MANITOBA Pulse Soybean GROWERS

pulsebeat

Issue 93 • June 2021

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Please direct your comments or concerns to Sandy Robinson at 204.745.6488 or email sandy@manitobapulse.ca

In This Issue

Cover photo by Laura Schmidt, MPSG

Manitoba Pulse & Soybean Growers 2021 Board of Directors and Staff

ELECTED FARMER DIRECTORS

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Vice Chair – Melvin Rattai – *Beausejour*
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Bryce MacMillan – *Marquette*
Ben Martens – *Boissevain*
Brendan Phillips – *Hartney*
Bryce Pallister – *Portage la Prairie*
John Preun – *St. Andrews*
Frank Prince – *Waskada*
Garrett Sawatzky – *Altona*
Ernie Sirski – *Dauphin*

*Director Intern – Non-voting position

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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, A. Burgess (non-voting)

Research – F. Prince, B. Martens, B. Pallister, B. Phillips, M. Rattai, G. Sawatzky, A. Burgess (non-voting)

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, J. Preun
- **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)

OUR MISSION

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

MPSG is a Research Organization – A Policy You Can Count On

Toban Dyck, Director of Communications, MPSG

'POLICY' IS AN amorphous term. It's used in a variety of ways. And at Manitoba Pulse & Soybean Growers (MPSG), we use the word frequently.

We question how active we should be in the policy space. After all, research, extension and market development have been our meat and potatoes. We talk at length about the kinds of issues that should trigger our interest and expertise. We do all of this without starting each conversation with a working definition of what policy means.

Surprisingly, the definition of policy is not uncontroversial. Without getting into the weeds on this (I took a Public Policy in Canada course at the University of Winnipeg this winter, so I've spent a lot of time in the proverbial policy weeds), let's operate on the assumption that by 'policy,' we mean every outward expression (action, statement, bill, etc.) taken by a government, organization or company.

I'm coming up on five years with MPSG, and during each one of those, the association has taken part in many consultations. One way or another, these meetings influence policy. Federal and provincial governments rely on the expertise of organizations like ours to bolster their own internal capacity to come up with agricultural policies and they lean on groups like ours to provide meaningful feedback on exiting or nascent agricultural policies.

When we, as an organization, have taken the time to determine whether or not MPSG is a group that should be involved in this arena, the conclusion is always that, whether or not we make 'doing' policy an explicit part of our mandate, we are, invariably and inextricably involved in it.

Research is a policy issue. Government-funding programs of any sort represent policy. The provincial government's decision to shutter 21 of its Manitoba Agricultural Services Corporation and Rural Manitoba Agriculture and Resource Development locations is very much a policy move.

The realities and nuances of this policy space were brought home to us this winter with our involvement in the consultations surrounding a proposed Code of Practice for farmers. This code, put briefly, is a voluntary set of guidelines aimed at securing market access for Canadian crops and building trust among the public that farmers are, in fact, growing food, sustainably.

We were opposed to the draft, as it was written, but we were sensitive to the consultation process, which sought feedback from organizations as well as individual farmers, and we didn't want to poison the well or put words into people's mouths. Our position required a careful analysis of the social media channels this pressure was coming from and thoughtful discussion about the sanctity of the consultation process. MPSG's Executive Director, Daryl Domitruk, speaks to this and our policy involvement in other areas in his report.

Regarding ag policy, MPSG seeks to occupy a meaningful space amid a busy network of agricultural groups vying for your undivided attention.

This divulgence of MPSG's relationship to policy does not represent a change in our operations. This is merely a look into what goes on behind the scenes of a commodity group like ours. Research, extension, *Pulse Beat*, production advice and our On-Farm Network will remain priorities for MPSG as long as they remain priorities for you, our farmer members.

I hope you enjoy this episode of *Pulse Beat* and I wish you all a fantastic growing season! ■

Message from Board Chair

Calvin Penner, Chair, MPSG

AS I WRITE this, it's mid-April, and we're experiencing some welcome, wet snowfall. Our farm is still trying to catch up from a large moisture deficit. I realize that not all Manitoba farmers are looking for moisture at this time. Manitoba has a large range of environmental conditions that vary greatly from area to area and year to year. At Manitoba Pulse & Soybean Growers (MPSG), we have this range in mind and we're always curious about the kinds of weather each region will experience. My wish for every farmer is that his or her farm receives the right amount of rain at the right times. If I am wishing, I might as well wish big, right?

I was looking at social media and saw a video of a sheep being rescued from a narrow trench. The video showed the sheep being pulled out of the trench and bounding off, only to leap back into the trench. While this amused my grandchildren and me, it made me think of how I sometimes try to repeat the same thing, even though it didn't work the first time. I do this hoping that conditions will change and have a different, more favourable outcome. The video also made me think that perhaps the difference between getting in a groove or being stuck in a rut (trench) is quite subtle. I was reminded of these quotes from Albert Einstein: "Insanity: doing the same thing over and over again expecting different results," and "No problem can be solved from the same level of consciousness that created it."

This is why MPSG continues to do research. We want to find new ways to solve problems and create a better bottom line for Manitoba's pulse and soybean farmers. This is why our On-Farm Network will continue to replicate and test the claims of new products and compare seeding rates against farm-scale trials.

And this is why we at MPSG collaborate with university researchers, work with partners to develop new markets for our crops, go on trade missions—even virtual pandemic ones—and work with various government agencies and scientists. We are working with plant breeders to look for new and improved traits in smaller-acreage and/or niche pulse crops that may not be getting adequate research attention. We want to grow not only better crops but also increase the knowledge base that will help make Manitoba's farmers more financially sustainable and improve their operations agronomically, so we all leave our farms in better shape than when we started.

As I mentioned earlier, we at MPSG also realize that growing conditions vary significantly across the province. That is why we have refocused and have two very knowledgeable agronomists—one in the eastern part of the province and one in the western part of the province. They are always ready to answer your questions.

I think we have a great, knowledgeable, hardworking staff who have the same goals as the board of directors—to make farms more sustainable and profitable while promoting the many advantages of pulses and soybeans. So, I would like to extend a big thank you to the staff and board for all your hard work.

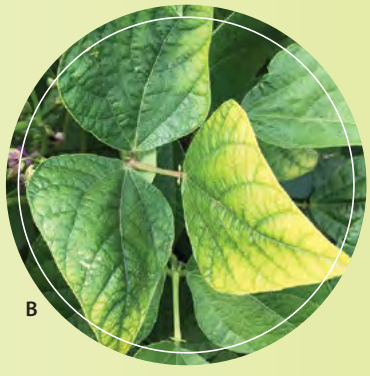
I will close with another Einstein quote: "In the middle of difficulty lies opportunity." On this note, I wish for you—in the midst of the difficulties that are typical of farming—much opportunity and success. Please take the time to be safe and enjoy the things that are important. ■

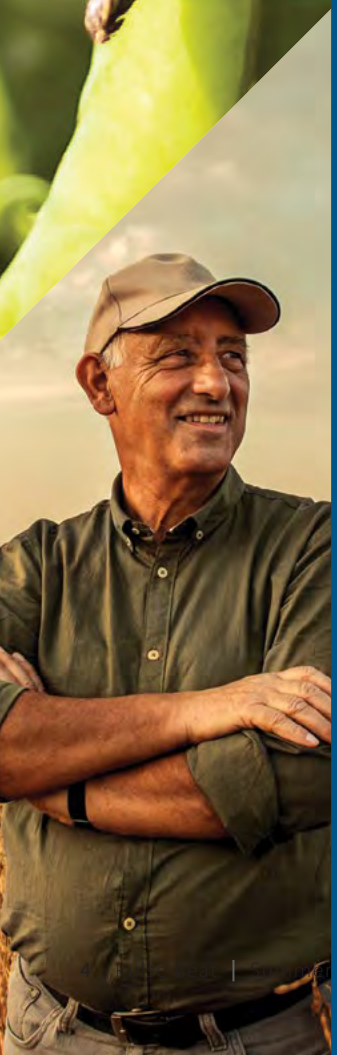
— Calvin

Dry Bean Scout

What deficiencies are these bean plants suffering from?

Answers can be found on page 54





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Message from Executive Director

Daryl Domitruk, Executive Director, MPSG

AS OUR COMMUNICATIONS director, Toban Dyck, outlines in the opening pages of this edition of *Pulse Beat*, activities often labelled as *policy* have acquired space on our calendar. That's not to say we've diminished our focus on core programs in research, extension and market development. After all, Manitoba Pulse & Soybean Growers (MPSG) is not a policy organization.

Wisely, however, the MPSG board of directors recognize our core activities are made possible by certain policies. The policy of governments to support research, for example. Taking advantage of this policy, we fund research to stimulate improvements to farmers' production and marketing of pulses and soybeans.

Policy exists on local, provincial, national and global scales. Picking the scale of policy MPSG is best equipped to influence is the first step. Secondly, we need to be prepared to support organizations addressing policy at other levels. Finally, recalling that the reason we step into policy is to improve our core programs, we must carve a role we can fill with the skills and resources we have.

MPSG's most valuable contribution in this space is interpreting how global, national and provincial policies might affect crops and farmers at the local level. Our role isn't to form policy but rather to explain the technical sides of our industry through a Manitoba lens that contributes to a constructive critique of policy options. With a policy committee up and running and some well-practiced virtual meeting skills, MPSG's policy effort is working its way into weekly activities.

The province has developed a policy to grow the protein industry. Of course, our crops already figure prominently in this opportunity. Throughout these discussions, MPSG emphasized the challenges to be overcome to sustain the production of peas and soybeans. The fact there is but one dedicated pulse crop researcher in Manitoba speaks to one of the challenges we are seeking to address.

BUSINESS RISK MANAGEMENT

MPSG, together with its sister organizations in Manitoba, were consulted by the Minister of Agriculture and Resource Development regarding business risk management (BRM). The focus was AgriStability. Ultimately, governments agreed to remove the reference margin limit. Soon we will be engaged with the province on renewed BRM programs to begin in 2023.

When it comes to BRM, numbers matter. Commodity groups do not typically have the capacity to analyze BRM options for government. Instead, we look to government to provide that analysis. This puts us on the sidelines of these discussions. If Manitoba growers want independent or original analysis, that capacity will have to be developed.

MANITOBA AGRICULTURAL SERVICES CORPORATION

Each year, MPSG meets with the board and management of Manitoba Agricultural Services Corporation (MASC). This year, again, there was open dialogue regarding trends in the insurance industry and agriculture. Research supported by MPSG has better determined the cost/benefit of different seeding dates, as well as more precisely documenting the effect of hail on soybean yield. Such projects are intended to provide MASC with data to support making their insurance products more accessible for pulse and soybean growers. MPSG raised the issue of reseeding coverage in an era of increasing seed costs. With soybean seed at the high end of the cost scale, it's important for growers to have access to adequate coverage in the case of a reseed. We will continue to follow up on this issue.

KEYSTONE AG PRODUCERS

Participation on the Keystone Ag Producers (KAP) Advisory Council and its Grains, Oilseeds and Pulses subcommittee give us a window on local farm issues. In addition, MPSG supports special activities such as KAP's reviews of Responsible Grain and the Canada Grains Act (more on those later). Overall, we feel we can offer KAP more based on our expertise in research, extension and market development. With KAP reviewing the role of commodity groups, we're hopeful an efficient and productive form of mutual support and collaboration can be identified.

CONSULTATIONS AND REVIEWS

A formal review of the Canada Grains Act is underway. This is an example of national groups such as Pulse Canada (PC) and Grain Growers of Canada (GGC) taking the lead and of MPSG and other provincial groups functioning to ground-truth ideas. Growers are unified in demanding the preservation of producer protection in the case of grain buyer default. This pertains to clauses in the Act requiring buyers to post security and

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Notice to Members

In accordance with MPSG bylaws, any active member who wishes to bring forward a resolution to the annual general meeting (AGM) must provide notice to the board of directors by December 1 of the year prior to the AGM.

Resolutions to be presented at the February 16, 2022 AGM must be received by December 1, 2021.

Please forward to Sandy Robinson at **sandy@manitobapulse.ca** on or before that date.

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obtain a license—two issues close to the heart of the pulse industry.

The other hot topic is mandatory inspections of outbound shipments. Currently, container shipments are exempt. With containers being a primary method of shipping pulses, our industry suggests things remain as is. It's interesting to hear from both sides as we have the fortune to hear from PC's board members who represent grain buyers. Likewise, Canadian Grain Commission (CGC) staff has provided very helpful descriptions of the current Act and of the CGC's method of administration. Of course, a look behind the scenes at CGC reminds us things are more complicated than they appear on the surface. Nevertheless, there's confidence that by modernizing the Grains Act and providing the CGC with more flexibility to respond to a rapidly changing global grain industry, a regulatory system that works for farmers can be created.

The province's policy of supporting regional Diversification Centres is also under review. Being a key part of MPSG's research program, our organization has become directly involved in encouraging the continued operation of these centres. We will be engaging the government and each independent centre in discussions of new models for funding and conducting research.

The federal Pest Management Regulatory Agency (PMRA) has an ongoing program of reviewing pesticide registrations. MPSG supports a regulatory system that maintains Canada's access to the world's safest and most effective crop protection products. At the same time, we hope to initiate a broader commitment to product stewardship so that key chemicals such as glyphosate and neonic seed treatments are not overused and can remain on the market well into the future. Knowledge is available to advance us toward this goal through improved pest targeting, genetic innovations and more independent thought on the part of growers.

Say Hello to MPSG's 2021 Summer Students

My name is **Shelby Dheilly**. I am from Elm Creek, Manitoba, which is a small farming community in the R.M. of Grey. I grew up close to my grandparent's grain farm. When you read this, I will have completed my first year of agribusiness at Assiniboine Community College in Brandon. I am excited to be a summer student at Manitoba Pulse & Soybean Growers (MPSG). I look forward to working with the various crops that MPSG studies. My goals are to gain knowledge of all the pests and insects that affect pulses and soybeans. I cannot wait to get in the fields and learn.

Good luck with this season and I look forward to meeting you!

My name is **Karissa Render**. I am from Winnipeg, Manitoba. This fall, I will be starting my final year at the University of Manitoba to complete my Bachelor of Science degree in Agronomy. I am very excited to have the opportunity to be a summer student at Manitoba Pulse & Soybean Growers (MPSG) this year. I am really looking forward to all the different learning opportunities this position presents across a variety of different crops. With this being my last summer before I graduate, I am excited to take in all the knowledge I can about pulses and soybeans and all that growing them entails.

I look forward to connecting with MPSG farmers and the 2021 growing season!

