weeds are 2–4" in height.
10. Skip the in-crop fungicide application.

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agronomy practices and identify areas that could be improved. Chances are, you are already implementing some of these practices, so I've identified a couple of scenarios where just two practices are changed. Hopefully, it convinces you that even small changes add up.

Assumptions for the table and scenarios include a five-year average soybean yield of 34 bu/ac, a new crop soybean price of $12/bu and total operating and fixed costs of $375/ac. Further reading on each agronomic response is available in the footnotes. I'll pose the last disclaimer as a question—will these practices and yield responses look the same for every field, every year? No. They may not even look the same for entire fields as precision agriculture research takes a foothold. Successfully applying agronomic data into practice requires an understanding of context—field history and characteristics, environmental conditions, regular scouting, commodity and input prices, evolving research findings and their interactions.

Scenario 1 – Adjust seed depth and skip the seed treatment.

Instead of being tempted to seed soybeans deep into moisture or shallow for quick emergence under good soil moisture, make sure that soybeans are seeded between 0.75 and 1.75", as close to 1.25" as possible. New Manitoba research has shown the detrimental effect of seed depths outside this range. Unless there are certain pest risks in a field, the probability of yield response to soybean seed treatment is only 11% based on 44 on-farm trials.

*Scenario 1 – Here, these agronomic changes lead to a **133% increase in profit**.*

	Before		After
Yield	34 bu/ac	+8% from optimum seed depth	37 bu/ac
Price	$12/bu		$12 /bu
Revenue	$408/ac		$441/ac
Costs	$375/ac	-$11/ac from seed treatment	$364/ac
Profit	$33/ac		$77/ac

Scenario 2 – Seeding earlier and managing weeds on time

Instead of waiting for May long weekend or for all the canola to be in, consider seeding soybeans earlier if soil and weather conditions are favourable. This is especially true among farmers who have been dealing with spring canola challenges like flea beetles. Once the crop is seeded, scout regularly and ensure weeds are managed before they are 2–4" in height. Soybeans are poor competitors with weeds and dirty soybean fields equates to yield loss.

*Scenario 2 – Here, these agronomic changes lead to **64% increase in profit.***

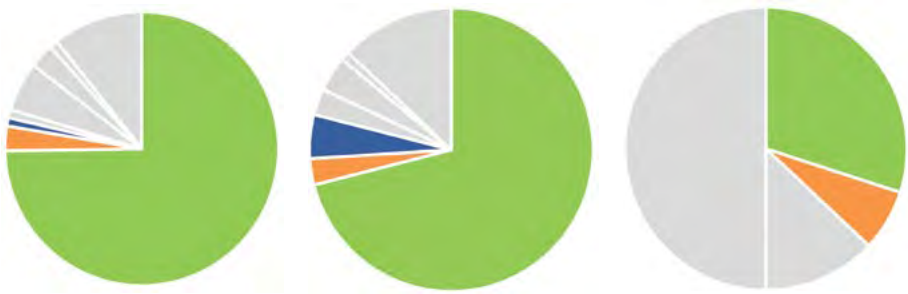
	Before		After
Yield	34 bu/ac	+3% yield for seeding in first half of May +2 bu/ac for keeping soybeans weed-free	37 bu/ac
Price	$12/bu		
Revenue	$408/ac		$444/ac
Costs	$375/ac	+ $15/ac for pre-emergent herbicide	$390/ac
Profit	$33/ac		$54/ac

AGRONOMY AND ENVIRONMENT GO HAND IN HAND

Environment has accounted for the majority of soybean yield variation in several of these agronomy studies (Figure 1). For example, in my most recent soybean seeding date study, soybean yield ranged from 20 to 65 bu/ac across 12 environments, yet from only 33 to 39 bu/ac across four seeding dates. Certain weather and soil conditions are more favourable for soybean production, regardless of best management practices. The 5% rule can also be applied to land management, i.e., adopting practices that build soil organic matter and water holding capacity will likely lead to greater yield potential. Ongoing studies continue to relate water availability to soybean yield potential. One example might be adopting rotational tillage, where tillage is reduced or eliminated in one phase of your crop rotation. This doesn't minimize the importance of agronomy but rather emphasizes that a focus on both agronomy and environment is warranted. After all, my favourite definition of agronomy states it quite simply...

> *"Agronomy is the study of soils and plants, [application to] the practice of field crop production and the management of land and water resources."*
>
> *— University of Manitoba*

Figure 1. The % of variation in soybean yield attributed to environment (green) relative to seeding date or depth (orange), variety (blue) and other factors (grey) is demonstrated from three Manitoba agronomy studies (2015–2019).



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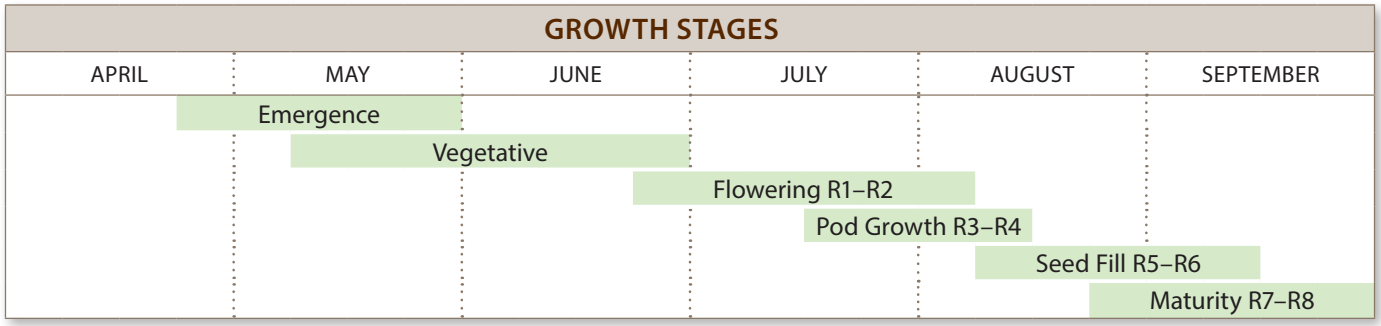
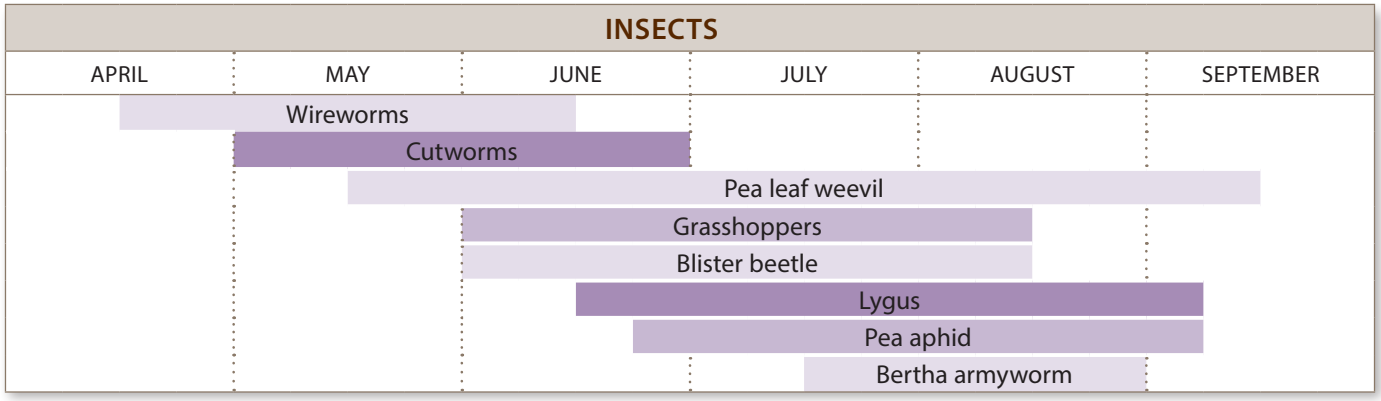
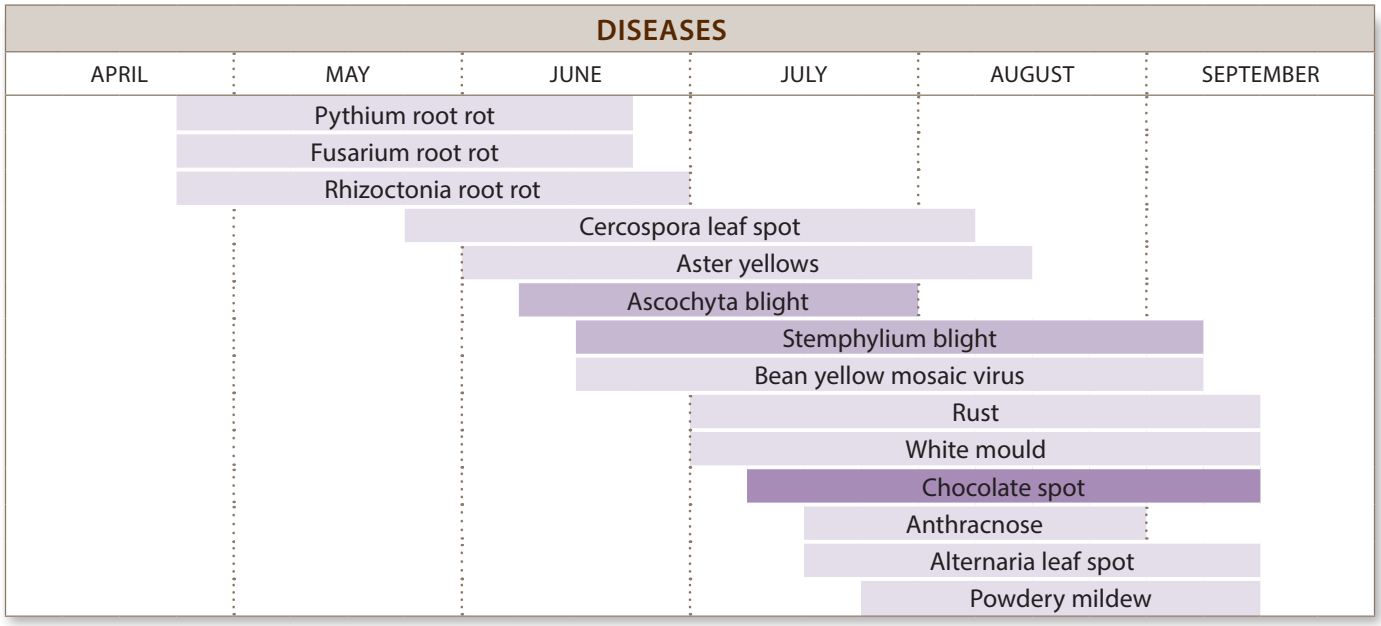
Faba Bean Insect and Disease Scouting Calendar







Potential Impact on Faba Bean Production and Quality in Manitoba

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Managing Kochia in Pulses and Soybeans

Laura Schmidt, PAg, MSc, Production Specialist – West, MPSG

EARLY-SEASON KOCHIA SEEDLING IDENTIFICATION

- Cotyledons are linear to oblong in shape with a pink underside
- Leaves are dull green, covered with soft, fine hairs and have a linear to lanceolate shape arranged alternately along the stem
- Stems are often tinged red
- Often germinates in dense grey-green mats

One weed emerging one week before the crop will have the same effect on yield as 100 weeds emerging three weeks after the crop.

– Harker and O'Donovan

PULSE AND SOYBEAN farmers are no strangers to kochia. It tolerates salinity, while our crops do not, leaving those marginal areas of the field open for kochia to populate.

Kochia is an early germinator, meaning we have larger, more competitive plants to control at spray timing. Most herbicides are only effective when kochia is small (<4").

It thrives in dry conditions. As it gets drier, the cuticle grows thicker, it develops more hairs and the stomates close. All of these things mean it's tougher for herbicides to enter the plant's system and do their job.

And even when we get those herbicides into the plant's system, we have herbicide resistance to contend with. Group 2 herbicide resistance (imazamox) is common in kochia, group 4 (dicamba, fluroxypyr) resistance is known in other regions and group 9 resistance (glyphosate) has been a real up-and-comer over the last five years.

STATUS OF HERBICIDE-RESISTANT KOCHIA

Survey data from Agriculture and Agri-Food Canada (AAFC), as well as individual qPCR plant tests from submitted samples to the Pest Surveillance Initiative (PSI), have given us a window into the status of herbicide resistance of kochia in Manitoba (Figure 1). In 2013, kochia seed was sampled from 283 sites in southern Manitoba and grown out in the greenhouse to test for herbicide resistance. This same survey was repeated five years later in 2018, where samples were taken from 297 fields. To add to this data set, PSI has tested 279 kochia plant samples suspected of glyphosate resistance (GR) from 2015 to 2020.