CODE OF PRACTICE

Responsible Grain or the grain growers code of practice has drawn attention in the ag news and on social media. Another national initiative, the draft code, was scrutinized by MPSG and its sister pulse organizations under the coordination of Pulse Canada. We had additional input through GGC and a provincial perspective through KAP's review process.

Around each table, there was strong agreement the draft code was rife with deficiencies. That point was driven home repeatedly as successive organizations and individuals across Canada examined the documents. Some groups publicly stated their opposition to the code. Even though early on MPSG fell into the majority camp opposing the draft code, we chose not to make a public statement preferring to encourage growers to have their say independent of the conclusions we had drawn. Indeed, farmer perspectives were clearly expressed in the review process.

Several lessons were learned. The code's sponsor, the Roundtable for Sustainable Crops, will be deciding where, if anywhere, the code idea will go next. Rather than looking back, MPSG will glean lessons from Responsible Grain and move forward with research and market development work aimed at monetizing the social and environmental value embedded in every pulse and soybean crop. That should be grounds for good policy.

MORE AT MPSG

Administering check-off refunds is not a small task. Printing and mailing hard copy cheques is expensive. So, we've streamlined the process by moving to electronic deposits and purchasing new check-off management software. Now we can better track refunds by crop and location.

As with all businesses, MPSG continues to operate under a COVID-19 protocol. Administrative staff continue to work from home, as do field staff, who also take precautions while travelling around the province visiting farms and research centres.

With new management at Soy Canada, it's a good time to move our partnership to a new level. We've enjoyed great relations with retiring Executive Director Ron Davidson. Under Davidson's leadership, we've seen Manitoba's profile increase among Canada's soybean industry. As

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Brian Innes takes the reins, MPSG will set out to enhance the Manitoba angle on key files initiated by Davidson, including sustainability and market access.

Speaking of national groups, MPSG members should be aware our primary partners are Pulse Canada, Soy Canada and Grain Growers of Canada. We pay an annual membership to each organization. In all cases, the return has been excellent. It helps that some of our more seasoned and wise directors serve on these boards. Having our national partners looking out for our interests lets us focus on our core business at home in Manitoba.

MPSG jointly funds a project at the University of Manitoba where agribusiness students take on internships with grower groups to study a particular topic of importance to that group. At a recent priority-setting meeting, we let students know about a range of questions our members would have. Among them are the ability of farmers to monetize sustainability, the financial return on public sector research specifically in Manitoba and how policies supporting value-added processing stack up in terms of benefits to farmers.

Assiniboine Community College is trying hard to enhance its agriculture teaching and applied research programs. The latter is a new emphasis and, given the very practical nature of the college's plans for research, which could be a welcome addition for farmers in Westman. College leaders are campaigning for funds to renovate the North Hill campus in Brandon and have reached out to MPSG.

The 2021 provincial budget retained $3.0 million for research. There have been very significant changes to the organization of government services in agriculture. The budget reflected the realignment of workgroups to fit the newly combined mandate of agriculture and resource development. The announced office closures have gone ahead and several remaining locations are now off-limits to the public. Several staff are awaiting clarification of their role in the new department. We anticipate the exact services government has chosen to provide to farmers will become clearer over time.

MPSG's relationship with Roquette continues to advance. We are partners on several provincially-funded projects to improve pea production for Roquette and their farmer contractors. We're gaining an understanding of their company and their regard for Manitoba. As Merit comes online, we look forward to cultivating a similar working relationship. We're hoping that the success of these companies will attract more processing to Manitoba.

Growers of pulses and soybeans play a significant role in the province's strategy for *sustainable protein.* A recent talk by a United Nations official outlined how countries have defined sustainability to include carbon, water, worker health and equality. Tall orders to package into a simple legume. Manitoba growers can do it, but what will be the return?

Have a great, safe growing season! ■

— Daryl

Improving Supply Chain, Increasing Demand

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

WHILE PULSE GROWERS are hard at work seeding across western Canada, the team at Pulse Canada continues to work to advance the priorities of our industry. Whether working with growers, policy officials in Ottawa, or officials and customers in priority pulse markets worldwide, our team is focused on creating efficiencies throughout the supply chain while growing sustainable demand for Canadian pulses and pulse ingredients.

This past winter, Pulse Canada kicked off work to assess the environmental impact of Canadian dry bean and faba bean production. Thanks to the dozens of Manitoba bean growers who participated, along with their colleagues in Alberta, Saskatchewan, and Ontario, the information gathered will help position Canadian dry beans and faba beans as foods with a low environmental footprint. This data is now being analyzed through a partnership with the University of British Columbia, and we look forward to sharing the results with members as they become available. There is no doubt that Canada's pulse industry has a unique opportunity to take advantage of the global demand for more sustainable food products and food ingredients by showcasing our industry's sustainability advantages.

However, an industry won't grow without the emergence of new challenges. The growing interest in pea protein in the alternative protein sector has created a need to address the subsequent increased production of pea starch. Pulse Canada recently commissioned a comprehensive market research study looking at new uses for pulse starches. The study identified new, more profitable markets, including pharmaceuticals and bio-plastics, as well as some new industrial uses. The end goal is to provide growers with more markets for every part of a pulse crop—raising demand and bringing more value back to the farm gate.

Here in Canada, regulations behind labelling foods as a *source of protein* continue to hinder the growth of the alternative protein sector and the opportunity for pulse protein to cement itself as a preferred ingredient. In order to make a case for having clearer identification of plant-proteins in the grocery-store aisle, Pulse Canada is facilitating the research needed to better understand how plant protein affects the protein quality of diets and prove the importance of better food labelling. Work led by Pulse Canada's Chris Marinangeli recently found that Canadians who eat plant-based diets are receiving most of their proteins from foods like breads and crackers. The exciting news is that getting these Canadians to diversify their protein intake through products that use pulse ingredients would not only improve their health but would raise demand for Canadian pulses.

Of course, for Canada's pulse industry and the grain industry overall to meet that growing demand, reliable and timely rail service is a must. While both of Canada's national railways are speaking in terms of volumes moved, Pulse Canada and our allies around the Ag Transport Coalition have been increasing the attention of the industry and the government on the importance of on-time delivery. For too many weeks, Canada's railways have failed to meet the demand from grain handlers. Each car not spotted represents real dollars being delayed or, in some instances, not being delivered entirely back to the farm gate. We are continuing to draw attention to weekly performance gaps through the *Grain by Train* podcast, where we break down weekly car fulfillment and other issues impacting grant transportation in 10 minutes or less. Pulse growers can listen to the podcast on the Pulse Canada website or via their preferred podcast streaming platform.

At the time of this writing, the Canadian pulse industry is facing a bubbling crisis at the Port of Montreal. With the Port and the longshoreman's union at odds, Canadian agriculture is paying the price. Pulse Canada has played a leading role in rallying agriculture groups from across Canada to pressure the federal government to intervene and mediate a solution. Uncertainty is costing our industry hard-earned dollars and well-established relationships. Pulse growers can visit stopthestrike.ca to send a letter to the government to raise further awareness of the importance of resolving this issue.

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Foreign Events Impact the Canadian/Manitoba Soybean Sector

Ron Davidson, Executive Director, Soy Canada

CONTRARY TO THE circumstances that existed for the 2018 to 2019 soybean crops, it is certainly a welcome change to prepare Soy Canada commentary when soybean demand and prices are not only strong but are projected to remain so for at least the coming year.

Previous articles have focussed primarily on current events that were impacting the Canadian/ Manitoba soybean sector at particular points in time. The observations and perspectives that follow reflect a somewhat broader and longer horizon.

Soybean production in Manitoba recorded a remarkable expansion from only 36,700 tonnes in 2001 to 1,162,800 tonnes in 2020. At the same time, equally extraordinary developments were occurring elsewhere in the global soybean sector. These transformations have resulted in a major reordering of the previously established parameters of global soybean production and trade.

REORDERING OF WORLD SOYBEAN PRODUCERS AND EXPORTERS

On a global basis, soybean exports soared from 55.5 million tonnes in 2001 to 169.72 million tonnes in 2020, an increase of 114.22 million tonnes or 206%. Although steady increases in U.S. production and exports were significant contributors to the more than doubling of global trade, the U.S. played only a secondary role in notably more dramatic and rapid changes that were occurring in Brazil.

During the 20-year period, Brazilian production leapfrogged from being equivalent to only 31% of U.S. production in 2001 to representing 119% of U.S. production in 2020. Brazil surpassed U.S. production in 2017, 2019 and 2020—and was reverted to second place by only 0.8 million tonnes in 2018.

In the case of exports, Brazil surpassed the U.S. in 2013/2014 and continued by an expanding margin that reached as high as 46.36 million tonnes in 2019/2020.

The rapid increase in Brazil's production and exports during the last two decades has been supported by three significant contributing factors:

1. land area devoted to soybeans increased from 35 million acres in 2000 to 94 million acres in 2020, primarily as a result of the conversion of permanent pasture to cropland (a process that could continue for many more years);
2. for the past six years, but particularly since 2020, Brazilian producers have benefited from a substantially weaker Brazilian currency that has notably enhanced the relative price competitiveness of Brazilian soybeans in the global marketplace; and
3. Brazil has invested heavily in road and port infrastructure required to transport soybeans north and northeast out of the interior soybean producing states of Mato Grosso and Goias.

NOT ALL SOYBEANS ARE CREATED EQUAL

Confronted with the loss of its longstanding positions as the number one producer and as the largest exporter of soybeans, the U.S. soybean sector has invested in a series of initiatives intended to protect international market share in the context of a rapidly increasing supply of competitively priced soybeans from South America. These actions include:

- continuous, direct contact with foreign importers and processors through a global network of United States Soybean Export Council (USSEC) representatives divided into eight international regions: Americas, Greater China, Greater Europe, Middle East and North Africa, Northeast Asia, South Asia, Southeast Asia, and Sub-Saharan Africa;
- aggressive promotion of the U.S. Soy Sustainability Assurance Protocol (SSAP) based substantively upon U.S. government mandatory requirements and voluntary programs, particularly the USDA managed, audited and funded national Farm Service Agency (FSA) services and National Conservation Reserve Program (NCRP), both of which are funded by the U.S. government; and
- launch of a *Dare to Compare* digital global marketing campaign that highlights research indicating U.S. soy offers preferable and cost-saving nutritional profile, sustainability, and refining characteristics compared to other soybean producers.

REORDERING OF WORLD SOYBEAN IMPORTERS

While Brazil has secured the pole position on soybean production and exports, China has been the singular and unchallenged star player of the last two decades on imports.

In 2000/2001, China imported 13 million tonnes accounting for 24% of total global imports at that time. During the same year, the European Union imported 19 million tonnes or 35% of global imports.

By the end of 2020/2021, it is projected that China will have imported 100 million tonnes accounting for 60% of global trade and that imports by the EU+UK will have decreased to 15 million tonnes or 9% of global trade.

During the same two-decade period, Japan's imports have decreased gradually from five to three million tonnes. Conversely, imports by Mexico have increased from four to six million

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With April 1 marking the beginning of our fiscal year, our team is now executing against a revamped two-year strategy—all aimed at achieving the pulse industry's 25 by 2025 diversification targets. We will be updating pulse growers regularly on areas of interest as we look to create efficiencies throughout the value chain while creating sustainable demand for pulse and pulse ingredients in new markets around the world. On behalf of Pulse Canada staff, I want to wish you, your family and your business a safe and productive growing season.

If you have any questions on any one of the initiatives being undertaken on your behalf, please do not hesitate to reach out to me at jenglish@pulsecanada.com. ■

Sharp and Focused on Being Where Farmers Need Us to Be

Erin Gowriluk, Executive Director, Grain Growers of Canada

MUCH LIKE FARMING, the agriculture advocacy world is one that changes with the seasons and can force you to be put your best-laid plans by the wayside.

For 2021, this has been the case, with several files where we have been asked to represent our sector while also contributing to some long-standing consultations, where the voice of grain farmers is desperately needed.

POLICY PRIORITIES

On the policy front, we have been at the ready with several committee appearances and urgent government consultations on files that our members have a direct stake in. As your voice in Ottawa, Grain Growers of Canada (GGC) continues to be seen as an informed advisor and has been invited to appear before various committees to provide the grain farmers' perspective.

On March 8, GGC Chair Andre Harpe and I appeared before the Standing Committee on International Trade for their study on the modernization of the World Trade Organization (WTO). Our message focused on the importance of trade, the need for a rules-based trade system, a functioning dispute settlement system, and a revitalization of the WTO negotiating function.

The following day, Andre Harpe and GGC Policy and Government Relations Manager Branden Leslie appeared before the Standing Committee on Finance for the review of MP Larry Maguire's *Bill C-208*. We highlighted our support for the legislation and the value it would have for incorporated family farms that are seeking to pass the farm on to a family member.

In April, GGC Director (and Manitoba Crop Alliance representative on GGC's Board), Jonothan Hodson, and I appeared before the Standing Committee on Agriculture and Agri-Food in support of MP Phillip Lawrence's Bill C-206. This bill would see natural gas and propane used for drying grain exempt from the carbon tax. It has received support from the Conservatives, Bloc Quebecois, NDP, the Green Party and several independent MPs — along with Liberal MP Francis Drouin. There is clear support and recognition (even by parties who support a carbon tax) that farmers have no choice but to rely on fossil fuels to dry their grain.

We have provided written submissions to the federal government on a few pertinent items, including the proposed Clean Fuel Regulations, suggestions on how Canada Water Agency can best value our natural and physical water infrastructure, and what the Canadian Food Inspection Agency can do to foster innovation. All these submissions can be accessed via our member app, and we encourage you to look through them to stay up to date on these important policy files.

The Canada Grain Act review has also been top of mind, and we have commissioned a members' working group to prepare a submission to Agriculture and Agri-Food Canada. As part of this review, we have prioritized farmers' interests while ensuring that the Act is 'future proofed' to serve our sector for years to come. The submission will be coupled with some targeted advocacy with legislators and policymakers to ensure we maintain momentum on this file and get these changes across the finish line.

RESPONDING TO THE CARBON TAX

As we move forward with pushing MP Phillip Lawrence's Bill C-206, we have also leveraged our national voice as part of the brand-new Agriculture Carbon Alliance (ACA). This national coalition of industry-wide farm organizations was established to ensure that the sustainable practices of Canadian farmers are recognized through a policy environment that maintains their competitiveness, supports their livelihoods and leverages their critical role as stewards of the land.

Through the ACA, we will work proactively on behalf of Canadian agriculture to advocate for constructive and evidence-based policies regarding carbon pricing, offsets, retrofit funding and related environmental policies. The alliance will also function as a resource for the federal government and, in particular, Environment and Climate Change Canada (ECCC) regarding solutions-oriented strategies to ensure the industry remains competitive, both at home and around the world.

STAY IN TOUCH

If you have not had the chance to listen, now is a great time to download and catch up on the latest episodes of our podcast, *Fireside Chats with Erin*. I have been very privileged to sit down with amazing guests and agriculture influencers, the latest of whom is Robynne Anderson of Emerging Ag. If you haven't already, you can access these conversations on our YouTube page or wherever you source your favourite podcasts.

Until next time. ■

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and imports by Southeast Asia are approaching 10 million tonnes.

CONCLUSION

While potentially available land could support a strengthening of Brazil's position as the leading producer and exporter of soybeans, the prospects for further expansion of China's role as the globe's preeminent importer may become constrained by an ageing and either an already or soon to be decreasing population.

Nevertheless, given the projections of continued growth of both the global population and the global middle class, rising demand for high-quality soybean protein and oil would seem to be assured throughout the foreseeable future. A less concentrated and more diversified import market could benefit all participants in the global soybean sector. ■

Expanding Plant-Based Food Market Leads to Expanding Opportunities

Miranda Burski, Marketing and Communications Consultant, Protein Industries Canada

THERE'S NO QUESTION that the global demand for plant-based food, feed and ingredients is increasing. Between a growing worldwide population, the desire to lead a healthy lifestyle and support for a sustainable food value chain, many consumers are turning to plant-based foods and beverages for part or all of their protein needs.

According to an Ernst and Young Report recently commissioned by Protein Industries Canada, the global market for alternative-meat products alone is expected to reach up to CDN$180 billion by 2035. Based on this estimate, Protein Industries Canada expects the overall global plant-based foods market to reach CDN$250 billion by the same year.

Canada is in a particularly good place to benefit from this growth. Bill Greuel, Chief Executive Officer of Protein Industries Canada, expects the country's plant-based food, feed and ingredients sector could supply 10 percent of the global market or one in every ten plant-based meals. Importantly, this ability will be driven, in part, by the rising demand for ingredients derived from Canada's diverse raw commodities.

"It looks very promising for the crops that we produce at scale here in western Canada," Greuel said. "Consumers want choice, and these diverse sets of plant-based ingredients that we can create from the crops we produce in western Canada give that choice."

While soy is expected to remain in the top spot as the plant-protein ingredient of choice, western Canada's more traditional crops — such as peas, lentils and other pulses — won't be far behind. The Ernst and Young Report estimates the demand for crops used in alternative-meat products could rise to approximately 66 million tonnes, with soy and peas making up more than half of the crop mix.

Ensuring Canada reaches these goals won't be an easy task, but it will be achievable. One particularly important step toward such an achievement is an alignment and proper leveraging of strengths across the country — and among every link in the value chain.

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Laura Schmidt, Production Specialist – West

CHECKING PEA NODULATION

Pea nodules develop as early as 14 days after emergence. To evaluate peak nodulation, check nodules at R1 (flower bud stage). Peas have indeterminate nodules, meaning they tend to branch as they grow and form clusters. This makes it a bit more difficult to count than soybeans or dry beans. So, we use a scoring system instead.

Visit three areas of the field and gently dig up 5–10 plants. Wash roots to gently remove soil. Use the checklist to evaluate nodulation.

Take a look at the above-ground portions of the plant — you're looking for green, vigorous growth indicating the plant's getting enough nitrogen. Then, count the number of nodule clusters and note if they are on the crown of the root system near the base of the plant or on the periphery of lateral roots. Break open a few nodules and see if they are pinkish-red, signifying active nitrogen fixing.

Scores of 11–13 indicate effective nodulation. A score between 7–10 suggests less effective nodulation where N-fixing potential is reduced. Investigate to see if this is due to inoculant application errors or poor growing conditions. A score of 1–6 is considered unsatisfactory. Re-evaluate your inoculation strategy including products and placement. At this low level, a rescue N treatment of 50 lbs N/ac is recommended at the 9th to 12th node stages.

			Your Score
Plant Growth and Vigour	Plants green and vigorous	5	
	Plants green and relatively small	3	
	Plants slightly chlorotic (less green)	2	
	Plants very chlorotic	1	
Nodule Colour and Number	Greater than five clusters of pink pigmented nodules	5	
	Three to five clusters of predominantly pink nodules	3	
	Less than three clusters of nodules, or whitish/greenish nodules	1	
	No nodules, or white/green nodules	0	
Nodule Position	Crown and lateral root nodulation	3	
	Generally crown nodulation	2	
	Generally lateral nodulation	1	

11–13 = Effective nodulation 7–10 = Less effective nodulation 1–6 = Unsatisfactory

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Bill Greuel

"What we really need to do is coordinate and collaborate along that ecosystem," Greuel said. "If we're collaborating along the value chain, what we can do is make sure that consumer preferences are communicated back through the value chain very, very quickly. And if there are adjustments we need to make from a plant-breeding perspective — perhaps it's protein functionality or allergenicity or off flavours that we can change via plant breeding — creating that feedback loop makes sure that we're meeting end-use customer demands as efficiently and quickly as possible."

One of Protein Industries Canada's goals is to help move this work along through collaboration and co-investments into projects that advance Canada's plant-based food, feed and ingredients sector. Within Manitoba alone, and together with industry, they've committed more than $143 million into research and technology projects within the sector.

These have varied in focus, from improving traceability and marketing opportunities within the plant-based foods sector to developing new processing technology and ingredients. All, however, have led to benefits along the value chain.

The building and commissioning of new processing facilities provides some of the clearest examples. Over the past year, Merit Functional Foods and Roquette each opened their new facilities within Manitoba while developing new ingredients as part of Protein Industries Canada co-investment projects — Merit Functional Foods with The Winning Combination and Pitura Seeds, and Roquette with Prairie Fava. Both facilities have begun commissioning their products, with their ingredients being used in consumer-facing products sold across North America.

Expanding domestic processing in this manner means consumers have access to new product options, but it also gives farmers new selling options. With a wider domestic market, they have the choice to sell their crops to Canadian processors or to export them to processors around the globe. An increasing domestic market, however, also means fewer environmental impacts related to transporting commodities to those foreign processors, as well as a stronger Canadian economy.

Seeing Canada's plant-based food, feed and ingredients sector reach its $25 billion potential will take work — Greuel estimates the country's processing capacity needs to increase by approximately 6 million metric tonnes to reach demand — but it's work worth doing sooner rather than later.

"I think what we're going to see, over the course of the next five to seven years, countries around the world are going to look at the growth potential of plant protein and build out the infrastructure to meet that demand," Greuel said. "It's important for Canada that we invest now, build the infrastructure now, so that we're so that we're in a position to satisfy that global demand." ■

Clancey's Stats

Are the global base industrial commodity markets entering a supercycle?

Brian Clancey, Senior Market Analyst and Publisher, STAT Communications

THERE IS SOME interesting speculation emerging that global base industrial commodity markets could enter what is termed a supercycle, where demand is greater than supply for several years.

The last two were in the 1970s because of OPEC's (Organization of the Petroleum Exporting Countries) impact on global oil markets and the early 2000s because of steep increases in Chinese demand. The first lasted into the early 1980s and the second until 2014, helped by bullish crude oil markets in 2007 and 2008.

The question is whether agricultural markets get caught up in the excitement over commodities and whether this impacts pulses. There was undoubtedly a strong reaction in global agricultural markets after U.S. President Bush mandated that ethanol be incorporated into automotive fuel.

2000–2014 SUPERCYCLE BACKGROUND

Ethanol's share of the U.S. gasoline market is estimated to have jumped from 1% in 2000 to 10% by 2011. Those increases resulted in the *food or fuel* debate and may also have boosted public interest in sustainable crops and production methods.

Those mandates resulted in bullish market conditions for pulses in 2007 and 2008 largely because of competition for land use with grains and oilseeds. Global price indices for grains, oilseeds and pulses set new record highs in both 2007 and 2008. Values dropped off in 2009 because of production responses.

Grains and oilseeds reached their highest levels in history in 2011 and remained strong through 2014. Surging crude oil markets were a factor because they increased transportation costs and prices farmers had to pay for fuel, fertilizer and other inputs.

Pulse markets were not weak during that period but failed to follow other field crops. Rising seeded area and production levels worldwide moderated prices for pulses even though consumption was rising and the world's residual supplies of pulses were trending lower.

Except for pulses, the end of the supercycle in base commodities in 2014 was followed by lower values for all field crops.

GLOBAL PULSE MARKET SITUATION

Global pulse markets continued to advance through 2015 and 2016, helped by surging imports by India. That countries annual purchases jumped from 3.64 to 6.96 million metric tonnes (MT) between the 2013 and 2017 calendar years.

Dramatic changes in import policies and initial efforts to reach self-sufficiency in pulse production saw its imports collapse to around 2.5 million MT in 2018. They recovered to over 3.3 million in 2019 but reached only 2.88 million in 2020 despite efforts to drastically boost lentil imports.

India's demand helped global pulse exports leap to 19.12 million MT in 2017. They sank to 17.61 the following year but rebounded to 19.15 million last year, with China's demand for pulses for use as a livestock feed ingredient becoming a significant factor. Expansion of the fractionation sector helped increase domestic disappearance levels in several countries. Still, the quantity of whole pulses it consumes is less than one would think, given the dollar values being discussed.

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Global pulse markets have languished since 2016 and 2017. So far, between 2018 and this year, the index has averaged 76.55 points, compared to 88.19 during the same four-year period a decade earlier.

However, it has been trending upward this season, setting a new season-high of 88.4 points during the week ending March 19. That has coincided with steady gains in old crop grain and oilseed values. Demand has also been relatively good despite the end of COVID-19 coronavirus stockpiling. This impact on movement was partly offset by steep reductions in opening season inventories of most pulses, which helped moderate the impact of larger crops.

Several new crop grain and oilseed markets are heavily discounted to spot, but markets are starting to wonder if signals from China are intentionally bearish. On the other hand, there are offsetting doubts. Some believe China's harvest will be smaller than hoped, while others think new disease strains will halt the hog herd's expansion, reducing overall feed demand.

Those are short- to medium-term considerations. Suppose those analysts who think the world is entering the start of another supercycle in global base industrial commodity markets are correct. In that case, that could have an impact on global agricultural markets.

AGRICULTURAL MARKET DEVELOPMENTS

Agricultural markets lagged the start of the last supercycle by a year or more. We did not see the full impact until after 2009. That is not surprising as it takes time for higher costs to work their way to farmers. It also takes time for any economic benefits to be felt in the amount and diversity of foods people eat. There may be some key differences between what might happen and what happened in the past. Historically, there has been a fairly strong correlation between crude oil prices and those for field crops. Investment in oil production and refining has declined in recent years, while investment in alternate energy has maintained a relatively good pace. More importantly, the cost of producing alternate energy has declined. Several research projects are underway, which promise greatly improved storage capacity and efficiency for electric cars and other uses.

During the transition, there is good reason to believe oil prices will be affected. It is still a key ingredient in a wide range of industrial and consumer products. Apart from that, general strength in industrial commodities does impact cost across the field crop marketing chain. To the extent that makes farming less profitable, field crop markets will respond.

IN CONCLUSION

Sometimes prices for field crops are slow to respond to demand. More than once, market participants have lifted their heads from their book and declared, "Oh my gosh, there is not enough left!"

Prices reflect the sum of all the information held by all participants. No one individual or system has access to all the data. This can result in demand creep no matter how good the reporting systems for pending sales.

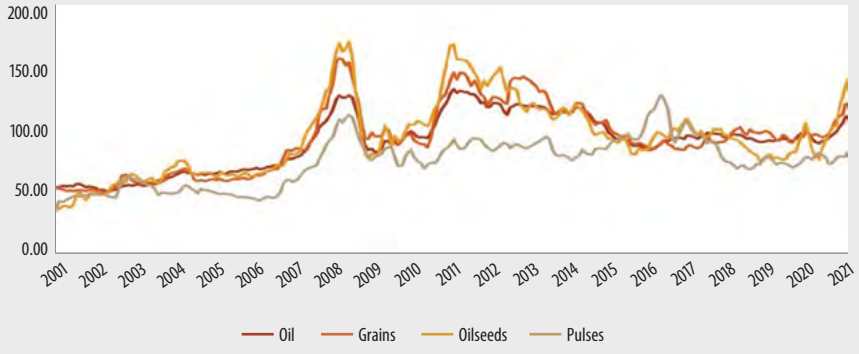
At the moment, inventories of pulses are thought to be more than ample in some destinations. If they see improved local demand, those importers may not react until it is absolutely certain they need to buy.

Such sentiments can run through all of agriculture. As a result, prices could appear to languish for an extended period of time. Upward trends may not be recognized until they become obvious.

The implication is that if 2021 or 2022 mark the start of a new supercycle in base commodities, it may not be reflected in agricultural markets until 2023 or 2024 because of the need for the economic benefits to become more widely distributed and global economic activity fully recovers from 2020. ■

World Price Index Comparison

(2014–2016 equals 100)



There We Go, Droning On and On About Tech – *Drone Tech*

Toban Dyck, MPSG's Director of Communications and Matthew Johnson, M3 Aerial and Volatus Unmanned Services

AT MANITOBA PULSE & Soybean Growers (MPSG), we talk about technology an awful lot. It's something many of us are personally interested in, but agricultural technology is also a topic on which we have perspective. Our researchers, agronomists and technicians have a keen sense of the complex technologies that are being implemented to deliver some of the agricultural advancements many farmers are taking for granted. Plant breeding, genetics, soil and plant science, scouting and many more pieces of agricultural scaffolding rely heavily on smart technology and smart operators.

During the last number of *Pulse Beat* editorial meetings, we've discussed including content explicitly focused on agricultural technology, believing this topic to be of interest to a large number of farmers. The technological requirements associated with being able to attend virtual meetings have contributed to placing our interest and, dare I say, dependence on technology on an exponential growth trajectory.

How many of you have upgraded your laptops, earbuds, microphones and/or webcams over the past year? I have.

Here is a quick rundown of what I use in my home office. I have two laptops—my work computer and my personal—connected via HDMI cable to one 27-inch monitor. I toggle between which computer is being broadcast to my monitor using an HDMI switch (pictured). I use a Blue Snowball USB microphone with a pop filter I purchased on Amazon. I also opted for an aftermarket webcam. I bought the Logitech C920. It is much more reliable than my computer's camera and it gives the user more control over how his or her image appears. When I use earbuds, I use ones with a built-in microphone (most come stock with this feature). All of these have made the home office more efficient. It's tech I use.