All of the kochia samples from the 2018 survey were resistant to group 2 herbicides. Group 4 resistance to dicamba and/or fluroxpyr was present in Saskatchewan, but has not been confirmed in Manitoba yet. Those samples are still being processed due to COVID-19 related delays. As dicamba use in Xtend soybeans increases, we can expect kochia resistance to this mode of action to increase.

Over the course of just five years, glyphosate resistance has spread throughout Manitoba's kochia populations. In 2013, 1% of kochia populations sampled were resistant to glyphosate. In 2018 that number rose to 59%. It's now more likely that uncontrolled kochia populations are GR than susceptible.

Kochia collected from Roundup Ready (RR) soybean and RR corn fields had a greater percentage of resistance, where, respectively, 77% and 70% of the kochia populations were GR. Comparatively, in RR canola, a more competitive GR crop than corn and soybeans, 53% of the kochia population was resistant. GR kochia was also found in cereals (48%), in other crops (53%) and in uncropped areas (21%).

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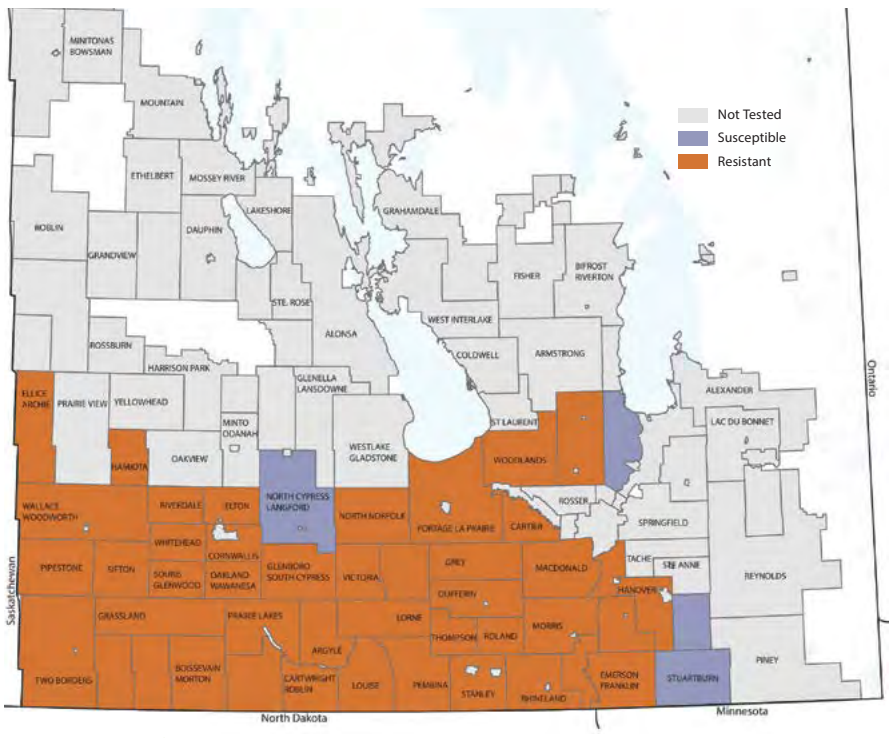
Figure 1. Glyphosate-resistant kochia distribution in Manitoba.



Data sources: Pest Surveillance Initiative (2020); Agriculture and Agri-Food Canada (2019)

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The mechanism of glyphosate resistance in kochia is gene amplification of the EPSPS gene that glyphosate targets. Kochia overcomes glyphosate by producing multiple copies of this gene. The PSI lab's qPCR test can rapidly identify how many copies of this gene a kochia plant has, giving us an indication of how resistant the individual plant is. Plants with one copy of the gene are still susceptible, those with two to nine copies have intermediate resistance and those with more than ten are considered resistant.

PSI typically only receives kochia samples if resistance is already suspected, with quite a few samples coming in from the RMs of Pembina, Louise, Two Borders and Montcalm. Of the 270 samples they have tested in the last five years, 44% were fully resistant, 39% had intermediate resistance and 16% were still susceptible. These susceptible plants were submitted either to validate that a kochia patch had different levels of resistance, or to determine if the problem was due to other factors. In the GR plants, 40% produced more than 20 copies of the EPSPS gene. One plant sampled in the RM of Pembina in 2019 had 100 copies of this gene.

HERBICIDE OPTIONS FOR KOCHIA CONTROL

Herbicides won't be the solution to solving herbicide resistance. Herbicides are part of an integrated weed management strategy—remember that they're not the only tool we need to use to manage kochia. Kochia has a massive seed set (14,000–30,000 seed/plant), but also only lasts about one to two years in the weed seedbank. This is something we can exploit to help us manage kochia. A key component will be to not let this weed go to seed.

To start working on a kochia strategy, let's take a look at our limited herbicide options (Table 1). We can assume our kochia populations will be resistant to the group 2 imazamox in our post-emergent herbicides.

Pre-emergent kochia management is especially important. We want to use soil-applied and/or spring burndown products with residual activity and consider a tillage pass over early flushes. The bulk of our pre-emergent options are group 14 and we anticipate that resistance to this group of PPO inhibitors is on the horizon for kochia. Incorporating mechanical weed control here will help reduce the selection pressure on this mode of action.

For groups 14 and 15 we need moisture to activate the herbicide for uptake by weeds. One option is to consider a fall application where the snowfall will provide that moisture and allow for a more even distribution in the soil following winter.

Post-emergent control is going to be maximized if you target kochia while it's still small (<4"). As mentioned earlier, kochia is an early germinator, with roughly 60% emergence by early May. Consider incorporating mechanical tools into your integrated weed management strategy post-emergence.

Layer your herbicides using pre-emergent and post-emergent herbicides from different groups. Try not to overuse group 14s and incorporate more modes of action like ethalfluralin (group 3) or pyroxasulfone (group 15) into your pre-seed burndown.

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Table 1. Products registered for kochia control in pulse and soybean crops in Manitoba according to the 2020 *Field Crop Protection Guide*. Products for soybeans where glyphosate was the only active ingredient controlling kochia have been excluded, as have discontinued products.

Products Registered for Kochia Control in Pulses				Crop			
Product	**Active**	**MOA**	**Timing**	**Soybeans**	**Dry Beans**	**Peas**	**Faba Beans**
Aim EC	carfentrazone	14	PRE	X	X	X	X
Authority 480	sulfentrazone	14	PRE	X[4]		X[4]	X[4]
Authority Charge[1]	sulfentrazone, carfentrazone	14	PRE	X[4]		X[4]	X[4]
Authority Supreme[1]	sulfentrazone, pyroxasulfone	14, 15	PRE	X[4]		X[4]	
Blackhawk	2,4-D, pyraflufen	4, 14	PRE	X			
CleanStart[6]	glyphosate, carfentrazone	9, 14	PRE	X	X	X	X
Edge MicroActiv	ethalfluralin	3	PRE	X[4]	X[2,4]	X[4]	X[4]
Fierce[1,3]	flumioxazin, pyroxasulfone	14, 15	PRE	X[4]		X[4]	
Goldwing	MCPA, pyraflufen	4, 14	PRE			X	
Heat brands	saflufenacil	14	PRE	X		X	X[5]
Heat Complete	saflufenacil, pyroxasulfone	14, 15	PRE	X		X	
Valtera[1]	flumioxazin	14	PRE	X[3]		X	
Zidua SC	pyroxasulfone	15	PRE, POST[7]	X[4]		X[4]	
Engenia, Banvel VM, Oracle, Xtendimax, FeXapan	dicamba[8]	4	PRE, POST	X			
MPOWER Samurai Master	clethodim, imazamox	1, 2	POST			X	
Viper ADV, MPOWER Boa Pro[9]	imazamox, bentazon	2, 6	POST	X	X	X	X

Note that Authority, Valtera and Heat are not registered in dry beans due to crop injury. This table is meant for reference only. For full herbicide details, consult the product label or the *Field Crop Protection Guide*.

[1] For in-season activity, must be activated prior to weed emergence. [2] Navy and kidney beans only. [3] Seed at least 1.5 inches (4 cm) deep. [4] Control of kochia when emerging from seed (not controlled if emerged at application). [5] Heat LQ. [6] Use highest rate for control of GR kochia. [7] Soybeans only. [8] Xtend soybeans only. [9] MPOWER Boa Pro is registered in peas only.

2020 Update on the Status of Root Rots in Soybeans, Dry Beans and Peas

Laura Schmidt, MSc, PAg, Production Specialist – West, MPSG
Summary of research by Dr. Debra McLaren, Agriculture and Agri-Food Canada – Brandon

During the disease surveys, 30 plant roots are collected from three random sites in each field and brought to the lab for root rot analysis of Fusarium, Pythium and Rhizoctonia species.

IN 2020, 63 soybean fields, 40 dry bean fields and 46 pea fields were surveyed in Manitoba for root diseases (Table 1). COVID-19 restricted some surveillance and testing capacity in the province in 2020, but for the most part we were able to capture a pretty clear picture of what happened in terms of pulse and soybean root diseases.

MPSG staff personally hopped into 56 of those fields to collect samples. Soybeans were sampled from mid-August to early September, dry beans were sampled in late July and peas were sampled in late June and mid-July.

The clear picture that emerged from 2020 was that Fusarium root rot continues to be our most prevalent disease infecting soybean, dry bean and pea roots (Table 1). Compared to 2019, the severity of Fusarium infections rose in soybeans and peas, from 4.3 to 5.0 and 2.9 to 3.7, respectively, and was consistent in dry beans, moving from 3.8 in 2019 to 4.0 in 2020 (Table 2). This increased root rot severity from 2019 to 2020 can largely be attributed to more moisture in 2020.

Table 1. Prevalence and severity of root rots in 63 soybean fields, 40 dry bean fields and 46 pea fields in Manitoba in 2020. Samples from 40 soybean fields were further isolated to determine the levels of Fusarium, Pythium and Rhizoctonia root rot infections.

Disease	Soybeans			Dry Beans			Field Peas		
	No. Crops Affected (%)	Disease Severity (0–9)[1]		No. Crops Affected (%)	Disease Severity (0–9)[1]		No. Crops Affected (%)	Disease Severity (0-9)[1]	
		Avg	Range		Avg	Range		Avg	Range
Root rot	63 (100%)	5.0	3.8–7.0	–	–	–	–	–	–
Fusarium root rot	40 (100%)	5.0	3.9–7.0	40 (100%)	4.0	2.4–6.3	46 (100%)	3.7	1.2–7.2
Rhizoctonia root rot	0	0	0	0	0	0	0	0	0
Pythium root rot	0	0	0	0	0	0	–	–	–
Phytophthora root rot	0	0	0	–	–	–	–	–	–

[1] All diseases, excluding Phytophthora, were rated on a scale of 0 (no disease) to 9 (death of plant). Average values are based only on crops in which the disease was observed.

Severity of root rot infection typically reflects soil moisture conditions of a given year. For example, take a look at 2016 in Table 2. Soybeans and dry beans recorded the highest severities, hitting 5.5 and 5.6, respectively. Peas were an enigma that year at an average rating of 2.8. Following it up in 2017 with drier conditions, we

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KOCHIA CONTROL GOALS

Take advantage of kochia's low seedbank persistence and make preventing kochia seed set a priority. Five percent of kochia seeds are viable after one year and one percent after two years. But keep in mind, with a plant that produces 30,000 seeds, one percent is still 300 viable, herbicide-resistant seeds.

Control patches and herbicide escapes. Mow, bale, graze, spot till, burn or hand pull surviving kochia plants before they set seed. Manage marginal areas of the field where your crops aren't growing but kochia is. For example, if you're putting fertilizer down in those areas and the crop isn't growing there, those nutrients are going to the weeds.

Consider crop rotation. Cereals have more effective herbicide options and are a competitive cropping option. Preceding pulse crops with a cereal will help deplete the weed seedbank, meaning there will be less kochia to manage from the start. As it stands right now, 45% of soybeans, 60% of peas and 28% of dry beans are planted into a cereal stubble.

Think about your herbicide plan the fall before growing pulses and consider your pre-emergent options. Maybe a fall application would suit your operations. In-season, manage weeds when they are small.

Maximize crop competitiveness to help take the selection pressure off your herbicides. Narrow up row widths, plant adequate to high plant populations and use appropriate fertility strategies.

RESEARCH

On-going research by Dr. Charles Geddes at AAFC-Lacombe is looking into integrated weed management strategies for herbicide-resistant kochia control in pulses. The effect of row spacing, seeding density and crop rotation on GR kochia control with typical kochia herbicides is being investigated. His lab is also exploring pre- and post-harvest management options and determining if managed kochia patches have time to regrow and set seed before winter following the early harvest of peas or winter wheat. ■

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Table 2. Root rot in soybeans, dry beans and field peas from 2014 to 2020.