This article isn't about general consumer electronics, though. It's about drone technology. It is of particular interest to me. I have had DJI Mavic Pro drone for a couple of years now, and I use it regularly. Last year, I took the test and acquired a license to operate it in eligible areas and only in a hobbyist capacity. As in, I can't get paid for my drone footage. That requires an advanced licence.

I have used my drone to get a closer look at areas of fields that historically don't produce like the others, but only exhibit signs of slowing well far enough into the growing season that crop trampling is a concern.

I also use it for recreation. I've cobbled together farm videos on iMovie and capture footage of our fields getting custom sprayed.

We asked Matthew Johnson, of M3 Aerial Productions and Volatus Unmanned Services, for his perspective on drones and drone technology in the agriculture sector. You may recognize his name. The companies he is involved with are quite active in agriculture, and he has certainly appeared at many ag events.

Here is what he has to say:

Farm Tech That Benefits You

Drones are providing crop insight we only dreamed about 10 years ago.

DRONE TECHNOLOGY IS quite a recent phenomenon. It was only about a decade ago when I first started hearing in the news that, this will be the year of the drone. This new miracle technology promised people the world, and, though it could do some incredible things, it couldn't quite do everything. People had high expectations in agriculture for drones, and now, finally, drones are beginning to lift their weight in digital ag.

You may be an independent producer looking to utilize drone technology to expand your own understanding of your crops. You may be an agronomist providing clients with powerful insights and advice. You could even be an input provider, service provider or research scientist. Whatever your role in the field of agriculture, drone technology has developed to a point where you are able to derive real value from a relatively low investment in time and resources.

Where is this value coming from all of a sudden? The analytics. The data that drones are collecting is becoming more reliable every year. Cameras are increasing in megapixel size, batteries are lasting longer and longer, but the number one reason for the tipping point we are witnessing in the industry is the software that can look at the data and tell us what we want to know.

In the last couple of years, there have been some major developments in artificial intelligence and machine learning algorithms that have made it

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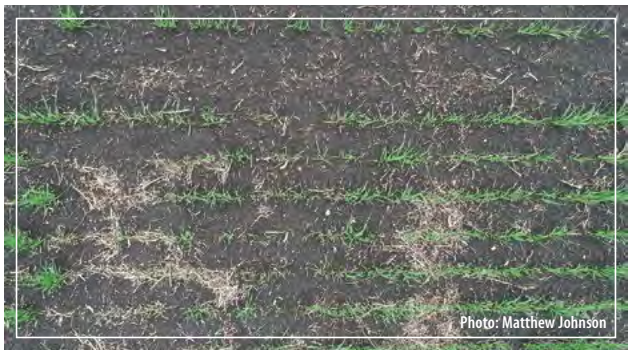
A DJI Phantom 4 Pro equipped with a multi-spectral sensor conducts an early-emergence diagnostics flight on a field near Winnipeg, Manitoba in May, 2020.



Growth rates vary drastically between plants that are just a few feet away from each other. Understanding the underlying variability can help determine why some plants grow faster, and some are stunted. A field near Portage la Prairie, Manitoba in June, 2020.

possible for software programs to identify metrics, such as the number of wheat heads in a field.

How about the number of skipped seeds, or the number of growing stands? Do you want to know how many doubles in your corn or soybean field? Or, use the tech to assign a quantitative value to the growth performance of a single plot, precise to a factor of 100,000, and also for the 10,000 additional plots all around it. Then take a look at the data and determine, based on an objective, quantitative analysis, which single plot is performing the best. We are even able to conduct a thermal scan of an entire field to determine where seeds that are planted in soil that is just a few degrees colder than its surroundings may end up taking a few extra days to emerge.

I have been working in the drone industry since 2015, and I have been specializing in the digital and precision agriculture space since 2016. I have seen first-hand how these technological marvels have developed over the years. If you've been on the fence for a while about drones, it might be time to take a closer look, because the drone itself has become very easy to program and fly, and the data workflows have become much more simplified.

I founded M3 Aerial Productions in 2015, but recently became part of Volatus Unmanned Services, a nationwide drone service provider, manufacturer and training authority. Now, I am spending most of my time in the field, either capturing data for clients, or showing them the ropes and getting them started with their own drone programs.

Maybe data collection isn't your primary focus. Perhaps you are more interested in showing off your excellent product to potential buyers, like at a good old-fashioned field day event that have become a little less frequent since we were blindsided by COVID-19. Drones are making it easier to attend the field day from your living room. Now obviously it's hard to beat the ability to touch, smell and see the plants in all their glory in person, but in the absence of that luxury, we make do with what we have. Volatus is working with a few seed producers to help them display their products by hosting virtual field days, with live and pre-recorded tours that allow you to get up close and personal with the plants.

Whether you have been using drones for a while, or if you are brand new; if you are interested in learning about some of the newest developments that are reshaping the way we think about collecting and looking at crop data, now is the time. You don't have to be an expert. My company is there to help facilitate the introduction of drones into your farming operations to help you find the most value. The old drone on the shelf idea is gone. It's time to actually use it for what it can do. ■

On-Stage with Farmer/Musician Bryce Pallister

An MPSG director profile

Toban Dyck, Director of Communications, MPSG

BRYCE PALLISTER'S GRANDMA wasn't around to see him graduate, but he finished his agriculture degree for her.

"Every time I would go visit her, she would ask, 'when are you going to get your degree?'" said Pallister. "So, I got it for her. I ended up getting both my agriculture diploma and my degree."

Pallister was elected to Manitoba Pulse & Soybean Growers' Board of Directors during the association's virtual AGM in February.

He farms alongside his brother, William, his father, Jim, and Marlo McArthur, a long-time employee-turned-partner.

I called him at 8 a.m. sharp. My dad was heading to the field with the seed tender he and I had filled a few minutes prior to this interview. Pallister's dad may have been on the field, too. I never asked (I always think of the good questions too late).

When I called him, Pallister had just finished the morning meeting, giving direction to the farm's staff, comprised of four permanent employees, 10 or so seasonal workers and a van-full of retired farmers, who help out when things get really busy.

"We service the tractors and combines and the van with retired farmers arrives a few hours later to just jump into the combine and go," said Pallister.

Managing people is a special skill and it's something he enjoys, so I had to ask, "What's your secret?"

"It's not easy managing people," he said. "What is the key? Age—it probably helps. Also, be calm. Roll with the flow. As farmers, we get mad about the mistakes that get made on the farm, but really the mistakes that an employee can make are usually pretty minor compared to the mistake we can make as owners. If you, say, use the wrong chemistry and the weeds didn't die, or you sold and the price increases, or you didn't sell to the right buyer. The stakes are so much greater for us owners."

Pallister's farmyard is located west of Portage la Prairie, close to Hwy 1. Most of his family-run operation's land is located north of Portage, and they also farm in the community of Edwin, which is located southwest of Portage. It's safe to say, Portage la Prairie is an agricultural region the Pallisters are familiar with.

Pallister is not an unfamiliar surname in Manitoba and for reasons both obvious and perhaps less obvious. "You can Google me," said Pallister. "I'm on there. I was a solo artist."

"Bryce Pallister—Driftn" is the first video that comes up, amid a grouping of three others that appeared below a link to his Twitter account and a sampling of Google images of him, with his guitar and his band.

"I've been farming since I was a kid. Well, I had a music career for a few years. I was a country singer," he said. "Semi-professional would be the classification, I guess. I was always farming at the same time.

It was during the "semi-professional country singer" part of his life when he met his wife, Jenna, a nurse currently working at the Rapid Access to Addictions Medicine (RAAM) Clinic.

Jenna and Bryce have three children: Dawson, son, five; Evelyn, daughter, three; and Aimelie, daughter, one.

"Five, three and one. It would probably make you wonder why I became interested in joining the MPSG board. You'd think I have enough going on in my life," said Pallister, amid our laughter. "We moved into where I grew up—the main farm site. We're taking that over, and yeah, the kids are all running around here and things are good."

The Pallisters grow wheat, canola and their staple crop, edible beans. "Navies and pintos, primarily."

They have, in his words, "dabbled in soybeans, dabbled in corn and we've dabbled in red lentils," something he says they couldn't resist trying three or four years ago when the prices had spiked.

"Soybeans are a little tricky for us due to the potential for cross-contamination with our edibles," said Pallister. "It's a fear, really—a fear of getting the edibles and the soys mixed up. We've definitely grown them and they are a good crop. But, you can only grow so many crops, I guess."

Pallister enjoys the marketing and management side of his family's operation, and he especially enjoys no longer being in charge of human resources, a responsibility he passed along to his brother, William, who, according to Bryce, is much better at it than he was.

There are roles assigned to each partner of the Pallister farm, but he was quick to clarify that everyone still does a little bit of everything.

"I like running a crew. When it's harvest time and I'm sending guys in 15 different directions. That's the part I enjoy. The pressure, "said Pallister. "It's also fun to see new ideas/innovations through, getting to see the fruits of those changes. A big example on our farm happened a few years ago when we moved from swathing our edibles to direct-harvest with a flex header. It was one of those generational changes. Dad had been swathing for years and doing it successfully. We had a couple

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of bad, wet falls, 2017 and on. That was what really drove the change. We had some quality issues, and then just the labour requirement of swathing on our scale was pretty stressful. We took the plunge and moved into straight-cutting our edibles and it has worked well."

Pallister utilized MPSG's on-farm trial results as well as its research on edible beans and soybeans to help them through this transition. He applied what MPSG released regarding air reels, cutting angles and combine settings to their farm's switch from swathing to straight cutting. They worked hard to augment their headers to limit edible-bean splits, damage and losses.

Pallister joined MPSG's board to challenge himself, expose himself to smart people and people interested in similar things.

"With fewer and fewer farms around, you have to go a little farther to find contemporaries, colleagues and like-minded people, "he said. "That was part of it. And to be challenged by those people. Once COVID-19 is done, we'll participate more in meetings and we'll be able to get out and talk to farmers. It'll help expand my network."

For Pallister, correcting the misconceptions the general public already has or are developing about agriculture should be a priority for the sector. Ignoring this mandate could pave the way for these misconceptions to grow, fester and lead to unnecessary restrictions being foisted onto farmers, keeping them from producing as much food as they possibly could, according to Pallister.

"We're making food more affordable to the whole world by maximizing production, which should keep food costs down. The problem is, it's not enough of an issue in the rich world. We're hiding from the fact that there are a lot of hungry people out there," he said. "If groundless policies are tying one of our hands behind our backs, that's one bushel per acre less for somebody who really needs that food—needs those calories."

Pallister's farm runs three, 20-plus-year-old seeders and, in general, runs older machinery, favouring its money going to skilled employees able to keep old iron in dependable condition over signing expensive service contracts to the greens, reds and yellows of the ag world. "I guess the one thing that makes our farm unique is that we try to run older equipment," said Pallister.

We had been chatting for a while at this point. Pallister was coordinating the receiving of a shipment of something, having to leave our conversation for brief spells to deal with the many things that no doubt compete for his time during the growing season.

"Hey, Steve—Sorry, Toban—Hey, Steve. It's 20 total."

I don't know what that meant or to whom he was speaking, but I knew I only had room for one more question:

"When you think about the 2021 growing season, what are you most excited about?" I asked.

"I am excited about this day: it's summer. It's the middle of the growing season and I'll be looking at the forecast and hoping it doesn't rain because we've received way too much already. That's a day I am looking forward to, "said Bryce Pallister. "I have been looking forward to a day like that since 2016." ■

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IT'S GROW TIME

*Source: 2020 AgData BPI Pulse Fungicide Report.
**Participation is limited and in the discretion of Bayer.

Your Investment at Work

MANITOBA Pulse & Soybean GROWERS

Maximizing Your Research Investment

Daryl Domitruk, PhD, PAg, Executive Director, MPSG

THIS EDITION OF *Pulse Beat* contains the annual list of research projects that MPSG has orchestrated and funded on behalf of members. At this point in the cycle, the list is at its maximum. There are more projects underway than have been completed. That will soon change as the five-year program cruises through year four and researchers start wrapping up projects that started as far back as 2018. By spring of 2023, the list will be much shorter. Of course, we hope and anticipate that governments will renew programs to support research resulting in the build-up of projects once again. Our overall goals for the new era of funding were discussed in the previous issue.

Our last round of multi-year projects under CAP received approval in late 2020. These new projects are distributed across three of four priority areas. In our yield and quality category, three projects were introduced. With the opening of opportunities for dry bean production in the southwest, we've tapped AAFC Brandon to perform trials to improve fertilizer recommendations specifically for that region. Lately, more peas are being planted, so PAMI is updating our knowledge on the potential for air-seeder damage to seed coats. Dry seed plus high distribution velocity can spell damaged seeds and poor emergence. Digital ag remains somewhat mysterious. As a result, we're working with a local soybean breeding start-up and AAFC Morden to determine if digital images of plants can improve the selection of lines with IDC and drought tolerance.

Moving to the category of reducing pest control costs, we've introduced two projects. We count very much on post-emergent herbicides to remove weed interference. Of course, there are frequently patches that show up later. Often, these are patches of herbicide-resistant weeds to which we respond by spot-spraying, mowing or cultivating. We time these operations to prevent the setting of viable seed. Other escapes occur as weeds emerge after the early season post-emergent application. It is often assumed later weed flushes pose no threat to weed seed build-up. The problem with patches and late flushes is that for many weeds, we don't know when seed viability kicks in. Workers at AAFC Lethbridge will lead a study involving the University of Manitoba (U of M) that will examine the phenology of common weeds and record the point in their development when their seeds become viable and a threat to subsequent crops. MPSG is co-funding this work with Manitoba Crop Alliance. Another pest project involves testing weather-based fungicide application models for dry beans. Easy-to-use disease models help reduce fungicide costs. The project is being conducted by Assiniboine Community College.

In the soil health category, two projects are joining the lineup. Multiple groups have come together to fund PAMI to evaluate the effect of low ground pressure traffic systems on compaction and subsequent crop emergence. Over at U of M, we welcome a new research collaborator Dr. Matthew Bakker in the Faculty of Science. Matthew is adding to our effort to understand soil biology under annual legumes. Combined with other studies, we're headed toward a good understanding of the value of legumes to soil health and important phenomena such as soil carbon maintenance.

In other news, Western Grains Research Foundation (WGRF) celebrated its 40th anniversary. The WGRF program is broad and deep...and very large. Over $200 million has been contributed to research since 1981!

Recently, WGRF released a study on the future research needs of the crops sector. A survey of 60 groups, including MPSG, showed that farmers foresee needs for research in artificial intelligence, precision ag (fertilizer recommendations), new crops, alternate methods of pest control, more efficient breeding technologies and biological soil amendments.

Some of these are new ideas, while others are long-standing needs put in the context of mid-21st century farming. Underlying the recommendations was strong support for independent, unbiased research to support the business decisions of farmers. Check out the WGRF website for details. A couple of years back, western pulse growers nominated Newdale's own Bruce Dalgarno to sit on the WGRF board. Bruce continues to serve dutifully, and his efforts are much appreciated. ■

Funding Approved for Research†

RESEARCHER	PROJECT	START	END	MPSG FUNDING	TOTAL VALUE
	CROP YIELD AND MARKET QUALITY				
MPSG – MCVET	Evaluating Yield, Disease Resistance and Protein in Pulse and Soybean Varieties	1990	ongoing	cost recovery	cost recovery
AAFC – Mohr	Management Practices to Optimize Establishment and Early-Season Growth of Soybeans	2017	2021	$73,462	$144,022
IHARF				$35,280	
CMCDC				$35,280	
U of M – Lawley	Cover Crop Strategies for Dry Beans and Soybeans in Manitoba	2017	2022	$195,444	$195,444
AAFC – Mohr	Sustainable Soybean Cropping Systems for Western Manitoba	2017	2022	$98,325	$196,651
U of M – MacMillan	Soybean Iron Deficiency Chlorosis – Variety Screening	2017	ongoing	In 2016, MPSG committed $400,000 per year for five years to support applied research at the U of M. Under this program an Agronomist-in-Residence conducts research, extension and student training. Projects are reviewed annually to ensure they align with farmer priorities.	
U of M – MacMillan	Effect of Preceding Crop and Residue Management on Dry Beans	2017	ongoing		
U of M – MacMillan	Optimizing Nitrogen Rates for Dry Bean Production	2017	ongoing		
U of M – MacMillan	Novel Pulse Cropping Systems	2017	ongoing		
U of M – MacMillan	Pea Crop Rotation Length and Sequence	2020	2023		
U of M – Lawley	Optimizing the Frequency of Soybeans in Manitoba Crop Rotations	2018	2023	$172,931	$496,588
U of M – Ayele	Mitigating Soybean Harvest Losses by Enhancing Podding Height	2018	2022	$71,453	$164,822
AAFC – Hou	Dry Bean Breeding for Early Maturity and Pest Resistance	2018	2023	$728,188	$1,456,376
AAFC – Bing	Pea Breeding for Yield, Pest Resistance and Flavour	2018	2023	$98,630	$2,776,828
AAFC – Han				$43,155	
AAFC – Cober	Short-Season Food-Type Soybean Breeding	2018	2023	$186,930	$2,368,188
AAFC – Cober	Meeting the Soybean Protein Meal Standard in Western Canada	2018	2023	$131,699	$658,500
U of G – Rajcan	Breeding for Organic Soybean Production	2018	2023	$20,000	$157,143
MPSG – On-Farm Network	Soybean Response to Seeding Rate	2012	ongoing	OFN	OFN
MPSG – On-Farm Network	Evaluation of Single vs. Double vs. No inoculation Strategies for Soybeans	2017	ongoing	OFN	OFN
MPSG – On-Farm Network	Soybean Response to Biological Stimulants	2019	ongoing	OFN	OFN
MPSG – On-Farm Network	Soybean Response to Row Spacing	2019	ongoing	OFN	OFN
MPSG – On-Farm Network	Evaluation of Inoculation Strategies for Peas	2019	ongoing	OFN	OFN
MPSG – On-Farm Network	Evaluation of Inoculation Strategies for Dry Beans	2019	ongoing	OFN	OFN
MPSG – On-Farm Network	Dry Bean Response to Nitrogen Fertility	2019	ongoing	OFN	OFN
MPSG – On-Farm Network	Intercropping with Soybeans	2019	ongoing	OFN	OFN
MPSG – On-Farm Network	Pea Response to Seeding Rate	2021	ongoing	OFN	OFN
WADO	Intercropping Practices for Yellow Peas	2019	2022	$23,004	$69,012
AAFC – Mohr	Economic and Environmental Value of Peas and Soybeans in Rotation	2019	2022	$82,800	$160,560
U of M – Stasolla	Genetics to Overcome Drought and Salinity Effects in Soybeans	2019	2022	$139,725	$270,945
U of M – House	Overcoming the Discount for Low Protein: Genetic and Environmental Effects	2019	2021	$48,875	$140,635
U of M – Oresnik	A Superior Rhizobium Strain for N-Fixation in Dry Beans	2019	2022	$188,830	$366,166
MPSG/MCA/MCGA	Tools and Techniques to Manage Extreme Moisture	2019	2022	$120,000	$823,000
U of M – House	Evaluating the Feeding Value of Western Canadian Soybeans for Layers, Pullets, Broilers and Swine	2020	2023	$239,760	$479,520
U of M – Oresnik	Effect of the Frequency of Soybeans in Rotation on Rhizobium and Soil Microbial Community	2020	2023	$110,486	$214,247
Roquette	Variety Adaptation Trial for Higher Protein Peas	2020	2022	$0	$17,064
Roquette	On-Farm Assessment of Precision Phosphorus Management for Crop Dry-Down	2020	2022	$0	$17,280
Roquette	Better Understanding of Return on Investment of Intercropping Combinations	2020	2022	$0	$18,507
Roquette	Efficacy and Return on Investment of Foliar Fungicide in Yellow Peas	2020	2022	$0	$64,800
Roquette	Pea Protein Survey/Investigation in the Swan River Region	2020	2020	$0	$5,076
Roquette	Volunteer Soybean Control in Yellow Pea Production	2020	2022	$0	$22,200
AAFC – Mohr	Optimizing Nitrogen and Phosphorus Management for Dry Beans in Southwestern Manitoba	2021	2023	$93,150	$186,300
PAMI	Pea Seed Mortality Due to Air Seeder Damage	2021	2023	$31,050	$62,100
Morden Community Economic Development Corporation	Validating Opportunities and Building Local Capacity for Digital Agriculture	2021	2023	$32,000	$202,000

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RESEARCHER	PROJECT	START	END	MPSG FUNDING	TOTAL VALUE
	REDUCE THE COST OF PEST CONTROL				
U of M – Gulden	Rotational Effects and Optimized Plant Spatial Arrangement for Wheat Production in Manitoba	2017	2022	$82,800	$349,140
U of M – Costamagna	Determining the Role of Crop and Non-Crop Habitats to Provide Sustainable Aphid Suppression in Soybeans	2017	2021	$107,838	$215,677
MPSG – On-Farm Network	Field Pea Response to Foliar Fungicide	2017	ongoing	OFN	OFN
MPSG – On-Farm Network	Dry Bean Response to Foliar Fungicide	2017	ongoing	OFN	OFN
MPSG – On-Farm Network	Soybean Response to Foliar Fungicide	2018	ongoing	OFN	OFN
MPSG – On-Farm Network	Faba Bean Response to Foliar Fungicide	2020	ongoing	OFN	OFN
AAFC – McLaren	Management of Root Rot in Peas in Manitoba	2018	2023	$0	$88,305
U of A				$45,404	
AAFC – Vankosky	Prairie Insect Survey	2018	2023	$20,000	$571,000
AAFC – Leeson	Prairie Weed Survey	2018	2023	$25,000	$753,100
AAFC – Leeson	Prairie Herbicide-Resistant Weed Survey	2018	2023	$3,000	$88,000
AAFC – Geddes	The Next Generation of Prairie Herbicide-Resistant Weed Surveys	2020	2023	$48,445	$96,890
AAFC – Turkington	Prairie Disease Monitoring Network	2018	2023	$45,000	$1,360,000
AAFC – Geddes	Glyphosate-Resistant Kochia – Rotation, Seeding Rates and Row Spacings	2018	2023	$15,000	$1,282,000
PAMI – Landry	Spray Drift Reduction with High-Clearance Sprayers	2018	2023	$30,000	$424,000
AAFC – Mohr	New Crop Rotation Economics	2018	2023	$35,000	$1,300,000
U of L – Leroy	Economics of Diverse Crop Rotations	2018	2023	$15,000	$351,000
AAFC – Chatterton	Optimizing Disease Management Strategies for White Mould and Bacterial Blights of Dry Beans	2018	2023	$61,951	$616,904
AAFC – Chatterton	Pea Root Rot – Resistance Genes, Crop Rotation and Intercropping	2018	2023	$30,679	$1,636,818
U of S – Shirtliffe				$18,426	
U of M – Tenuta	Root Lesion Nematode Survey	2018	2023	$20,639	$853,813
AAFC – Chatterton				$4,975	
AAFC – McLaren	Strategies for Effective Management of Phytophthora and the Root Rot Complex of Soybeans	2018	2023	$75,506	$887,919
LU – Bélanger	Root Diseases – Genetic Screening Methods	2018	2023	$44,657	$652,776
U of M – Daayf	Defining Pathogen-Related Soil Quality Targets for Annual Legumes to Pursue Through Crop Rotation	2019	2022	$88,172	$253,782
AAFC – Geddes	Integrated Weed Management to Mitigate Glyphosate-Resistant Weeds	2019	2022	$110,940	$309,984
Roquette	Developing the Capacity to Detect and Quantify Aphanomyces Oospores and Disease Severity in Manitoba	2020	2022	$0	$36,936
AAFC – Geddes	Manipulating Weed Seed Production Through Phenology-Based Weed Control	2021	2023	$11,556	$92,448
ACC – Singh	Developing a Weather-Based Fungicide Application Decision Support Tool for Managing White Mould in Dry Beans	2021	2023	$41,850	$83,700
	GROW MARKET DEMAND				
U of G – Duncan	Cholesterol-Lowering Properties of Dry Beans	2018	2023	$136,431	$757,680
AAFC – Ramdath				$47,196	
U of S – Nickerson	Pulse Ingredient Processing for Improved Flour Quality	2018	2023	$103,802	$2,866,150
AAFC – Hou				$12,571	
AAFC – Balasubramanium	Dry Bean Cooking Quality	2018	2023	$15,942	$87,444
	IMPROVE SOIL QUALITY				
U of M – Lawley	Cover Crops – Establishment Windows, Soil Health and Yield	2018	2023	$40,000	$1,519,772
MPSG – On-Farm Network	Tillage Management for Dry Beans	2020	ongoing	OFN	OFN
AAFC – Crittenden	Understanding How Soil Health Affects Corn and Soybean Yield and Quality	2020	2023	$60,350	$241,400
New Era Ag	Using Wood Ash as a Soil Amendment to Control Clubroot – Effect on Peas and Soybeans in Northwestern Manitoba	2020	2023	$7,500	$153,540
Agri-Earth Consulting, PBS Water Engineering	Beneficial Practices for Soil and Water Quality, Excess Water and Drought Resiliency in Southwestern Manitoba	2020	2023	$33,729	$391,200
PAMI	The Effect of Low Ground Pressure Traffic Systems on Soil Compaction in Heavy Clay Soils Affected by Extreme Moisture Conditions	2021	2023	$21,000	$137,500
U of M – Bakker	Integrating Microbiology into Assessments of Soil Health in Manitoba	2021	2023	$37,827	$151,308

† At time of printing.

AAF – Alberta Agriculture and Forestry
AAFC – Agriculture and Agri-Food Canada
BU – Brandon University
CMCDC – Canada-Manitoba Crop Diversification Centre
IHARF – Indian Head Agricultural Research Foundation
LU – Laval University
MCGA – Manitoba Canola Growers Association
MCVET – Manitoba Crop Variety Evaluation Trials
MPSG – Manitoba Pulse & Soybean Growers
MCA – Manitoba Crop Alliance
PAMI – Prairie Agriculture Machinery Institute
RRC – Red River College
U of A – University of Alberta
U of G – University of Guelph
U of L – University of Lethbridge
U of M – University of Manitoba
U of S – University of Saskatchewan
WADO – Westman Agricultural Diversification Organization


Mycosphaerella blight in peas

The Pea Report

All Things Ascochyta

Taking the complexity out of the Ascochyta/ Mycosphaerella complex in peas

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

THE COMPLEX

The Ascochyta/Mycosphaerella disease complex in peas consists of *Ascochyta pisi* causing leaf and pod spot, *Phoma pinodella* causing foot rot and *Mycosphaerella pinodes* (*Peyronellaea pinodes* or *Ascochyta pinodes*) causing the majority of symptoms and yield loss in Manitoba field peas. It is a complex, but research has shown that *M. pinodes* is responsible for most of the crop damage, accounting for roughly 95% of infections. *M. pinodes* is the most aggressive species, followed by *P. pinodella* and then by *A. pisi*.

Historically, *A. pisi* was a bigger problem. In the 50s, it accounted for roughly 85% of infections. Ten years later, that number was down to about 5% thanks to the advent of a resistant variety, Century, in 1961. Unfortunately, that was also about the time when *M. pinodes* took off. Over the past ten years, *A. pisi* has become more prominent again, but it has not been a major contributor to yield loss in field peas.

Mycosphaerella pinodes overwinters on crop residues and in soil. It is the only species of the Ascochyta complex to form a sexual spore stage (called ascospores), allowing disease transmission over long distances by wind dispersal. In early summer, ascospores are produced and spread by wind. Symptoms develop within two to eight days after infection. Secondary infection from asexual spores within the plant canopy amplifies the disease. Most of the infections in western Canada are due to initial infection by wind-blown spores, with secondary infection occurring later in the season after canopy closure.