	Soybean Root Rot			Dry Bean Root Rot		Pea Root Rot		
Year	% Crops Infected[1]	Avg Disease Severity (0–9)	% Infected with Phytophthora Root Rot	% Crops Infected[1]	Avg Disease Severity (0–9)	% Crops Infected[1]	Avg Disease Severity (0–9)	% Infected with Aphanomyces
2020	100	5.0	0	100	4.0	100	3.7	n/a
2019	100	4.3	5	100	3.8	98	2.9	83
2018	100	4.8	30	100	4.6	100	3.1	56
2017	100	4.4	35	100	4.2	100	3.6	47
2016	100	5.6	38	100	5.5	100	2.8	77
2015	98	4.3	–	100	3.8	98	3.0	–
2014	100	4.6	–	100	4.6	100	3.1	–

[1] Infected with the root rot complex composed of Fusarium, Pythium and Rhizoctonia species.

did not see those high severity levels maintained in soybeans and dry beans.

In our disease severity scale for soybeans and pulses, 4.0 represents the threshold past which we anticipate root rots have had a detrimental effect on yield. A root rot severity rating of 4.0 represents when symptoms were present on half of the root systems and plants had visible stunting.

For soybeans, 95% of fields in 2020 had average severity ratings above 4.0. In dry beans and peas, this proportion above 4.0 was 43 and 41%, respectively. Compare this to 2019, where 60% of soybean fields, 35% of dry bean fields and only 9% of pea fields were above 4.0.

Phytophthora root rot was not detected in any of the 68 soybean samples sent in from Manitoba in 2020. Rhizoctonia and Pythium root rots were also absent in the 2020 survey. The last two years have been quiet for Phytophthora, when previously we've typically found around a third of soybean crops infected with this disease.

Unfortunately, we were not able to get a beat on Aphanomyces in 2020 due to COVID-19. In previous years, Aphanomyces was found in 83% of pea fields sampled in 2019, 56% in 2018, 47% in 2017 and 77% in 2016.

It's important for pea growers to keep this disease in mind when planning rotations, and especially important that we keep monitoring for this silent yield robber. Aphanomyces oospores persist for a long time in the soil and will reproduce on other host species like alfalfa, dry beans, clover, lentils, vetches and several weed species.

Keep an eye on yellow patches in low-lying areas of the field, or in areas where water accumulates, and consider getting these areas tested for Aphanomyces. Or, consider signing up for the annual pulse and soybean disease surveys by contacting one of MPSG's production specialists: Laura or Cassandra @manitobapulse.ca ■

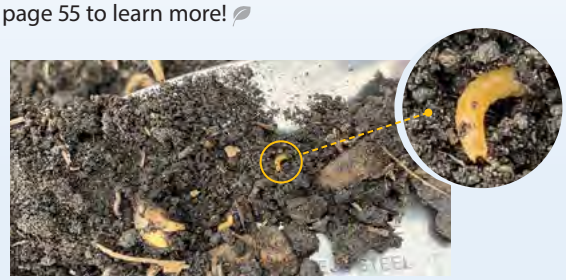
Megan Bourns, Agronomist – On-Farm Network

WHAT'S BUGGING YOUR SEEDLINGS?

In late May of 2020, while scouting emergence in On-Farm Network (OFN) trials, a soybean emergence failure in the field of a past OFN participant was brought to my attention. Nothing really came out of the ground, and it was time to pull the trigger on a reseed decision. Reseeds can be brought on for several reasons, but the main cause of this one really caught my attention – wireworms were wreaking havoc. Rarely do we hear about an emergence failure due to wireworm pressure, so I had to investigate for myself.

I walked the field, zigzagging around and dug up trowel-fulls of soil in multiple locations, finding one, two or three wireworms almost every time. In some cases, I even pulled up a wireworm feeding on a soybean seed. Wireworms are pesky critters with long life spans and few effective control measures. Insecticide seed treatments are often the best tool in a wireworm-infested field, though even these products do not kill the wireworms. However, they do work to slow down their feeding enough to protect seeds and early-stage seedlings. The decision to reseed with the addition of an insecticide treatment was certainly a good call for this field.

How prevalent are wireworms in Manitoba fields? How do you know if you have an infestation? Research is ongoing in Dr. Bryan Cassone's lab at Brandon University. Refer to the article on page 55 to learn more!



On-Farm Network Soybean Row Spacing Trials

Tighten the row and watch yield grow?

Megan Bourns, MSc, Agronomist – On-Farm Network, MPSG and Baljeet Singh, PhD, Assiniboine Community College

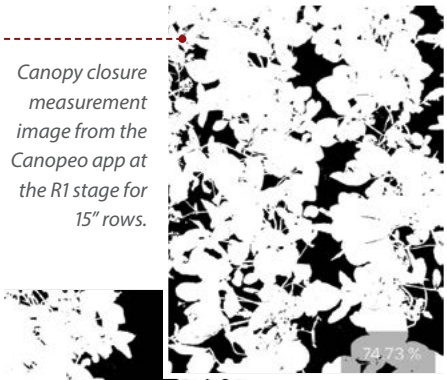
FROM 7.5 TO 30", *is there an optimal row spacing for soybeans? Does narrow spacing always lead to better yield? These are the types of questions the On-Farm Network (OFN) set out to answer, beginning in 2019. Over the last two seasons, the OFN hosted a total of 12 soybean row spacing trials comparing 7.5 vs. 15", 10 vs. 20" and 15 vs. 30" rows.*

ABOVE THE CANOPY – ROW SPACING AND CANOPY CLOSURE

The influence of row spacing on canopy architecture is often a driving factor in the decision to narrow soybean spacing. Generally, narrower spacing should increase the rate and extent of canopy closure. Why is this an important agronomic consideration? Canopy closure affects the efficiency of sunlight capture by the crop and can influence crop water availability through the effect of shading in the interrow space. Sunlight capture, which is critical for photosynthesis and water use efficiency, can then influence yield.

In 2019, canopy closure differences were observed in row spacing trials, and in 2020 the OFN set out to measure those differences. Closure measurements were captured at four of the five 2020 trials, measured in partnership with Assiniboine Community College. At three locations in each strip of each trial, canopy closure measurements were collected at the R1, R3 and R5 growth stages. These measurements were collected using an iPhone, with the Canopeo app, which measures the fractional green canopy cover from images captured one metre above the ground.

While this is a limited dataset, with just four sites in one growing season so far, the trends in canopy closure across spacings and crop stages behaved as expected. Generally, the trend is that canopy closure declined with wider row spacing (Figure 1). Additionally, the difference in closure between spacings tended to be smaller as the season progressed and the rows continued to close. In other words, the canopy closed more, and more quickly, in narrower spacing compared to wider spacing.



Canopy closure measurement image from the Canopeo app at the R1 stage for 15" rows.

Canopy closure measurement images from the Canopeo app at the R1 stage for 30" rows.

BELOW THE CANOPY – ROW SPACING AND PLANT ARCHITECTURE

In the OFN row spacing trials, seeding rates are the same throughout the trial. As a result, there are fewer seeds per row in narrow spacings, compared to more seeds per row but fewer rows overall in wider spacings. This difference in spatial arrangement of seeds leads to differences in individual plant architecture between

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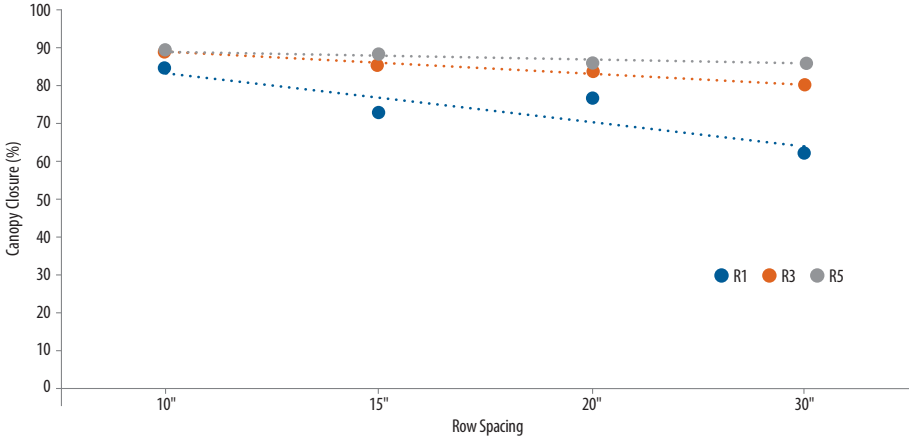
The effect of row spacing on individual plant architecture early in the season; representative plants from 30" spacing (left) and 15" spacing (right).

Figure 1. Average canopy closure from 2020 trials for each row spacing, at flowering (R1), beginning pod (R3) and beginning seed (R5).



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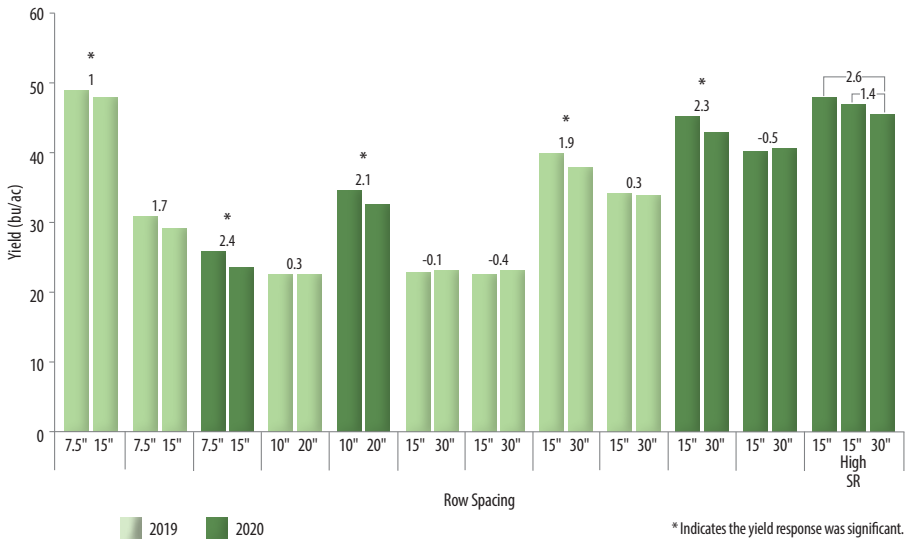
Thicker stemmed soybean plants with more branching on 10" spacing (top) compared to thinner stemmed soybean plants with less branching on 20" spacing (bottom).

Figure 2. Yield results from 2019 and 2020 soybean row spacing trials. Values above the bars indicate the difference in yield between the narrower and wider spacing for each trial.



narrow- and wide-row spacing. Generally, on narrower spacing with fewer plants per row, individual plants have more space to develop thicker stems and more extensive branching than soybeans on wider spacing where more plants are within a row. The effect of row spacing on individual plant architecture was observed throughout the 2020 growing season.

ROW SPACING AND YIELD

Out of the 12 total row spacing trials conducted through the OFN so far, narrower row spacing increased yield compared to wider spacing in five trials (Figure 2). There were significant yield differences in each of the three categories of row spacing comparisons—7.5 vs. 15", 10 vs. 20" and 15 vs. 30".

Across all trials, the frequency of yield increases from narrowing row spacing was 5/12 (42%). When we break this down to look at the frequency of response within each growing season, in 2019, the frequency of response was two out of seven trials (29%), but in 2020 the frequency of response was three out of five trials (60%). Why did the frequency of response double in 2020 compared to 2019?

The answer could lie in soil moisture and growing season precipitation differences between the two years. Generally, 2019 was fairly dry in most soybean growing areas of the province. On the other hand, in 2020, the moisture deficit was less severe. With more moisture, yield potential is increased and we may see the benefit of narrow-row spacing more frequently under less severe conditions. Narrower row spacing can help conserve moisture for the crop, and we may assume that the effect of row spacing on yield is greatest in dry years, but there still needs to be adequate moisture to support crop yield development. The effect of soil moisture and growing season precipitation on yield response in row spacing trials is something the OFN would like to monitor as the dataset expands with more trials in future seasons.

WHAT IS NEXT FOR ROW SPACING TRIALS?

The OFN plans to continue with row spacing trials to build this dataset and examine the mechanism behind yield differences—is it mostly driven by canopy closure? Growing season conditions? How does plant architecture and physical yield development on the plant come into play?