This sexual stage of the life cycle also imparts more genetic diversity. This means that any resistance mechanisms that crop breeders have been able to identify in the pea germplasm are quickly overcome in the field. Breeding was an effective tool to manage *A. pisi*, but the hunt for resistance to *M. pinodes* continues. Most varieties grown nowadays have moderate resistance to Mycosphaerella. Lodging resistance and

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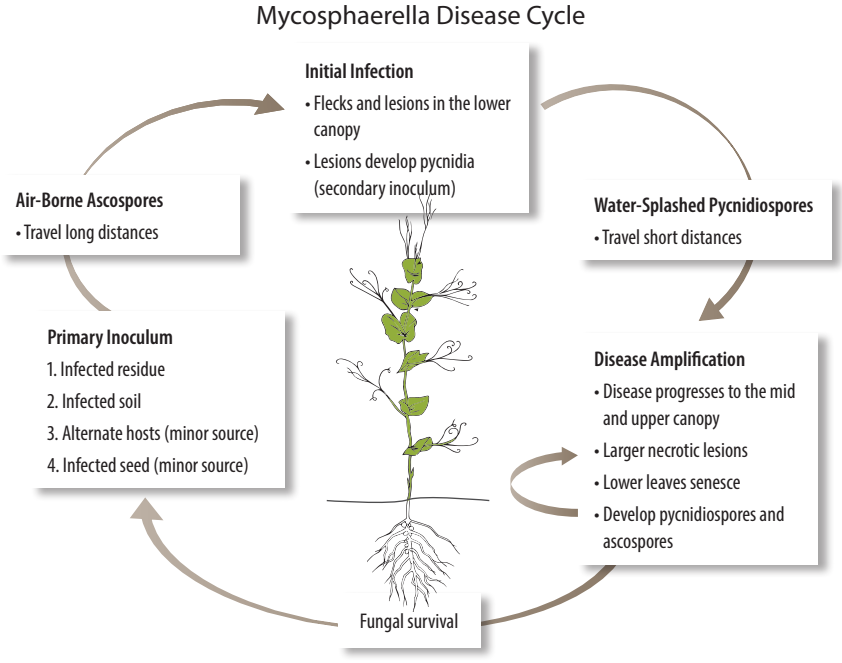

Table 1. Symptoms of each species in the Ascochyta/Mycosphaerella complex in field peas.

	A./M./P. pinodes	*A. pisi*	*P. pinodella*
Symptoms	Early symptoms found in the lower canopy. Start as small, dark flecks that enlarge and eventually coalesce. Leaves with many lesions wither before lesions become large.	Well-delineated, sunken, tan lesions with clear, dark borders. Numerous black, spore-producing pycnidia develop within these lesions. On stems, results in deep necrotic lesions and stem breakage occurs.	Similar symptoms as Mycosphaerella, but foot rot is the most typical symptom. Foot rot tends to begin at the point of seed attachment and extends as a bluish-black lesion above the soil line, weakening the stem.

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Mycosphaerella resistance have been positively correlated, so selecting varieties with improved lodging resistance may help as well.

PRIMARY SPORE SOURCES

Primary inoculum produce the ascospores that are responsible for the initial infection of Mycosphaerella blight in pea plants. There are four sources of primary inoculum—infected pea residue/stubble, soil, nearby alternate hosts or volunteers and seed. Wind-borne spores released from infected pea residues are the main source of inoculum, followed by soil-borne inoculum.

Infected residues are specifically the residue or stubble left above ground and unburied following pea harvest. Inoculum from these residues is initially high but drops to very low levels after one year. When planning to grow peas, consider the field history of surrounding fields. If the neighbouring field was peas last year and had high disease pressure, peas might not be the best option there since the crop residue will actively be releasing spores. One option to manage this source of inoculum is by burying residue two inches deep following pea harvest, reducing spore production and disease development in subsequent nearby pea crops.

On the other hand, soil-borne inoculum persists for a long time. Research from Australia found that soil-borne inoculum decreased by 15% per year, suggesting that a break period of six years is necessary to reduce the inoculum borne in the soil. *M. pinodes* and *P. pinodella* can survive and overwinter in the soil, while it is rare for *A. pisi* to be soil-borne.

In areas where peas are common and thus where there are more infected pea residues producing spores, inoculum from alternate hosts has been deemed a minor source of infection. Recent research infected 20 legume species with *M. pinodes* and found that Mycosphaerella caused visible symptoms on 19 of the species evaluated—the exception being dry beans. Peas were the most susceptible, followed by lentils, lupins, medics, clovers, fenugreek and vetches. Ascochyta species of other pulses like lentils and chickpeas are more specific and only infect their lentil and chickpea hosts, respectively. The Ascochyta species infecting faba beans are intermediately specific—infecting mainly fabas, but also slightly infecting soybeans, dry beans, clovers and common vetch.

Late-season Mycosphaerella infection at the R5 stage.

The fourth source of inoculum is seed-borne. Seed infection with Ascochyta/Mycosphaerella does not contribute substantially to above-ground disease symptoms. However, very high levels of seed infection do reduce seedling emergence. In western Canadian growing conditions, infected seeds are not regarded as a source of inoculum.

DISEASE AMPLIFICATION

Ascospores (sexual spores) and pycnidiospores (asexual spores) are released throughout the season by infected plant tissues within the crop. Spores are transmitted by rain splash onto neighbouring plant tissues and disease progresses up the plant canopy, becoming more severe. Only a small portion of these secondary spores escape the plant canopy.

FUNGICIDES

Fungicides are the main line of defence against Mycosphaerella blight. The optimal timing for application is at R2 (beginning bloom) stages, but can be delayed if conditions are not conducive to disease development. Use the *Field Pea Fungicide Decision Worksheet* to determine if an application is recommended. Once peas reach R4 (full pod), fungicide application is no longer recommended since disease is no longer expected to influence yield and peas are within the preharvest interval of several products.

Infection timing directly relates to yield loss. Infections that initiate at mid-flowering and at the 8–10 node stages result in greater yield loss than those that start at pod fill stages. If symptoms do not progress beyond the lower third of the plant canopy by the flowering stage, large yield losses are not expected.

A single application is often adequate for disease control if conditions are drier. Two applications are more common in wet years and have been shown to be beneficial if wet conditions persist and disease is progressing up the plant canopy. Find the results of On-Farm Network testing of fungicides in peas on page 35.

Table 2. Average effect of fungicide on Mycosphaerella blight severity and yield of peas at Minto and Hamiota from 2015 to 2016.

Fungicide	None	One App	Two Apps
Leaf severity (0–9)	4.3 a	3.6 b	2.7 c
Stem severity (0–9)	2.5 a	1.7 b	0.7 c
Yield (bu/ac)	51.2 b	54.0 ab	57.4 a

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INSENSITIVITY TO STROBILURIN FUNGICIDES

Resistance to the strobilurin fungicides (FRAC group 11) has been confirmed in Mycosphaerella, with resistance reported in North Dakota, Saskatchewan and Alberta. Though it has been reported and confirmed in those regions, it is currently unknown how widespread this resistance is in Manitoba.

Since all fungicides in FRAC group 11 use the same targeted mode of action, resistance to one likely means resistance to all of the fungicides in that group. There are two types of fungicide resistance that develop—quantitative, where the pathogen is less sensitive to the fungicide and higher rates or additional applications still work, and qualitative, where the pathogen is completely insensitive to the active ingredient. Strobilurin resistance is typically qualitative, meaning these products will not provide control of the pathogen (Table 3).

In 2016, Robyne Bowness confirmed the first report of *M. pinodes* insensitivity to pyraclostrobin (Headline) at low to moderate levels of resistance in SK and AB. This was followed up by research by Dr. Bruce Gossen, where surveys found 72% of Mycosphaerella isolates from SK were insensitive to strobilurins, indicating they were likely no longer effective in the field. On-going research in ND is finding widespread insensitivity as well. In chickpeas, resistance developed throughout the *Ascochyta rabiei* pathogen population completely in two to three years, and it seems that resistance is developing quickly in *M. pinodes* too.

Since we don't know what the spread of resistance is in the Manitoba pathogen population, I would caution that if you're applying a group 11 fungicide on peas, monitor fields for management of the disease. Wind-blown ascospores are a main vector of disease, so it is likely that these resistant populations are here. Select fungicides with multiple modes of action and rotate to fungicides of a different group for sequential applications.

Most fungicide options for field peas are a combination of a group 3 or 7 with an 11 (Table 3). Products with a group 3 or 7 alone have a medium risk of resistance development down the road and contact products like chlorothalonil and copper octanate have a low risk. In previous ND studies (2011-2012), products containing prothioconazole, fluxapyroxad+pyraclostrobin and azoxystrobin have provided excellent control of Mycosphaerella, while boscalid and penthiopyrad were less effective. There is a need in Manitoba to test fungicide efficacy, especially with newer products on the market and the likelihood that a fungicide-resistant pathogen population has developed since these products were last tested.

Table 3. Fungicides with Ascochyta/Mycosphaerella blight on the label for field peas in the 2021 *Guide to Field Crop Protection*. Group 11 strobilurin fungicides have been highlighted in red.

Trade Name(s)	Fungicide Group(s)	Active Ingredient(s)
Acapela	11	picoxystrobin
Bravo 500, Echo 720	M5	chlorothalonil
Cotegra	3, 7	prothioconazole and boscalid
Cueva	M1	copper octanate
Delaro 325 SC	3, 11	prothioconazole and trifloxystrobin
Dyax, Priaxor	7, 11	fluxapyroxad and pyraclostrobin
Elatus	7, 11	azoxystrobin and benzovindiflupyr
Headline EC, Mpower Spade	11	pyraclostrobin
Lance AG	7, 11	boscalid and pyraclostrobin
Lance WDG	7	boscalid
MIRAVIS Neo 300SE	3, 7, 11	pydiflumetofen, azoxystrobin and propiconazole
Proline Gold	3, 7	fluopyram and prothioconazole
Quadris, Azoshy 250 SC, Quasi	11	azoxystrobin
Quilt, Fungtion SC	3, 11	azoxystrobin and propiconazole
Vertisan	7	penthiopyrad

SEEDING RATES

Reducing seeding rate does not appear to be an effective tool to manage Mycosphaerella blight severity in field peas. In trials at Minto, Hamiota and Morden, lowering seeding rates only marginally reduced disease severity and often only did so at very low plant populations (< 50 live plants/m^2). The influence of pea seeding rates on blight severity will be further investigated in the On-Farm Network this year.

INTERCROPPING

Intercropping may have the potential to reduce Mycosphaerella blight disease levels. In Spain, growing peas with faba beans, barley, oats, triticale and wheat reduced disease—both the amount of diseased tissue per plant and the progression up the canopy. Intercropping peas with faba beans or triticale provided the greatest suppression, reducing disease by 60%. Oats, wheat and barley, had low to moderate suppressive effects. Intercrops were credited with less disease presence due to the combination of less pea biomass to infect, an altered crop microclimate and physical barriers to spore dispersal.

Local research from WADO at Melita has indicated that oats are a promising companion crop with peas in Manitoba conditions. Preliminary results of intercropping peas with barley resulted in lower leaf disease and earlier maturity in barley, ease of harvest and increased barley and oat protein. Intercropping may also provide further benefits through reduced blight severity. ■

Keep it Clean – What's New this Year?

KEEP IT CLEAN provides annual updates as part of its effort to ensure growers and their advisors are aware of the impact certain crop protection products can have on market access. Keep it Clean's purpose is to help growers protect their investment and ensure their crops meet the requirements of Canada's domestic and export customers. There are three updates to the 2021 *Keep it Clean Product Advisory* for pulse crops:

DIQUAT

Maximum residue limit (MRL) concerns for diquat (e.g., Reglone) have been effectively resolved, removing it from the advisory for the 2021 growing season. In the fall of 2020, the US EPA established tolerances for diquat on pulse crops that are now harmonized with Canada's MRLs for pulse crops at 0.9 ppm.

CHLOROTHALONIL

Chickpea growers should be on alert when using the fungicide chlorothalonil (e.g., Bravo ZN) as MRLs for all pulse crops will be revoked in the EU and established at the default level of 0.01 ppm later this growing season. Chickpeas treated with chlorothalonil may pose a marketing risk if exported to the EU, and it is recommended that growers consult with their grain buyer before using this product this growing season. There are no major marketing concerns for chlorothalonil applied to peas or lentils.

GLYPHOSATE

Growers will notice the use of a new notation within the 2021 advisory. An "MA" notation was introduced this year to bring further transparency to when a classification is made due to a MRL-related trade issue or a potential market acceptance trade issue. The MA notation has been applied to pre-harvest glyphosate use for peas and lentils as MRLs are established in all major markets; however, potential marketing risks may still be present due to the scrutiny of glyphosate within the global market place.

UPDATES FOR NON-PULSE CROPS

Growers can also find important information for cereal and canola crops within the *Keep it Clean Product Advisory*. For cereal crops, growers should be aware of potential marketing risks associated with the use pre-harvest glyphosate, saflufenacil and chlormequat. For canola, growers can now treat their crop with metconazole (e.g., Quash) and quinclorac.

WHAT CAN YOU DO TO MITIGATE RISK?

With Canada exporting 85 percent of its pulses, the success of our industry depends on maintaining access to key international markets. To protect your investment and ensure your crops are acceptable in all markets, **use acceptable pesticides only—those that are registered for use in Canada and won't create a trade concern, and always read and follow the crop protection product label**. Improper or off-label use of crop protection products may result in unacceptable residue levels that can jeopardize a producer's marketing options, as well as market access for all Canadian crops.

Consult the *Keep it Clean Product Advisory*, which outlines what crop protection products may restrict marketing options due to missing or misaligned MRLs in our export markets or market acceptance issues by certain buyers.

THE WORK BEHIND KEEP IT CLEAN

Pulse Canada, the Canola Council of Canada and Cereals Canada continuously monitor potential marketing risks in major export markets and will communicate these risks back to the value chain while effort is taken to address the risks. We also encourage all life science companies to commercialize new crop protection products responsibly, which means making sure that any market access issues or other potential problems have been addressed before a new product is introduced or before a new use is added to the label.

The process of responsible commercialization is voluntary and relies on a strong commitment to open communication and co-operation throughout the value chain. With rare exceptions, co-operation throughout the industry has been very strong. In addition, we are always working with the Canadian government and industry partners to encourage other trading nations to adopt more consistent review processes and import rules.

More information at keepingitclean.ca or follow @KICCanada on Twitter.

If you have any questions on the program, please reach out to Greg Bartley, Director of Crop Protection and Crop Quality with Pulse Canada at **GBartley@pulsecanada.com**

Know the Market Impacts of Your Crop Protection Decisions

The **2021 Product Advisory** on the other side this document outlines the market risks that can arise from using certain crop protection products on some crop types. **Growers are encouraged to review this information before proceeding with crop management plans.**

Products listed in the advisory may restrict marketing options due to missing or misaligned maximum residue limits (MRLs) in our export markets or market acceptance issues by certain buyers. Growers must be aware of these restrictions and take appropriate risk mitigation steps to ensure product residues remain below MRLs set by regulatory agencies.

WHAT CAN YOU DO TO MITIGATE RISK?

Ensure product residues remain acceptable for both domestic and export customers by following these tips:

1. USE ACCEPTABLE PESTICIDES ONLY

Only apply pesticides that are both registered for use on your crop in Canada and won't create trade concerns.