These are the questions the OFN will look to answer as we expand these trials! ■

If you are interested in hosting a row spacing trial on your farm, contact

Megan at **205.751.0439** or **megan@manitobapulse.ca**

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The Prairie Plant Protein Project

Results and industry opportunities

Laina Hughes, Research Communications Officer, Red River College

PRAIRIE RESEARCH KITCHEN
TECHNOLOGY ACCESS CENTRE

A CURSORY GLANCE around the shelves at your local grocery store reveals a growing trend in the market: plant-based products like non-dairy cheeses made from cashews, almond beverages and jackfruit jerky are comfortably nestled in among their more common meat and dairy-based counterparts.

A closer look reveals that more and more Canadian prairie crops are finding shelf space in grocery stores, too. Hemp hearts, oat milks and pea proteins are gaining traction as novel protein ingredients in response to increased consumer demand for healthy, sustainable protein sources.

Dehydrated fava/hemp/soy tofu as a meat replacer (pictured here as a taquito filling).

Protein crumble used to make the taquito filling.

Summary of food products developed during this study from different Manitoba-grown crops, following extraction and coagulation. Extraction refers to the process of making a plant-based "milk." Coagulation is the next step, turning that liquid into a solid, such as tofu or cheese.

Crop	Developed Product
Faba beans	Fava tofu gnudi (dumplings)
Hemp	Used as a blend with other prairie plant proteins in food applications: • Faba bean and hemp tofu cheese • Dehydrated fava/hemp/soy tofu meat replacer
Soybeans	Used in a blend with other prairie plant proteins for food applications: • BBQ tofu filling in a steam bun • Tofu garlic aioli • Dehydrated fava/hemp/soy tofu meat replacer
Navy and black beans*	Ice cream

* Navy and black bean proteins did not form a strong coagulation network to form a solid tofu, but once extracted and coagulated, the milk thickened and could be used in a range of applications as a dairy replacer.

With an abundance of plant protein potential right here in the prairies, the Canadian Agricultural Partnership Ag Action Manitoba and Manitoba Pulse & Soybean Growers are currently funding a project to further develop Manitoba crops like hemp, faba (or fava) beans, dry beans and soybeans into new and novel food products.

The project is a collaborative one, playing to the strengths of three local research groups. The Prairie Research Kitchen at Red River College is working with the University of Manitoba's Food and Human Nutritional Sciences department, as well as the Food Development Centre on the project titled, "Development of value-added food platform technologies using plant-based protein sources including bean, soy and hemp."

Heather Hill, a research manager at the Prairie Research Kitchen, has a food science background and considerable experience working with pulse ingredients. She says the project was a good opportunity to focus on plant proteins that are commonly found in the Canadian prairies.

Ice cream made from navy and black beans.

Fava/hemp/soy tofu created at the Prairie Research Kitchen.

"We're finding that consumers right now are really interested in plant proteins, so we're trying to get our Canadian and Manitoban ingredients into the hands of consumers in novel and innovative ways," she says. "Here in the Canadian prairies, farmers are growing plant protein sources like pulses and we can then use these plant proteins to feature Canadian ingredients."

The project focused on extracting functional proteins from novel plant sources to form a tofu-style product from a range of prairie crops. Some of the research front-runners so far are faba bean, soybean and hemp, while researchers are undertaking further research and development work on protein extracted from black beans, navy beans and pinto beans. The proteins can be extracted through a relatively straightforward process and then coagulated, in much the same way that soy tofu is created.

"The Food Development Centre has been doing work on optimizing extraction and the technology that's needed. Our Prairie Research Kitchen team has been working on coagulating them into proteins that can be used by consumers here," says Hill. "Our research chefs are

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1 – Crop rotation study lead by Dr. Oscar Molina at AAFC, Morden Research and Development Centre. This study compares effects of the previous crop (soybean, corn, canola, wheat, alfalfa) on the current year's crop (soybean, corn, canola, wheat, alfalfa).

Soil Health in Soybeans

Dr. Stephen Crittenden, Research Scientist, Agriculture and Agri-Food – Brandon

THE COMMON DEFINITION of soil health is "the capacity of soil to function." Personally, I find this definition a little confusing—while soil is complex, soil health doesn't need to be complicated. What's going on in soil is consistently dynamic and always changing, but weather is the main player. Temperature and precipitation drive the biological, chemical and physical processes in soil, and soil health is all of these processes put together.

We can measure soil health in several ways. Traditionally, we have used soil fertility tests to look at snapshots of nutrients (like nitrogen, phosphorus, potassium and sulphur) before applying fertilizer to help plan application rates. After harvest, we can take soil samples to see what nutrients are left and how efficient our crop has been. Both of these measurements are chemical indicators of soil health that the producer can influence directly through fertilization.

Soil biology includes everything from bacteria and fungi to earthworms. Soil physical properties are things like aggregation (sand, silt and clay particles stuck together) and infiltration (the ability for water to move into soil). The biological and physical indicators of soil health are mostly influenced indirectly. Tillage, for example, changes soil structure and thus the environment in which soil biology lives. Cover cropping and manuring have a good chance of influencing soil health, but all aspects of soil health interact with each other.

If you are tracking your soil health, in addition to the traditional soil fertility, I recommend "digging in" to your soil organic matter. Organic matter is the lynchpin that many soil processes hinge on, such as nitrogen mineralization (the process where nitrogen becomes available from organic matter). Additionally, higher soil organic matter often means better soil structure. Your soil health or soil fertility reports may also include an "index." A soil health index is a way of putting all these measurements together in a meaningful way. First, you choose a scale, like 1 to 100, then rank the values from your measurements on this scale. The problem with ranking is that it can be subjective—"healthy" soil may be in the eyes of the beholder. There is no definitive soil health score and how these scores are calculated changes depending on where your soil health report is from; however, the calculations behind these indexes should be available upon request.

One thing I want to point out is the difference between lab and field measurements. Some soil health indicators cannot be assessed in a "grab" or regular soil sample. For some soil properties, we must take specialized equipment to the field, for example, infiltration, penetration resistance and earthworms. Some of my favourite soil properties are those that cannot be tested from a grab sample but rather must be done in person or with intact soil cores.

Infiltration is often a focus of discussions on soil health. We assume that adding carbon improves soil structure and should also improve the way water moves through it. We want water to move into soil and away from

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using them in innovative ways to make new food products and recipes."

Research chefs at the Prairie Research Kitchen initially used the plant proteins to develop tofu, then transformed these proteins into food applications to meet the growing plant-protein food trends as meat and dairy extenders and replacers, as well as condiments, desserts and entrées. Through post-processing treatments like dehydration, novel prairie tofus are transformed to a product resembling ground meat texture and used, in one example, as a taquito filling.

"We're blending different plant proteins to help improve the quality of the protein," says Hill. "By blending plant proteins, like faba bean with hemp, we're getting a different combination of amino acids and that is much more nutritional and provides a more complete protein."

The Prairie Research Kitchen team is taking their own approach to food development using the extracted, coagulated proteins. They will be publishing a new cookbook later this year that highlights all of the applications developed within this project—like a navy bean ice cream and a faba bean crème patisserie.

"We're using a whole variety of different pulses and prairie plant proteins and products," says Hill. "We're seeing that our faba bean ingredients are really functional proteins that are interesting to convert into a total product, and we're also combining that with hemp and soy to make very new and novel food products. That's looking very promising right now."

Our upcoming recipe book, *Prairie Plant Proteins*, will highlight the different ways to use plant proteins in various food formulations. ■

Funding for this research was contributed by

CANADIAN AGRICULTURAL PARTNERSHIP
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the rooting zone when we have too much, but we also want soil to hold water when it is dry (water retention). My assertion is that we need both lab and field measurements of the soil chemical, biological and physical properties to get the most complete picture of soil health that we can.

Some of the new soil health indicators we're looking at are the Haney test (a series of chemical extractions from soil), Solvita (CO_2 burst from soil), ACE protein (N in soil organic matter) and POXC (reactive soil carbon). We're evaluating the usefulness of these new indicators relative to traditional soil tests that have been calibrated for Manitoba and have local research behind them. First, we're looking at crop rotations and soil tillage. The crop rotation combinations include soybean, corn, canola, wheat and alfalfa (Photo 1). Tillage systems include vertical tillage, subsoiling and raised beds compared to conventional tillage with a cultivator (Photo 2).

The twist we've added to these experiments is that of climate change.

2 – Subsoiling in tillage experiment at AAFC, Portage la Prairie. *Deep tillage, vertical tillage, and raised beds are compared to conventional tillage with a cultivator. Heavy rainfall is applied to half of the plots.*

3 – Tillage and crop rotation study lead by Dr. Stephen Crittenden at CMCDC, Carberry. *Chisel is compared to no-till in canola-wheat-soybean and canola-soybean-wheat. Drought is simulated by excluding rainfall from portions of the research plots.*

Climate change could bring more variability in weather patterns, lengthy droughts and intense rainfalls. We've included some simulated climate change in our experiments where we either irrigate heavily to simulate rainfall or exclude rainfall with shelters to simulate drought (Photo 3). The objective is to look at the utility of these soil health indicators and decipher which management combinations will result in better crop performance and how this might holdup under climate change. This work will contribute to the development of a soil health index for Manitoba.

Our soil health work with Manitoba Pulse & Soybean Growers should help Manitoba farmers interpret what soil health means and understand what soil measurements are useful for their farms—and of course, we're always looking for soil management practices that work well. As a scientist, I rely on evidence-based solutions, so my message to you about soil health is to define your soil health goals, keep track and think critically. ■

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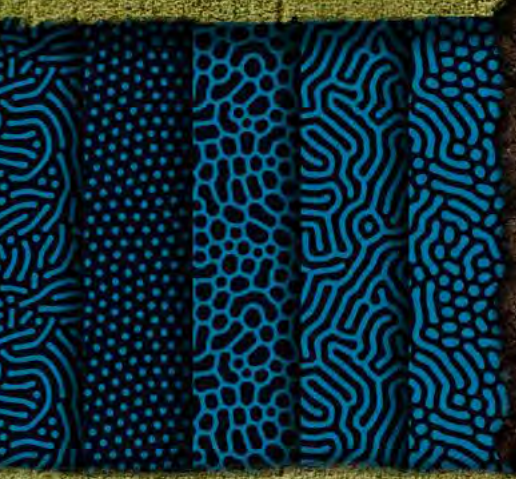

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Update on Pea Intercropping Research in Manitoba

Westman Agricultural Diversification Organization

WADO

INTERCROPPING IS NOTHING new in agriculture. It's been around for hundreds of years—for example, the Native Americans grew beans, squash and maize called *The Three Sisters*. Fast forward to 2020, ancient methods are resurrected under modern-day industrial mechanization and field crops.

Many benefits are often realized with intercropping: fewer weeds due to increased crop competition, fewer insect pests such as aphids in pea–canola intercrops or reduced risk from environmental woes like excessive moisture or frost. Despite benefits come challenges, such as weed control, harvestability, aligning maturities and economic costs to separate the different crop types from one another, just to name a few. Today's computer statistical programs can shed insight into what the ancients could only prophesize at the time.

Roquette's pea processing facility in Portage la Prairie is interested in learning more about those benefits and challenges of intercrops and what it means for both the farmer's and their company's bottom line. In 2020, Roquette field agronomist Jennifer Theroux approached Scott Chalmers, WADO manager, to do seeding rate field trials at Melita. With peas as the primary focus and knowing that canola, oats and barley have decent reputations as being good companions with peas, they wanted to investigate what influence different seeding rates would have on final yield, quality (protein and disease) and most importantly, economics.

Though it's only the first year of results, they found that all three crops did well with peas. Whether it was peas with canola, barley or oats, the combinations increased field yield (total land equivalent ratio (TLER)) by 22–27%, respectively. Nitrogen fertilizer was not applied to the trials, as WADO knows from previous pea–canola research that it usually has no benefit to the overall yield or economics.

When economics were applied to these substantial yield increases, benefits quickly evaporated due to additional seed cleaning costs associated with intercrops (Tables 1, 2 and 3). It was an excellent pea year at Melita, but the net revenues of the intercrops were no better nor no worse than monocrop peas, except for the barley intercrops that generally had lower net revenue.

Aside from neutral economic outcomes, other intercrop benefits were discovered, such as slightly lower leaf disease and earlier maturity in barley, ease of harvest, a significant increase in barley and oat protein, and fewer pea splits in pea-oat intercrops compared to monocrop peas.

WADO is no rookie when it comes to intercrops—they have been researching them since 2009. Currently, Scott and his team have been working on a couple of

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Pea–barley intercrop at Melita at the time of establishment, at harvest and as a seed sample.

Table 1. Pea-oat intercrop yields, land equivalent ratios and economic outcomes under various seeding rates at Melita in 2020.

% of Normal Seeding Rate	Yield (bu/ac)		Land Equivalent Ratio[1]			Economic Analysis		
						COP[2]	Gross Revenue	Net Revenue
	Peas	Oats	Peas	Oats	Total	$/ac	$/ac	$/ac
100% peas (check)	79a	–	1.00a	–	1.00	346	646	300
100% peas, 15% oats	59b	44c	0.74b	0.44c	1.18b	342	645	303
100% peas, 25% oats	52bc	57c	0.66bc	0.58c	1.23ab	358	642	284
100% peas, 50% oats	42c	75b	0.52c	0.75b	1.27a	349	625	277
100% oats (check)	–	100a	–	1.00a	1.00	300	376	76
p value	<0.001	<0.001	<0.001	<0.001	0.017			
CV (%)	8	9	9	9	3			

[1] LER is a measure of the yield advantage gained by growing an intercrop compared to growing the same crops as monocrops (calculated as the ratio of land under monocropping vs. intercropping). Total land equivalent ratio is the sum of individual crop. LERs (representing the full intercrop), compared to individual or monocrop LERs. E.g., a value of 1.29 means 29% more land would be required to achieve the same yield under monocropping as has been achieved by intercropping.

[2] The costs of production (COP) in part from the Manitoba Agriculture and Resource Development 2020 Cost of Production Guide.

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Table 2. Pea-canola intercrop yields, land equivalent ratios and economic outcomes under various seeding rates at Melita in 2020.

% of Normal Seeding Rate	Yield (bu/ac)		Land Equivalent Ratio			Economic Analysis		
						COP	Gross Revenue	Net Revenue
	Peas	Canola	Peas	Canola	Total	$/ac	$/ac	$/ac
100% peas (check)	88a	–	1.00a	–	1.00	346	714	368
100% peas, 25% canola	76b	8c	0.87bc	0.25c	1.11bc	378	717	339
100% peas, 50% canola	76b	11bc	0.87bc	0.35bc	1.22a	394	759	365
75% peas, 25% canola	69b	9c	0.79bc	0.28c	1.07c	369	672	303
75% peas, 50% canola	66b	14b	0.76c	0.43b	1.19ab	385	709	324
100% canola (check)	–	32a	–	1.00a	1.00	364	390	26
p value	<0.001	<0.001	<0.001	<0.001	0.004			
CV (%)	6	12	6	12	4			

Table 3. Pea-barley intercrop yields, land equivalent ratios and economic outcomes under various seeding rates at Melita in 2020.

% of Normal Seeding Rate	Yield (bu/ac)		Land Equivalent Ratio			Economic Analysis		
						COP	Gross Revenue	Net Revenue
	Peas	Barley	Peas	Barley	Total	$/ac	$/ac	$/ac
100% peas (check)	82a	–	1.00a	–	1.00	346	665	319
100% peas, 15% barley	64b	19b	0.79b	0.39b	1.18	341	605	264
100% peas, 25% barley	63b	23b	0.77b	0.49b	1.26	343	613	270
100% peas, 50% barley	56b	26b	0.69b	0.55b	1.24	346	568	222
100% barley (check)	–	47a	–	1.00b	1.00	299	211	-87
p value	0.005	<0.001	0.004	<0.001	0.171			
CV (%)	11	14	11	12	4			

other projects in peas funded by Manitoba Pulse & Soybean Growers, the Canadian Agricultural Partnership and Western Grains Research Foundation.

The first project is looking at the agronomic and economic parameters of intercropping peas with either canola, mustard, flax, wheat or oats, called the *Multi-Crop Intercrop Trial*. This project is being run at WADO (Reston and Melita sites) and the Prairie Crop Diversification Foundation (PCDF) at Roblin.

Scott notes that the first two years (2019 and 2020) of the three-year study indicated canola, mustard and oats serve as the most promising companion crops with peas. WADO is finding consistent over-yielding year to year in the promising crops, and that wheat and flax have fallen behind due to the difficulty of harvesting these crops with peas. Wheat or flax both require high combine cylinder speeds and tight concave clearance in order to thresh properly. Peas require the opposite. WADO has found that to thresh wheat or flax properly, the peas must take a beating, causing them to split and break, losing yield and quality. Whereas oats, mustard and canola have similar settings as peas, allowing those intercrops to thresh properly.

Scott indicates that compared to Melita or Roblin, the Reston site has unique challenges, as the presence of both Fusarium and Aphanomyces root rots has had substantial effects on pea performance. To put it into perspective, in 2020, Reston yielded just 3 bu/ac while Melita yielded 74 bu/ac without the crippling effects of root rot. When peas are under this sort of stress, the

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Multi-crop intercrop trial at Reston in 2020.

companion crops "pick up the slack" and produce a satisfactory crop and income. Whereas peas grown alone at the Reston site lost money after production costs were taken into account.

The second trial also at the Reston location, called the *Pea–Mustard–Canola Intercrop Trial*, is looking at the influence of either canola or mustard seeding rates with peas to determine: 1) what rate works best and 2) if there are any secondary influences on pea production success, such as changes in disease incidence and severity.

Again, two of the three years are complete in this second study. One of the key features of this study is the assessment of root rots in peas caused mainly by a complex of *Fusarium* species and *Aphanomyces*. Root samples were dug up after emergence/prior to flowering and sent to AAFC Lethbridge for Dr. Syama Chatterton and her team to decipher the prevalence of these pathogens based on the copies of DNA they quantify. To date, the trials have seen inconclusive evidence that canola and mustard as companion crops influence the effects of these diseases in peas.

Healthy pea roots (left) and diseased roots (right) at Reston (June 2020).

Keep up to date on the progress of these trials by visiting the Manitoba crop diversification centres website: **mbdiversificationcentres.ca** or the MPSG website: **manitobapulse.ca/research.** ■

Insect Issues in Pulse and Soybean Crops in 2020 and Outlook for 2021

John Gavloski, Entomologist, Manitoba Agriculture and Resource Development

INSECT ISSUES IN pulse and soybean crops in 2020 were an interesting mix. Populations of insects like grasshoppers and cutworms that have been building in recent years continued to be of concern. Of the insects that move into Manitoba from the south, some, such as potato leafhopper, did arrive at levels that caused at least localized concerns. Others, such as soybean aphid, never did arrive at levels that were a threat to crops. Additionally, we continue to monitor levels of an invasive insect of peas and faba beans.

GRASSHOPPER LEVELS CONTINUE TO INCREASE

There has been an increase in grasshopper populations over the past few years and this trend of higher populations continued in 2020. Grasshopper populations have more successful development in dry years and generally increase over a series of dry years. If this trend of drier summers continues in 2021, pulse growers should keep an eye on grasshopper levels around and in their crops.

Some predators of grasshoppers, such as certain species of blister beetles and bee flies, were abundant in some areas, which could help regulate levels somewhat. Rainy weather at critical points in the grasshopper's lifecycle, such as when they are newly emerged or laying eggs, can help bring levels down. There are also fungal pathogens that can help control grasshoppers. One of these that can be noticeable is when grasshoppers are infected with *Entomophaga grylli*. This pathogen results in dead grasshoppers left clinging to the stems of plants. It is most effective under warm, humid conditions.

Grasshopper infected with Entomophaga grylli

CUTWORMS ARE STILL THE MAIN EARLY-SEASON CONCERN

Although not quite as bad as in 2019, cutworms were still a concern in some pulse and soybean fields in 2020. In 2019 there were reports of reseeding because of cutworm feeding in soybeans, peas and faba beans, as well as extensive insecticide applications. There were no reports of reseeding of pulse or soybean crops because of cutworm feeding in 2020,

Redbacked Cutworms

but insecticides were used to control cutworms in some fields. Hopefully, the population cycles for our main species of cutworms are now declining after a few troublesome years. Cutworms remain an insect you want to make sure you are scouting for in 2021.

Seed treatments are one option for cutworm management in pulses and soybeans. Lumivia CPL is available as a seed treatment option in dry beans, chickpeas, faba beans, lentils and field peas. The active ingredient in this seed treatment is chlorantraniliprole, the same active ingredient as in the foliar insecticide Coragen. There are no seed treatments registered for cutworms in soybeans—just wireworms and seedcorn maggot.

Predators such as ground beetles and parasitoids, including bee flies, Tachinid flies and several species of parasitic wasps, can help manage cutworms. Wet soil conditions promote fungal diseases among cutworms and also force the larvae to feed at the soil surface, where they are subject to the attack of parasites and predators. High populations of these natural enemies can help regulate cutworm levels.
To promote healthy levels of natural enemies, a recommended approach is to scout and get an idea of what levels of cutworms and cutworm feeding are like early in the season and control them if levels are high. When cutworm levels are naturally low, applying insecticides can be uneconomical, not only because of the insecticide costs but also by disrupting cycles of natural enemies.

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Potato Leafhopper

POTATO LEAFHOPPERS – MAY ARRIVE EARLIER

Potato leafhoppers (*Empoasca fabae*) are an insect that does not overwinter in Manitoba. In some years, populations from the south arrive in Manitoba at levels that can be of concern in dry beans. In 2020, levels were near threshold in some dry bean fields in the central region of Manitoba, with at least a couple of fields receiving insecticide treatments for potato leafhopper.

The potato leafhopper does not overwinter in the north but migrates northward each season. The overwintering range is estimated to extend as far north as Missouri, Kansas, Kentucky, Virginia and Maryland. Each year in April and May, a northward movement starts. There is also a return migration to overwintering areas later in the season. A study published in 2015 looked at the average date of the first arrival of potato leafhopper in various states, including some northern states such as Minnesota and North Dakota. They found that over a 62-year period (ending in 2012), the average arrival date had become 10 days earlier over that period. Results suggest that continued warming could advance the time of potato leafhopper colonization and increase its impact on affected crops. The average date of first arrival in North Dakota was June 8th. This may be an insect to keep an eye on in dry beans.

PEA LEAF WEEVIL – ESTABLISHED IN NORTHWEST MANITOBA

Larvae of pea leaf weevil feed on the nodules on the roots of pea and faba bean plants, and if there is excessive feeding, the reduction in nodules can lead to the plants not fixing enough nitrogen. Until recently, pea leaf weevil had been an insect that was moving eastward through the prairies but had not been found in Manitoba. Pea leaf weevil was found in Manitoba for the first time in 2019, after an agronomist in the northwest region sent in a sample for identification. In 2020, pheromone-baited pitfall traps for pea leaf weevil were set up in several locations in western Manitoba in the spring and early summer to determine the levels and range of pea leaf weevil in Manitoba. Pea leaf weevils were found in traps near Kenville and Minitonas in the northwest. In addition, a MPSG production specialist collected a sample of weevils from peas near Dauphin in September, which was verified as pea leaf weevils. All traps in the southwest were negative for pea leaf weevil. Pea leaf weevil appears to be established through a large part of the northwest region of Manitoba, but so far has not been detected outside this region.

Pea Leaf Weevil

Regular crop scouting is essential to ensure insects and other potential pests do not cause economic damage to your crop. In 2021, be vigilant for grasshoppers and cutworms and potential surprises from the south. If anyone suspects that they have found pea leaf weevil, please contact Manitoba Agriculture and Resource Development or a MPSG production specialist. We will continue to determine the range of locations and levels of pea leaf weevil in Manitoba. ■

Cassandra Tkachuk, Production Specialist – East

INVESTIGATING YELLOW UNIFOLIATES

While scouting emerged bean fields this spring, keep an eye out for yellow unifoliate leaves. If you spot them, take a minute to investigate further.

I took these photos over the past few growing seasons that show yellowing of soybeans and dry beans. I collected samples of still-living, infected plants and submitted them to the lab. As it turned out, plants were infected in each of these cases with one or two diseases of the root rot complex – Fusarium, Pythium and/or Rhizoctonia. I suspected root rot due to the underground symptoms and wilted seedlings nearby. Before moving on from the field, and with hula hoop in tow, I took random plant counts noting the percentage of affected plants (incidence).

One of our goals in Manitoba is to gain a better handle on root rot incidence to help farmers make more informed, economic management decisions. I've found that taking a few extra notes and confirming suspicions in-lab can help achieve this goal.


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Residue management treatments established north of Brandon in late October 2017.

Early-Season Management of Soybeans

Dr. Ramona Mohr, Agriculture and Agri-Food Canada – Brandon

EFFECTIVE EARLY-SEASON MANAGEMENT practices are key to growing successful soybean crops in short-season growing regions like Manitoba.

Despite ongoing improvements in soybean genetics that have led to the introduction of varieties well-adapted to the prairie climate, and supported widespread production of soybeans in Manitoba, soybean is inherently a cold-sensitive, long-season crop. Damage from cold temperatures at seeding along with spring or fall frosts remains a risk in some locations and years. Cold and wet spring conditions may significantly delay crop emergence, contribute to seedling disease and reduce crop vigour and/or stand, whereas spring frosts may cause varying levels of crop damage or loss depending on the timing, severity and duration. Similarly, late-season frosts can result in yield reductions or total crop loss depending on the stage of crop development and frost severity.