- **Consult with your grain buyer** to ensure the products you are using are acceptable to both domestic and export customers.
- **Refer to the Product Advisory** (other side) for information on market considerations and classifications of specific crop protection products.

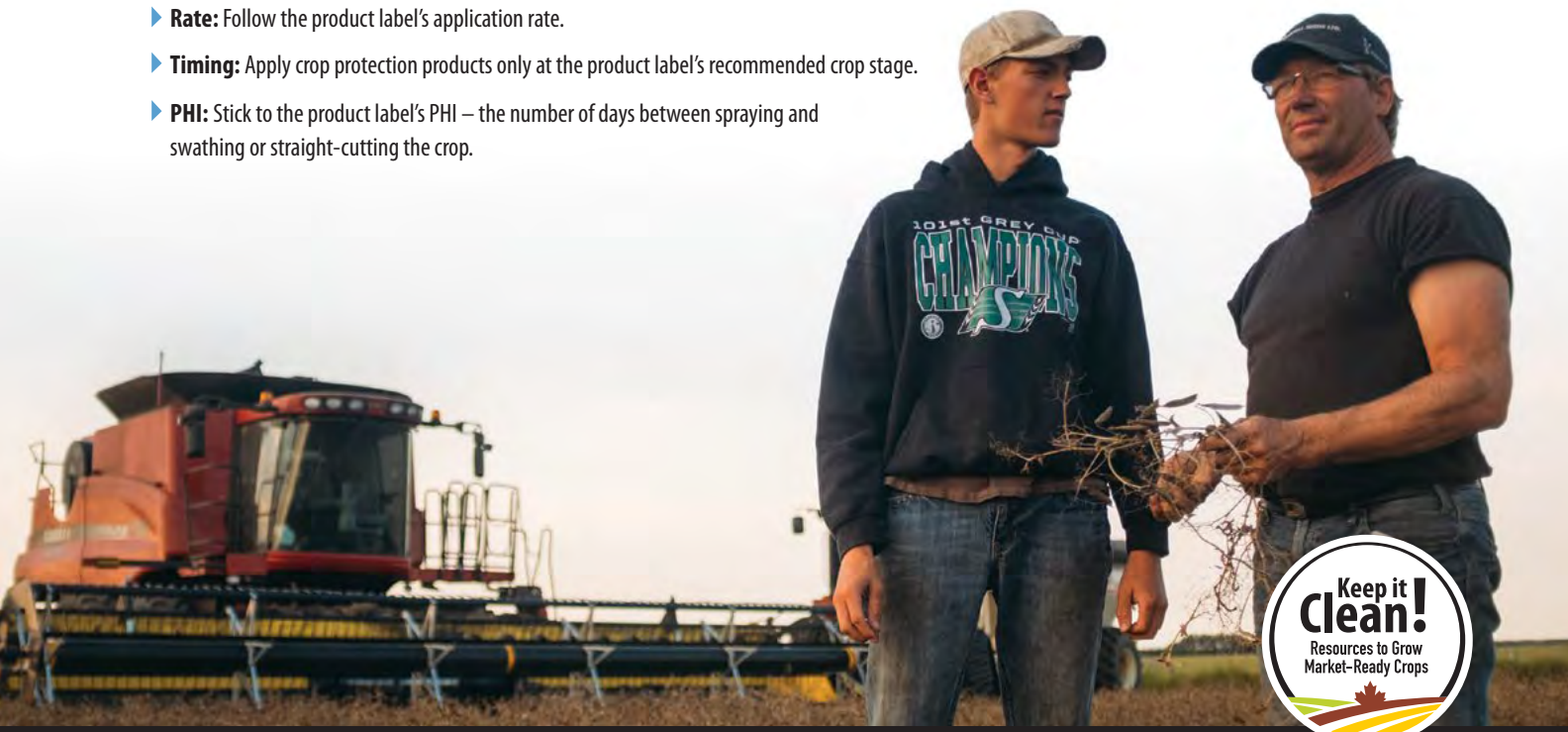
2. ALWAYS READ AND FOLLOW THE LABEL

Always follow the label for application rate, timing and pre-harvest interval (PHI).

- **Rate:** Follow the product label's application rate.
- **Timing:** Apply crop protection products only at the product label's recommended crop stage.
- **PHI:** Stick to the product label's PHI – the number of days between spraying and swathing or straight-cutting the crop.

> *I always have a copy of the Keep it Clean Product Advisory on-hand.* ***It's an important tool to help keep our crops market ready.***

COREY LOESSIN | Radisson, SK
canola, lentils, oats, peas and wheat



Keep it Clean! Resources to Grow Market-Ready Crops

canolacouncil OF CANADA | PULSE CANADA | Cereals Canada | Conseil de l'orge du Canada | Barley Council of Canada | Prairie Oat Growers Association

keepitclean.ca | @KICCanada

2021 Product Advisory

Be aware of market risks associated with these crop protection products/crop types.

CEREALS	OATS	WHEAT	MALT BARLEY	BARLEY		COMMENTS
Pre-harvest weed control						
Glyphosate (e.g. Roundup)	!	!	⊗	!		Grain buyers will not accept **malt barley** if treated with pre-harvest glyphosate. Glyphosate is registered for pre-harvest weed control. **Do not use as a desiccant.** To prevent unacceptable residues in the harvested grain, only apply pre-harvest glyphosate when grain moisture content is less than 30% in the least mature part of the field. Consult with your grain buyer before using this product on **wheat, barley and oats**. Some grain buyers may not accept cereal crops treated with pre-harvest glyphosate. **Strictly follow the product label guidelines** to minimize scrutiny in the global marketplace.
Saflufenacil (e.g. Heat Harvest)	NR	✓	⊗	✓		Grain buyers will not accept **malt barley** if treated with saflufenacil.
Plant Growth Regulator						
Chlormequat (e.g. Manipulator)	✓	✓	!	!		Check with your grain buyer to **confirm contract obligations and acceptance** before using chlormequat on **barley for malt, food or feed**.

PULSES	PEAS	LENTILS	CHICKPEAS	DRY BEANS	FABA BEANS	COMMENTS
Fungicide						
Chlorothalonil (e.g. Bravo ZN)	✓	✓	!	NR	NR	Consult with your grain buyer before using chlorothalonil on **chickpeas**. MRLs will be revoked in the EU and established at low levels.
Pre-harvest weed control						
Glyphosate (e.g. Roundup)	! MA	! MA	!	!	!	Glyphosate is registered for pre-harvest weed control. **Do not use as a desiccant.** To prevent unacceptable residues in the harvested grain, only apply pre-harvest glyphosate when grain moisture content is less than 30% in the least mature part of the field. **Consult with your grain buyer before using this product on pulse crops**. Some grain buyers may not accept pulse crops treated with pre-harvest glyphosate due to scrutiny in the global marketplace and low MRLs for some pulse crops in certain major markets.
Desiccant						
Glufosinate - Western Canada (e.g. MPower Good Harvest)	NR	⊗	NR	NR	NR	**Do not use glufosinate on lentils as a crop desiccant**. There is an elevated risk of MRL-related trade disruption due to missing or very low MRLs in most major markets. Grain buyers will not accept treated lentils.
Glufosinate - Eastern Canada (e.g. Ignite)	NR	NR	NR	!	NR	Consult with your grain buyer before using this product on dry beans in Eastern Canada. MRLs are missing or set at low levels in most major markets.

PULSES PRODUCT UPDATE: Diquat (e.g. Reglone) has been removed from the advisory as MRL concerns have been resolved.

CANOLA PRODUCT UPDATE: Canola can be treated with metconazole (e.g. Quash) and quinclorac (e.g. Clever, Facet and Masterline Quinclorac). There are no market concerns with products registered for use on canola.

- ✓ No market risks identified in major markets. Treated crop accepted by most grain buyers.
- ! Be informed. Treated crop may not be accepted by some grain buyers. Consult with your grain buyer before using this product.
- ⊗ Do not use. Treated crop will not be accepted by grain buyers.
- NR Not registered. Only use registered product.
- MA Market acceptance issue. Maximum Residue Limits (MRLs) are established in major markets but marketing risks may still be present.

Keep it Clean! Resources to Grow Market–Ready Crops

Last update, May 11, 2021. Any further updates will be posted at keepitclean.ca/product-advisory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HOT TOPICS in COMMODITIES

Webinar Summaries

Earlier in the year, MPSG teamed up with Glacier Farm Media and the other commodity organizations to bring you the Hot Topics in Commodities webinar series.

During the soybean webinar, Kristen P. MacMillan provided a summary of the applied pulse and soybean lab's results, discussing seven research projects in just under four minutes a piece. She returned during the pulses webinar to provide an overview of three on-going dry bean research projects.

Dr. Syama Chatterton provided a summary of her most current research on root rots in peas. Specifically, the yield robbers Aphanomyces *and* Fusarium avenaceum.

Find the recorded webinars at manitobapulse.ca.

Soybeans

Putting Soybeans to Work on Your Farm *was presented by Kristen P. MacMillan and covered the applied pulse and soybean lab's recent research on soybean agronomy topics in Manitoba.*

SEEDING WINDOW

The soybean seeding window is flexible in Manitoba. There was no difference in soybean yield when planting throughout May 1 to 24. Yield was reduced by 15%, on average, when delaying seeding until May 31 to June 4.

On the flip side, seeding can be too early in western Canada. Soybeans are susceptible to frost and cool soils. Check the average date of the last spring frost in your area, avoid cool soils below 8°C and make sure there is no cold rain in the forecast for the first 24–48 hours after planting.

Seeding during the second week of May maximized yield potential while avoiding cold soil and the risk of late spring frost.

LATE SEEDING OF SOYBEANS

Can 80% yield potential be maintained with June seeding? In short, yes, in southern Manitoba at the Portage and Morden sites, but not in shorter and cooler growing areas of the province like Arborg. At Arborg, as seeding was delayed, yield was reduced by up to 35% and the risk of a fall frost was just too great.

These results may mean extending seedling deadlines in southern areas like Portage and Morden to the first week of June, but not in other growing areas, due to the risk of early fall frost.

SEEDING DEPTH

Is there a yield penalty if we seed soybeans deeper, seeking moisture in dry conditions? Even under dry soil conditions like those experienced from 2017–2019, it was not beneficial to seed deep. According to this research, the optimal seed depth range was .75 to 1.75 inches, where yield was maximized at 1.25 inch seed depth. Precipitation at Arborg and Carman over the three years of this study was 40 to 70% of normal during May and June, but the rains always came.

This research found a 20% yield loss from shallow seeding (<.75 inch) and a 10% yield loss from seeding too deep (>1.75 inches). At shallow depths (<.75 inch), seeds imbibed water and then dehydrated and desiccated. Yield loss from deep seeding can likely be attributed to the loss of cotyledons, hypocotyl swelling, chlorosis and delayed emergence.

Measure your seed depth while seeding and post-emergence when doing plant counts to make adjustments for next time.

IRON DEFICIENCY CHLOROSIS (IDC)

How much is yield affected by IDC in Manitoba? In this study, each 0.1 unit increase in IDC reduced yield by two to three bu/ac. As a next step, Kristen's lab is investigating if there is a trade-off between IDC score and yield, and working to identify varieties that perform well in both IDC and non-IDC areas of the field, to manage it more precisely in the future.

HAIL DAMAGE

On average, from 2009–2018, the majority of hail events occurred from July 1 to August 31. Specifically, in soybeans, the greatest losses from hail claims occurred from V7 to V10, which coincides with flowering and pod fill.

Previous estimates for assessing hail damage in soybeans have underestimated yield loss by as much as 30%, especially when high levels of leaf defoliation occur from V3 through R4. For example, no yield loss is currently attributed to defoliation during soybean vegetative stages, but this new Manitoba research found significant yield loss during V3 with 100% leaf loss.

Results of this study will be made available to farmers, agronomists and crop insurance adjusters to more accurately estimate the impact of hail damage on soybean yield and maturity.

FOLIAR FUNGICIDES

There have been no significant yield responses to foliar fungicide in soybeans over three years of testing (2017–2019) at Carman. This is consistent with the findings from MPSG's On-Farm Network. The foliar diseases we commonly see in Manitoba are not yield robbers. ■

Pulses

DRY BEAN AGRONOMY UPDATE

Three research projects have been underway in the soybean and pulse agronomy lab to support dry bean production in Manitoba. This is a summary of the findings from all three projects to date. Full details can be found in the annual report available at manitobapulse.ca.

PRECEDING CROP AND RESIDUE MANAGEMENT

Pinto bean production can be successful following a range of crops (wheat, corn, canola or dry beans) and under direct seed conditions in Manitoba with no penalties to plant stand or yield. But there were important and clear agronomic effects on weed density and root rot in this study that should be considered in crop rotation planning.

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Comparison of *Aphanomyces euteiches* and *Fusarium avenaceum* root rots.

A. euteiches	*F. avenaceum*
• Highly specialized, infecting mainly pea and lentil crops. • Produces long-lived soil resting spores (oospores). • Prefers warm soil and excessive soil moisture.	• Generalist with broad host range. • Survives on stubble, bridging from crop to crop. • Prefers very warm soil and more moderate soil moisture (may set in later).

Nodules on dry bean roots fertilized with 0, 40, 70 and 140 lbs N/ac (left to right) in an on-farm trial.

For example, pinto beans grown on wheat stubble had grassy weed pressure that was 4x greater than beans grown on corn stubble. This suggests that the herbicide program in the preceding crop can influence the following year's crop. Beans grown after beans had higher root rot pressure—something that will depend on each field's history and soil moisture conditions. And it should be noted that white mould was not present in any of these trials, but past white mould pressure is an important consideration when selecting bean fields.

OPTIMIZING NITROGEN RATES

Dry beans are an N-fixing legume, but nitrogen (N) has traditionally been supplied by fertilizer rather than N-fixation. This is because the N-fixing capability of beans is relatively low compared to other pulse crops. N-rates are being revisited in Manitoba to update old research and to investigate the relationship between N-fertilization and root nodulation, due to the common, yet peculiar, presence of root nodules in fertilized bean crops around the province. Rates of 0, 35, 70, 105 and 140 lbs N/ac were tested from 2017 to 2019 in both small-plot and on-farm trials.

Emerging N fertility guidelines for dry beans from this study:

1. *No supplemental N and no inoculation*—The most economical practice so far from five site-years. Expect 86–93% of maximum yield.
2. *Supplemental N at 35 lbs N/ac or ~70 lbs total N*—If skipping fertilizer is too risky, you can achieve maximum yield without reducing nodulation with this practice.
3. *Inoculation*—Not a viable option yet but will become a good option as product availability and testing increases.
4. *Inoculation and supplemental N?*—Has not been tested yet.