These risks can be partly managed by growing soybean varieties that are well-adapted to local conditions, planting into warm soil to reduce the risk of chilling injury and hasten emergence, and by considering the 24-hour forecast following seeding to avoid cold and wet conditions that may contribute to chilling injury. Calendar date is another important consideration for soybeans in short-season areas. Seeding soybeans too early increases the possibility of cold temperature damage and spring frosts, whereas late seeding may reduce overall yield potential and increase the chance of fall frost damage. Managing the order of seeding on-farm so that more frost-tolerant crops like cereals are seeded prior to soybeans may be helpful in reducing the risk of cold temperature damage to soybeans in spring. It may also contribute to increased yield potential in crops like cereals.

There is also some interest in the potential for using different residue management strategies to create a more suitable seedbed for soybean establishment. Theoretically, using residue management practices to modify the early growing season micro-climate or give the crop a competitive advantage under stressful conditions, might help create growing conditions more conducive to soybean establishment, growth and yield. The question is how effective this is under Manitoba conditions, and what are the relative costs versus benefits.

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To begin to address this question, a series of small-plot soybean trials were conducted in western Manitoba from 2015 through 2017. In all cases, soybeans were planted near or during the recommended planting window for soybeans in Manitoba, into soils measuring 15°C or higher. The effects on soybean of preceding crops, including wheat (tilled, stubble with straw removed or returned), oat (stubble with straw removed or returned) and canola (stubble with straw returned) were studied over 12 site-years. In about half of the site-years, tillage and straw management practices influenced seedbed conditions at soybean planting. In those cases, tillage warmed the seedbed at planting by 1 to 5°C compared to untilled treatments, while straw removal increased the seedbed temperature by ≤1 to 3°C compared to stubble with straw returned. Tillage and straw removal also reduced seedbed moisture in about half of the site-years.

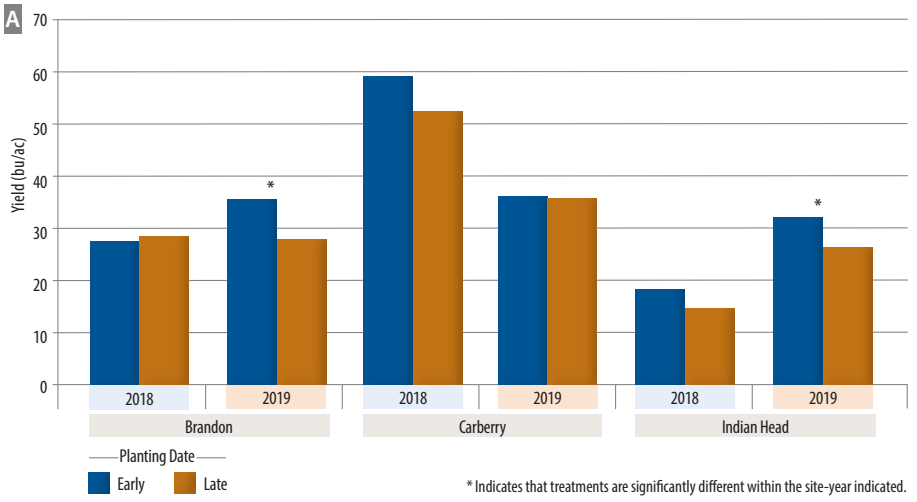
Although tillage and straw removal resulted in a warmer and/or drier seedbed in a number of cases, these practices hastened soybean emergence in select cases only, by up to one to two days, and had no effect on final soybean stands. More importantly, residue management practices had no effect on soybean yield in the great majority of site-years (10 of 12 site-years) and limited effects on soybean seed weight, protein and oil. In two of the 12 site-years where yield differences were observed, higher yields were not consistently associated with higher spring soil temperatures.

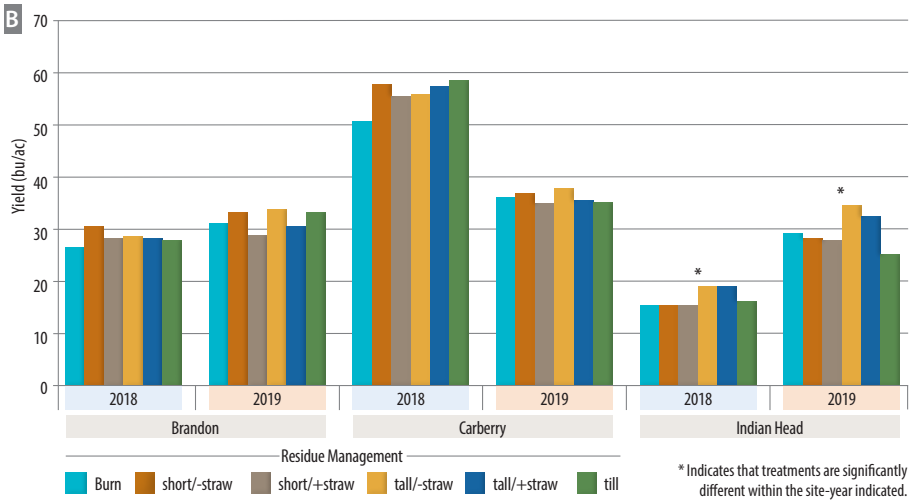
In part, the early-season differences in seedbed temperature and moisture measured in the various residue management treatments may not have been large enough to affect soybean yield, or the soybean crop may have been able to compensate for differences earlier in the season. Although the results of this study suggest that residue management is likely to have limited effects on soybean seeded into warm soils during the recommended planting window, it is possible that residue management may have a greater effect under more marginal growing conditions.

To look more closely at this question, a follow-up study is currently underway in western Manitoba and eastern Saskatchewan to assess the effect of a wider range of residue management practices (fall-tilled; fall-burned; short stubble with straw returned; tall stubble with straw returned; short stubble with straw removed; tall stubble with straw removed) on earlier and later planted soybean (approximately May 10 and two weeks later, as weather permits). In this study, preceding crops are wheat at Brandon and Carberry, and canary seed at Indian Head.

Based on preliminary results from 2018 and 2019, residue management practices had a similar effect on soybean yield regardless of whether soybean was planted earlier or later. There were differences between 2018 and 2019 in the effects of planting date, however. In 2018, seeding date had no effect on soybean yield at any site, whereas in 2019 earlier seeding increased yield by an average 7.7 bu/ac at Brandon and 3.5 bu/ac at Indian Head compared to later seeding (Figure 1A). At those sites, soybeans had been seeded on May 9 and 29 at Brandon and on May 14 and 30 at Indian Head. In part, earlier seeding in 2019 likely helped the soybean crop avoid cold conditions early in the fall that delayed crop maturity and harvest. In both 2018 and 2019, residue management affected soybean yield only at Indian Head, with tall stubble showing some yield benefit over other residue management practices (Figure 1B). Analysis of 2020 field samples is currently underway, with field trials set to wrap up at Brandon following the 2021 growing season. ■

Figures 1A and 1B. Effect of planting date and preceding residue management on soybean yield at Brandon, Carberry, and Indian Head in 2018 and 2019. Reported values for planting date are averaged across residue management practices and for residue management practices are averaged across planting dates.





Soybean Seeding Rate Trials Optimizing the Bottom Line

Update from the On-Farm Network

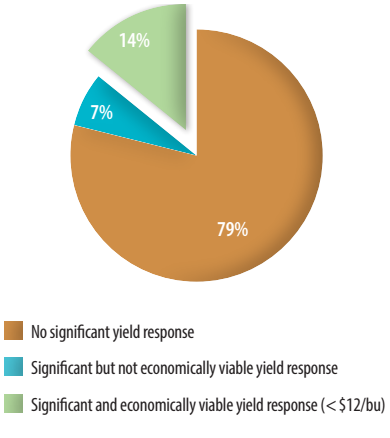
Megan Bourns, MSc, Agronomist – On-Farm Network, MPSG

YIELD DEVELOPMENT IS not a simple, predictable process, regardless of what yield-contributing factor you consider. This holds true for optimizing seeding rate, which initializes the range of potential yield. We can only have successful yield if we have successful seed in place to grow that yield. What are the steps to determine how much seed we need to achieve our target yield? What management and environmental factors affect the success of our seed? And ultimately, what do we do with this information?

YIELD RESPONSE UPDATE – 2020 RESULTS

In 2020, the On-Farm Network (OFN) completed another 11 seeding rate trials, two of which had significant yield differences between treatments. Adding the 2020 trials to the overall dataset, the frequency of soybean response to seeding rate remains at 21% (Figure 1). Out of 86 total trials, 18 have had a significant difference in yield between seeding rates, with varying economic outcomes (Table 1).

Figure 1. Proportion of the 86 OFN seeding rate trials from 2012 to 2020 with significant and economic yield responses, assuming a maximum soybean price of $12/bu.



Economic response was determined using the combined soybean seed and seed treatment estimated cost of $66.50/unit from Manitoba Agriculture's 2020 *Cost of Production Guidelines*.

Optimizing seeding rate involves setting target plant stand, determining seeding rate, calculating actual plant stand and assessing the influence of management and environmental factors to feedback into seeding rate decisions for future years.

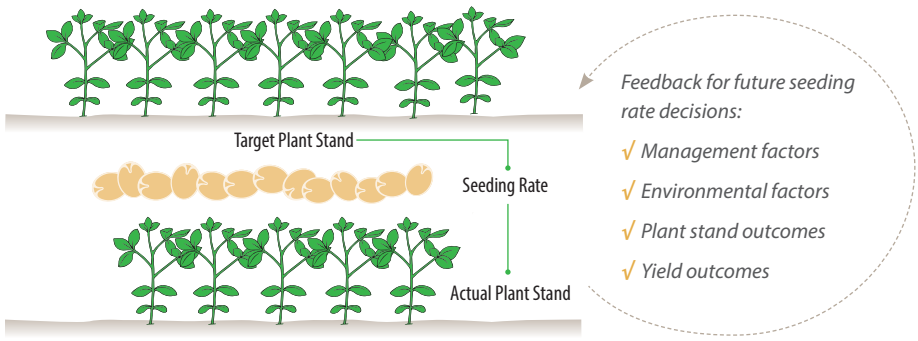


Table 1. Average yield difference from increased seeding rates and the required soybean selling price to cover the increased cost of seed for the 18 On-Farm Network trials where seeding rate significantly influenced yield.

No. of Significant Trial Comparisons[1]	Seeding Rate Comparison (000 seeds/ac)	Average Yield Difference	Average Soybean Price to be Economical[2]
		bu/ac	$/bu
4	200–220 vs. 170–190	+0.3	15.72
3	190 vs. 160	+1.1	13.24
6	190 vs. 130	+2.0	15.97
3	180 vs. 150	+1.3	13.88
1	180 vs. 120	+2.9	9.83
3	170–175 vs. 140–145	+1.5	9.42
4	150–165 vs. 120–135	+2.1	7.94

[1] Some trials compared more than two seeding rates. Only significant responses are included here.

[2] Averaged across individual significant responses.

Seed to yield – a different story in different places

Soybean seed is expensive, there are no two ways about it. Based on current soybean seed prices, reducing seeding rate by 30,000 seeds/ac, for example, results in savings of $14.25/ac. What are the steps to define an optimal seeding rate? Before we launch in, I think it is important to set a foundation of individualization – the optimal seeding rate for one farm in one area of Manitoba, in one growing season, may not be the same as the optimal rate for another farm in another area or perhaps another season. Seeding rate sets the foundation for yield, but the outcome of that seeding rate is very farm- and field-specific. We see this variation in yield outcomes at the same seeding rates across trials in the OFN. For example, at seeding rates of 130k, 160k and 190k, yield has varied as much as 45 bu/ac across sites and years (Figure 2).

Set a target, determine seeding rate

Seeding rate decisions begin with determining target plant stand. This is the

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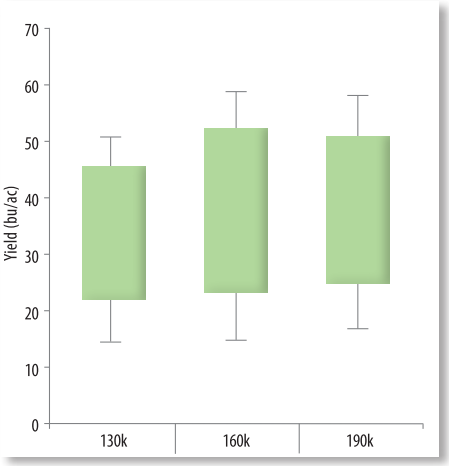
Figure 2. Range in yield for three common seeding rates in the On-Farm Network trials.



number of live plants/ac that you want to establish. The general recommendation for soybean target plant stand in Manitoba is 140k to 160k live plants/ac. Your target plant stand may be outside of this range, based on your production conditions and past knowledge about stand performance in terms of yield for your specific fields—and that is okay. The point is to target a plant stand that will generate desired yield as successfully and reliably as possible.

How do you translate target plant stand into seeding rate? We know that not every seed in the furrow will develop into a yield-producing plant, so our seeding rate should be greater than our target plant stand to account for expected loss. What influences seed survivability?

CONDUCTING A SOAK TEST

- Submerge 200 seeds in a container of water
- Soak for 5–10 minutes
- Count the number of swollen, oblong seeds, which indicates cracked seed coats
- Calculate the % survivability you can expect based on seed quality from the soak test results

100% – [(# of swollen seeds/200) x 100%]

Seed lot and seed quality

Different seed lots and quality will change expected survivability. Germination tests and soak tests are useful tools to assess the expected survivability based on the quality of your seed lot.

Seeding equipment

The general expectation is 70–75% seed survivability using an air seeder and 80–85% survivability using a planter. However, this can vary greatly with equipment and seed handling. Among the 86 OFN seeding rate trials, survivability has averaged 80% for air seeders and 83% for planters. The best course of action to determine survivability for your equipment is to do your own early-season plant counts and survivability calculations.

Seedbed

A combination of soil conditions at seeding will affect survivability. Too dry, too wet, caking, pulverization that can leading to extensive blowing after seeding—all of these factors can influence seed survivability. Seeding conditions, particularly soil moisture, also play into seed depth decisions, which can affect emergence and survivability.

Insect and disease pressure

Wireworms, seed corn maggot, cutworms and seedling root rots, if present, can all impact plant stand.

Weather

Although out of your control and hard to predict, temperature, precipitation and wind can influence survivability in some years.

The goal is to determine the percentage you should increase your seeding rate over and above your target plant stand to account for all the factors contributing to lack of survivability. Obviously, this is easier for some survivability factors than others. Luckily, MPSG has a handy tool to aid in this calculation—the Bean App.

COUNT YOUR PLANTS!

A critical step in evaluating seeding rate performance is getting out to scout. Target stand is what you want, seeding rate is what you put in the ground and actual plant stand is what grows. While counting plants may seem like a bit of a pain, the information is very valuable in assessing performance of a seeding rate.

In the OFN, we count plants in areas of 2 rows x 10 ft. We do this at two spots in every trial strip, which equates to a plant count for roughly every 1.5 ac in the trial area.

There are multiple methods for plant counting to determine stand, but they all involve counting the number of plants in a given area and then multiplying that by the necessary factor to convert it to plants/ac. MPSG's handy Bean App has a built-in plant stand calculator to make this as simple as possible for you in the field.

Survivability, or % emergence, is calculated by taking the live plants/ac, dividing by your seeding rate (seeds/ac) and multiplying by 100%. Compare this to your expected survivability and target plant stand to determine how your seeding rate performed.

Plant stand and survivability are useful tools to understand your yield at the end of the season—if you seeded at 180,000 seeds/ac with an expected survivability of 80%, but you only ended up with 60% survivability, yield could be limited by a low plant stand.

Was it really dry in the spring? Were you seeding into moisture? Did you observe insect damage in the seedlings? How did growing season conditions compare to other years? Doing some detective work to determine, as best as possible, what factors contributed to actual plant stand, can help adjust seeding rate for those circumstances in future years.

> If a change in seeding rate is something you are considering for your farm, and you would like to assess how various options perform in your fields, the OFN is happy to help!
>
> Contact Megan at **204.751.0439** or **megan@manitobapulse.ca**. ■

Hypnoidus bicolor *wireworm captured in a Manitoban crop field.*

Wireworms in Manitoba and a Guide to Scouting your Fields

Ivan Drahun and Dr. Bryan Cassone, Brandon University

WHAT ARE WIREWORMS and why is it important to scout your fields for them?

Wireworms are the soil-living larvae of click beetles. They are small (1/2" or so) and worm-like, with three pairs of legs on their underside. Wireworms are pests of several important crops grown in Manitoba, including wheat, soybean, corn and potatoes. Although the adult beetles pose no harm, the larvae are voracious feeders and can also cause plant injury by burrowing into tissues. Most of the damage occurs to seeds and seedlings, and can result in cosmetic damage, stunted plants, and even plant death.

Heavy infestations can cause significant yield losses or reductions in crop value. Historically, wireworms were successfully managed by the pesticide lindane, but since its ban in 2004, wireworm numbers have exploded. While nothing on the current market is as effective as lindane, there are other seed treatments available and cultural management practices that can help to reduce damage. The larvae are unusually long-lived (two to six years), which means they can be present in your fields for several growing seasons and this makes their control even more important. Over 90% of southern Manitoba fields we surveyed over a three-year period had wireworms, but infestations were rare. We found at least seven pest species, with *Hyponoidus bicolor* being the predominant species.

WHAT ARE SOME CLUES THAT YOU HAVE WIREWORM INFESTATIONS?

The presence of click beetles in crop fields or the surrounding vegetation may serve as a sign of nearby wireworm infestations. In heavily infested fields, it is common to find the larvae near or even above the soil surface. Patchy crop growth is also a good indicator of wireworm damage but should be investigated through scouting before preventative measures are undertaken, as it could also be due to other factors.

Our data also suggests that moisture within the soil could reduce wireworm abundance. This means that in years of high precipitation, wireworms are less likely to be problematic and that flooding could serve as a natural management option. It should also be noted that wireworm infestations are often localized. So heavy infestation in one area does not necessarily mean the entire crop field is infested to the same degree.

WHEN SHOULD YOU SCOUT FOR WIREWORMS?

Most experts recommend scouting for wireworms in the spring, prior to planting and once soil temperatures rise above freezing (around 5°C). Wireworms are attracted to carbon dioxide (CO_2) produced by germinating seeds, which means finding them after seeding can be more challenging due to the competing CO_2 sources. Post-harvest is another reliable time to scout

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STEP-BY-STEP BAIT TRAPPING INSTRUCTIONS

1. Fill a clean 4" plant pot halfway with coarse vermiculite (Grade 4). After ensuring that the vermiculite in the trap is level, add two tablespoons of untreated wheat seed. Top off the pot with a level layer of vermiculite (A).
2. On the day of trapping, water each trap with slow-running, lukewarm water until water comes out of the bottom drainage holes. Repeat the process 30 minutes later.
3. Once in the field, dig a 6 ½" hole with a shovel or hand trowel (B). Remove any green vegetation and roots within 3' of the hole (competing CO_2 sources).
4. Add a 1/2" layer of fine soil to the bottom of the hole and carefully place the trap on top, ensuring a snug fit. This is done to minimize the air pockets between the hole and the trap, as they interfere with the gradient of CO_2 germinating wheat produces. Add the rest of the dug-up soil, wiggling the soil snug up against the sides of the trap. The trap should be covered with about 1" of soil.
5. Place an 8" upside-down plastic saucer on top of the trap (C). Leave the centre of the saucer exposed. The saucer will protect the trap from rainwater and absorbs sunlight to stimulate the wheat seed to germinate. Be sure to mark the location of your traps with stake flags or something similar.
6. After about two weeks, retrieve the traps by wiggling them out of the ground using a trowel.
7. Wireworms can then be extracted by hand by carefully breaking up the trap contents and closely inspecting for larvae (D).

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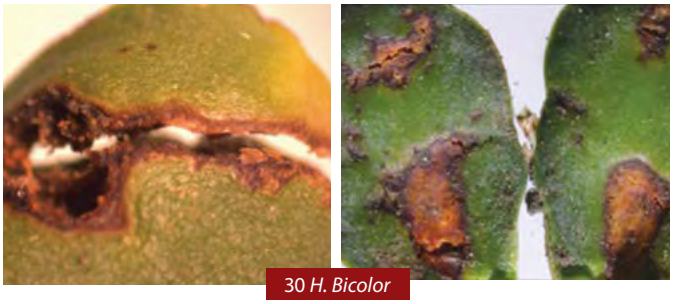
Soybean cotyledon damage comparison between 30 Hynoidus bicolor *wireworms and 10* Limonius californicus *wireworms. Wireworms have the most access to cotyledons while the seeds germinate, thus damage is commonly found on them. Chewing and burrowing through plant tissue leads to secondary infection that can result in stunting, wilting and plant death. Due to their larger size and longer larval stages,* L. californicus *is considered a more damaging pest than* H. bicolor. *However, both species can pose significant harm to crops in high enough densities.*



30 *H. Bicolor*

10 *L. californicus*

for wireworms, as long as it is before the freezing temperatures start to occur (as cold temperatures cause wireworms to burrow deeper into the soil).

Since we have found that in some fields the pest species composition changes throughout the growing season, we recommend testing your fields at two or three different times. Should patchiness become apparent in your crop throughout the growing season, scouting within the patchy area will still indicate whether wireworms are present.

HOW TO SCOUT YOUR FIELDS FOR WIREWORMS

The good news is that scouting for wireworms in your fields is not too difficult or expensive. All of the needed items can be purchased at your local gardening store. There are two different methods available—soil coring and bait trapping.

Soil coring consists of random soil sampling and inspection to estimate wireworm presence. Since the distribution of wireworms in a field tends to be patchy and unpredictable, large numbers of samples are needed to obtain an accurate measure. This process is labour-intensive and often not sensitive enough to detect problems.

Bait trapping is the more accurate and preferred method for most fields. The traps are designed to create an optimal environment for wireworms. They should be installed in areas suspect of infestations or along the peripheries of fields, about five metres apart. As wireworm infestations can be localized within a field, we recommend trapping in more than one area of a field. For our scouting, we trapped in four different field sections with four traps per section. The more traps, the more accurate your estimates will be.

HOW MANY WIREWORMS PER TRAP IS A SIGN OF INFESTATION?

The University of Nebraska estimates that an average of one wireworm per trap is equal to 20,000 wireworms per acre. While we are currently working to determine the economic thresholds for wireworms in Manitoba, studies in the Midwest USA indicate fields with an average of one to two wireworms per trap have a 50% to 74% chance of economic damage. Fields with more than four wireworms per trap have a greater than 90% chance of economic damage. Before spending money on treatment options, it is a good idea to first seek advice from an expert.

Do you want further information?
Please contact Dr. Bryan Cassone, Associate Professor of Biology – **cassoneb@brandonu.ca** ■

Soybean Scout ANSWERS

A – Dingy Cutworm

Dingy cutworms have a thin light line down the very middle of their back. On either side of this thin line there is a broader series of diagonal markings that look like tire tracks, or "V's" along the back. They also have four equal-sized black dots on the back surface of each abdominal segment.

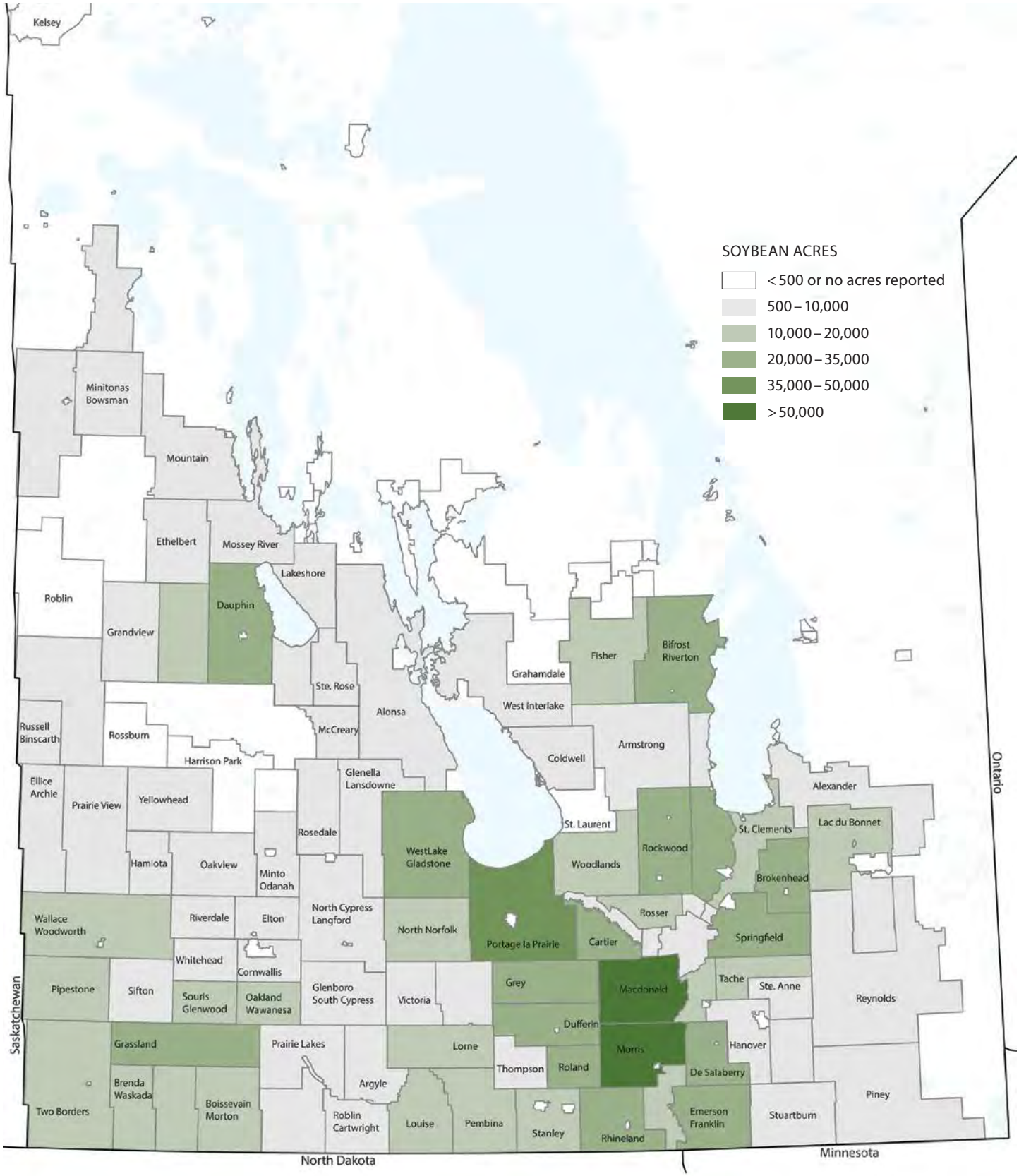
Dingy cutworms are common in Manitoba. They are primarily leaf feeders and rarely cut plants. Dingy cutworms overwinter as larvae. This means they typically appear sooner than redbacked cutworms and will often grow larger earlier in the season.

B – Redbacked Cutworm

Redbacked cutworms have two broad dull-red stripes along the length of their back and a yellowish-brown head. Mature larvae are about 1.5" long. Young larvae make small holes and notches in the foliage. Older larvae eat into stems and often sever them.

Redbacked cutworms are common in Manitoba. They overwinter as eggs in the top centimetre of soil. This means larvae typically feed later in the spring than dingy cutworms.

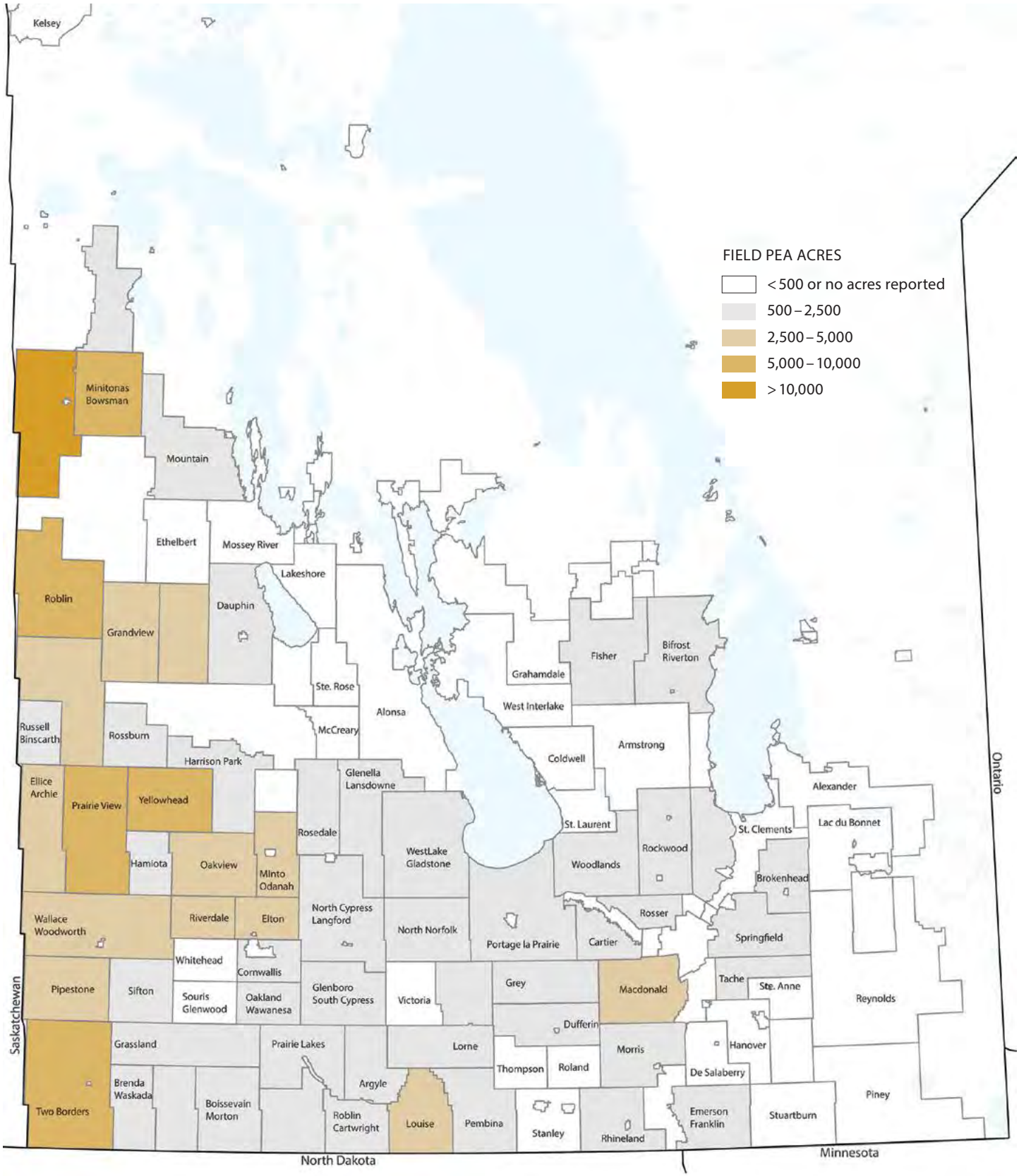
2020 Soybean Acres



MANITOBA Pulse Soybean GROWERS

MASC
Manitoba Agricultural Services Corporation

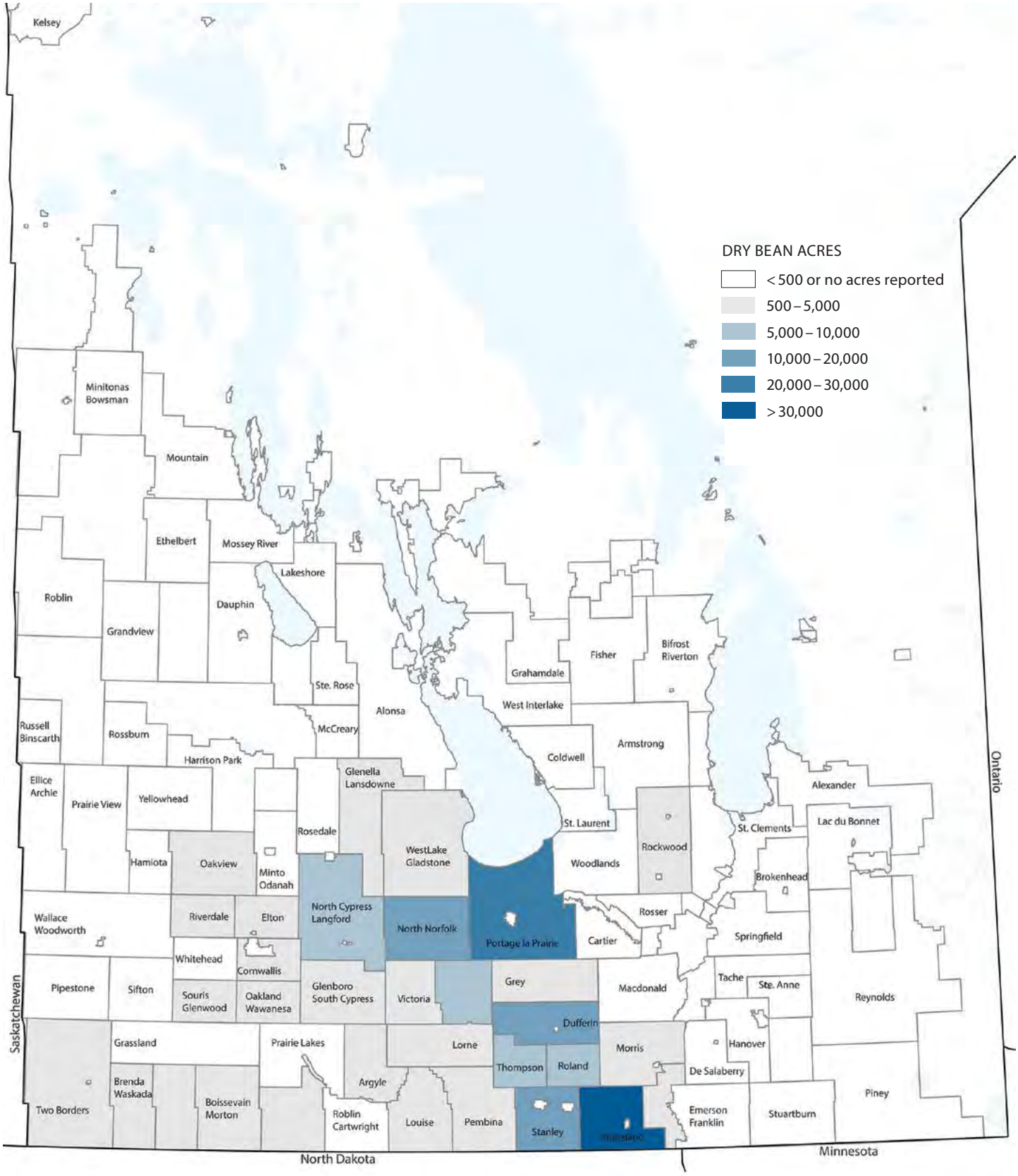
2020 Field Pea Acres



MANITOBA Pulse Soybean GROWERS

MASC Manitoba Agricultural Services Corporation

2020 Dry Bean Acres



MANITOBA Pulse Soybean GROWERS

MASC Manitoba Agricultural Services Corporation

Recipe Corner

Seared Manitoba Steelhead Trout* with Navy Bean and Lentil Marinara

Servings: 6–8 | Prep time: 15 minutes | Cook time: 45 minutes | Total time: 60 minutes

Ingredients

Lentil Marinara

1 cup (250 ml) green or brown lentils

1 cup (250 ml) canned navy beans, drained

1 can (800 ml) diced tomatoes *— good quality*

1 tbsp (30 ml) tomato paste

4 cloves garlic, chopped

1 red onion, chopped

1 tbsp (30 ml) fresh oregano

2 tbsp (60 ml) parsley, chopped

6 cups (1.5 L) chicken stock

2 tbsp (60 ml) canola oil

Salt and pepper to taste

Steelhead Trout*

4 portions, 4–6 oz each

2 tbsp (60 ml) canola oil

Salt for seasoning

Small salad greens for garnish optional

** can substitute with salmon*

Method

1. In a heavy bottom pot, sweat the onions and garlic with canola oil until soft and translucent, season with salt. Add tomato paste and cook an additional 2–3 minutes.
2. Cover with half of the chicken stock and simmer on low heat for 20 minutes to develop flavour.
3. Add the remaining chicken stock and the dried brown or green lentils.
4. Add fresh oregano and simmer until lentils are tender.
5. Once lentils are cooked to the desired consistency, take half of the tomato and lentil sauce and purée *— blender or hand-blender both work well.*
6. Add the puréed lentil and tomato mixture back to the original base.
7. Fold navy beans into the tomato sauce and add the fresh chopped parsley.
8. Season to taste with salt and pepper and reserve on low heat.
9. Heat sauté pan first and then add canola oil.
10. Season trout with salt and sear presentation side down until golden brown.
11. Place in preheated 375°F oven and bake seared side down for approximately 8 minutes.
12. Place two spoons of marinara sauce in large pasta bowls and top with seared side-up trout.

    Serve with fresh lemon and a small tuft of baby salad greens.

Recipe featured on Great Tastes of Manitoba – www.greattastesmb.ca

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