EVALUATION OF DRY BEAN INOCULANTS

This ongoing study was initiated in 2019 to assess the impact of newly available dry bean inoculant products, including BOS peat and Primo GX2 granular (not yet available to Manitoba farmers).

Preliminary findings show that dry bean nodulation and yield response to inoculant depend foremost on the environment. A statistically significant response was found at one of the three site-years in this study, in which Primo GX2 boosted nodulation and yield. All bean market classes behaved similarly. Recent testing in Saskatchewan from five site-years has shown no response to inoculant in CDC Blackstrap black beans.

There is still much to learn on this subject, including how much N is being acquired by modern bean varieties through N-fixation in our Manitoba environment.

THE COMPLEX TALE BEHIND ROOT ROT IN PEAS

Dr. Chatterton leads a research program at AAFC Lethbridge, focusing on root rots in pulse crops across western Canada. Here are the main take-aways from her presentation.

The two main root rot players in peas are *Aphanomyces euteiches* and *Fusarium avenaceum* that act together in infecting roots. *F. avenaceum* is the most common, but there are several other Fusarium species that can be found in peas.

One main driver for Aphanomyces infection is soil moisture. In Manitoba, Aphanomyces was present in more fields and at higher incidence in the wetter years of 2016 and 2019, compared to lower levels in the dry years of 2017 and 2018.

The other main driver is crop history. The threshold for Aphanomyces to develop is 100 oospores/g of soil. At a starting population of 1,000 oospores/g of soil, it takes at least five to six years to drop below the threshold and seven to eight years at a starting population of 10,000 oospores/g of soil. This is where the current recommendation comes from to wait six to eight years before growing peas again on a field with Aphanomyces pressure. Starving the pathogen of its hosts will reduce soil inoculum.

However, there is still more to learn on the impact of pea or lentil frequency in rotation, with research currently underway (2020 was year three of a five-plus year study). So far, soybeans, faba beans and chickpeas appear to be alternate crops that do not increase disease inoculum in the soil. Dry bean susceptibility to Aphanomyces varies by variety and market class.

Other ongoing research is focused on intercropping peas with brassicas like canola and mustard. Early results have shown a yield boost from intercrops but no reduction in disease severity.

For 2021, choose your pea fields very carefully, considering crop frequency, performance, weather (e.g., was it a wet year the last time you had peas on a certain field?) and field conditions. Get your soil tested, consider seed treatment for low risk or patchy fields and test your roots in-season. ■

Advanced root rot in peas from infection by both Fusarium and Aphanomyces.

2020 Foliar Disease Survey and On-Farm Fungicide Trial Results

Cassandra Tkachuk, Production Specialist – East and Laura Schmidt, Production Specialist – West

Each year, a representative sample of soybean, field pea and dry bean fields are surveyed for root, foliar and stem diseases across Manitoba. These surveys are a collaborative effort between Agriculture and Agri-Food Canada, Manitoba Agriculture and Resource Development and Manitoba Pulse & Soybean Growers. Here are the results from the 2020 foliar and stem disease surveys. Root rot results can be found in the spring 2021 issue of Pulse Beat.

The On-Farm Network has also been testing the use of foliar fungicides in soybeans, dry beans and field peas over the past several years to evaluate the performance of these products under a range of environments. Find the on-farm results after each survey summary in this article.


Northern Stem Canker

SOYBEAN DISEASE SURVEY

A total of 66 fields were surveyed for soybean foliar and stem diseases at the R6 (full seed) stage in 2020. Soybeans were visually assessed for infection by bacterial blight, Septoria brown spot, downy mildew, frogeye leaf spot, northern stem canker, white mould, pod/stem blight and anthracnose.

Bacterial blight and Septoria brown spot were again the most common foliar diseases of soybeans in Manitoba (Table 1). These diseases were easily identified in fields, but mainly present at low severity levels, meaning their impact on yield was low overall. A severity level of one means only trace symptoms of that disease were found.

We are generally more concerned about soybean stem and root diseases than foliar diseases. Stem disease levels were low in 2020, having little to no impact on yield. Northern stem canker is relatively new and has somewhat risen the ranks, partially due to a longer soybean-growing history in Manitoba and more confident diagnosis by surveyors. We plan to continue monitoring the lower crop canopy for this and other stem diseases in future surveys.

Table 1. Prevalence, incidence and severity of soybean foliar and stem diseases from 66 fields in Manitoba in 2020.

		Region (number of fields surveyed)				
Foliar Disease	**Rating**	**All of Manitoba (66)**	**Central (25)**	**Eastern/ Interlake (21)**	**Northwest (4)**	**Southwest (16)**
Bacterial blight	Prevalence[1]	92%	80%	86%	100%	100%
	Incidence[2]	60%	74%	51%	71%	47%
	Severity[3]	1.26	1.4	1.08	1.57	1.32
Septoria brown spot	Prevalence	80%	84%	76%	75%	88%
	Incidence	55%	59%	57%	58%	35%
	Severity	1.11	1.05	1.12	0.77	1.11
Downy mildew	Prevalence	27%	12%	67%	50%	69%
	Incidence	9%	6%	12%	42%	7%
	Severity	0.24	0.12	0.34	0.66	0.29
Frogeye leaf spot	Prevalence	32%	24%	28%	25%	44%
	Incidence	2%	2%	3%	1%	3%
Stem Disease						
Northern stem canker	Prevalence	24%	44%	0%	25%	25%
	Incidence	4%	7%	0%	6%	3%
White mould	Prevalence	8%	12%	0%	50%	6%
	Incidence	1%	1%	0%	2%	0%
Pod/stem blight	Prevalence	5%	4%	5%	0%	0%
	Incidence	1%	2%	1%	0%	0%
Anthracnose	Prevalence	5%	12%	0%	0%	0%

[1] Average percentage of fields with some level of infection [2] Average percentage of plants infected within infected fields
[3] Average disease severity of infected plants within infected fields on a scale of 0 (no disease) to 5 (severe symptoms with defoliation)

ON-FARM EVALUATION OF FOLIAR FUNGICIDE IN SOYBEANS

Since 2014, 66 replicated and randomized field-scale trials have been conducted through the On-Farm Network to evaluate foliar fungicide in soybeans. The main goal for fungicide application in soybeans is to control white mould. However, white mould (Sclerotinia) is not the yield robber in soybeans that can be in other crops.

Of the 66 site-years, 11 (17%) have had significant yield responses. Only six of those significant site-years (9%) resulted in a positive return on investment, where the yield increase was great enough to cover the cost of fungicide application (Figure 1).

An economic response of 9% boils down to a profit from fungicide in one out of 11 years. If you were to utilize fungicide

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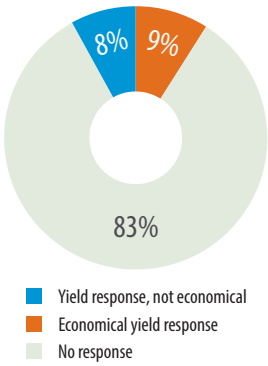


Figure 1. Soybean yield and economic response to foliar fungicide from 66 site-years of on-farm trials (2014–2020).

each year for 11 years, that would amount to an approximate accumulated cost of $165/ac. Your single-year profit boost might be $1/ac to $20/ac, but it is not enough to cover the accumulated cost from years where it did not pay for itself.

How do you predict the year where you will see a profit boost? Determine the likelihood of disease development each season and in each field, since profitability depends on white mould presence. Disease is likely to develop if conditions are wet and cool (< 21°C) leading up to flowering, if your field has a history of white mould and if there are signs of disease development while scouting (e.g., apothecia on the soil surface ahead of flowering). ■


Common Bacterial Blight

DRY BEAN DISEASE SURVEY

In 2020, 39 dry bean fields were surveyed for foliar and stem diseases during mid-August when plants were starting to mature. Most fields were in southern Manitoba and 10% of surveyed fields were outside of the traditional bean-growing regions. Fields were visually assessed for common bacterial blight, halo blight, white mould, anthracnose and rust.

Common bacterial blight was the most prevalent foliar disease in Manitoba (Table 2). It infects plants following any kind of tissue abrasion or damage from strong storms. Foliar products are available, but their effectiveness has been variable so far and they often require multiple applications throughout the season.

ON-FARM EVALUATION OF FOLIAR FUNGICIDE IN DRY BEANS

Since 2016, 14 replicated and randomized trials have been conducted to evaluate foliar fungicide application in dry beans through the On-Farm Network. White mould and anthracnose are the disease targets of foliar fungicide in dry beans, but white mould is the main concern. Anthracnose was not found during the 2020 survey and has not been a recent issue for dry beans due to variety resistance.

Over the duration of these on-farm trials, we have not seen any statistically significant yield responses to foliar fungicide in dry beans. Why? Trial sites were dry and did not have any white mould pressure. If the disease pressure is not there, fungicide will not provide much of a service. It should also be noted that dry beans in these trials were grown on wide rows (30 inches). These trials will continue in 2021 to capture more locations and environments.

Fungicide application timing for dry beans is in July at the start of flowering to protect plants from the potential spread of sclerotinia ascospores through flower petal drop. Intuitively, the amount of dry bean crops infected by white mould follows the trend of July precipitation year to year (Table 3). High rainfall in 2015 and 2016 led to greater disease levels, and it is likely that sclerotia bodies produced from those crops led to higher disease loads in 2017. Looking at the dry years that followed, disease levels were brought down.

For 2021, use rainfall amounts leading up to and during dry bean flowering to anticipate the development of white mould in your fields. Consider field history of host crops and disease pressure. If white mould levels were high in previous crops, the carryover of sclerotia bodies in the soil will increase your risk of disease development. Also scout for signs of disease development ahead of fungicide application and use the *Fungicide Decision Worksheet for Managing White Mould in Dry Beans*. ■

Table 2. Prevalence and severity of foliar and stem diseases from 39 dry bean fields in Manitoba in 2020.

	Prevalence	Severity
Foliar Disease	% fields infected	% leaves infected
Common bacterial blight	82%	12%
Halo blight*	25%	6%
White mould	31%	3%
Anthracnose	0%	0%
Rust	0%	0%

*Calculated from a total of 40 surveyed fields.

Table 3. White mould prevalence and severity from 2015 to 2020 compared to % normal July rainfall, which is a driver of white mould development.

	Prevalence	Severity	Precipitation
Year	% fields infected	% infected plant tissue	% normal July rainfall in central MB*
2020	31%	3.1%	80%
2019	3%	0.7%	75%
2018	3%	1.0%	55%
2017	68%	2.6%	42%
2016	40%	7.3%	137%
2015	45%	5.6%	147%

*Most (90%) of dry bean fields surveyed were in the central region of Manitoba.


Bacterial Blight

continued from page 34

FIELD PEA DISEASE SURVEY

In 2020, 14 pea fields were surveyed for Mycosphaerella blight, bacterial blight, downy mildew, white mould, powdery mildew, anthracnose, rust and Septoria leaf blotch. The number of fields was lower compared to past years due to COVID-19 constraints. Surveying took place during mid- to late-July at the R3 to R4 (flat to full pod) stages.

Find a detailed summary of 2020 results in Table 4 and a summary of Mycosphaerella blight, bacterial blight and white mould results from 2015 to 2020 in Table 5. Mycosphaerella blight has been found in every surveyed pea field since 2015 (Table 5). Over the past five years, the greatest severity of Mycosphaerella blight occurred in 2016 due to wet conditions and a high frequency of summer storms. A score of 6.0 indicates that, on average, plants had symptoms on <20% of the upper canopy, 21–50% of the mid canopy and on 51–100% of the lower canopy. Not reported in Table 5 are powdery mildew, anthracnose and Septoria leaf blotch, which have not been detected in Manitoba in the past five years.

In 2020, bacterial blight was easily identified in 71% of surveyed fields. High infection levels were due to early-season storms and strong winds that wounded plants, creating openings for bacterial blight to infect peas. Thankfully, only 1% of leaf tissue was infected, on average.

Table 4. Prevalence and severity of foliar diseases from 14 pea fields in Manitoba in 2020.

Foliar Disease	Prevalence	Severity
	% fields infected	0–9 scale*
Mycosphaerella blight	100%	3.4
		% infected leaf area
Bacterial blight	71%	1.0%
Downy mildew	57%	0.4%
White mould	14%	0.4%
Powdery mildew	0%	0.0%
Anthracnose	0%	0.0%
Rust	0%	0.0%
Septoria leaf blotch	0%	0.0%

* Average severity of infected plants within infected fields on a scale of 0 (no disease) to 9 (51–100% infection in the upper, middle and lower canopy).

Table 5. Prevalence and severity of field pea foliar diseases in Manitoba from 2015 to 2020.

	Mycosphaerella Blight		Bacterial Blight		White Mould	
	Prevalence	Severity	Prevalence	Severity	Prevalence	Severity
Year	% fields infected	0–9 scale	% fields infected	% leaves infected	% fields infected	% leaves infected
2020	100%	3.4	71%	0.7%	14%	0.1%
2019	100%	3.8	39%	0.1%	0%	0%
2018	100%	4.9	0%	0%	0%	0%
2017	100%	4.5	0%	0%	3%	0.1%
2016	100%	6.0	0%	0%	55%	0.5%
2015	100%	5.4	8%	0.2%	3%	0.1%

ON-FARM EVALUATION OF FOLIAR FUNGICIDE IN FIELD PEAS

Since 2017, 27 randomized and replicated, field-scale trials have been conducted across Manitoba to evaluate foliar fungicide in peas. Of the 27 trials, 17 have compared single vs. no fungicide, two have compared double vs. single vs. none, seven have compared double vs. single and one has compared double vs none (Table 6). Mycosphaerella blight and white mould are the targets of foliar fungicide in peas. However, Mycosphaerella is the main concern in most years.

These on-farm trials have shown us that field peas are more responsive to foliar fungicide than soybeans or dry beans. According to the aggregated results, yield increases occurred 33% of the time, but profit increases only occurred 18% of the time (Figure 2). Overall, the economic responsiveness of peas has been relatively low in these last few drier years.

When we examine the different trial types in Table 6, there have been more frequent, larger and more reliable economic responses from double fungicide application. However, this does not mean that double application is always the best practice. It simply means that double application may be necessary at times to control substantial disease pressure.

Pea yield response to fungicide varies among farms and will only be economical if the disease pressure is there, or if conditions are conducive to its development. Use the new *Fungicide Decision Worksheet for Managing Mycosphaerella Blight in Field Peas* to help you decide if fungicide will be beneficial in your field. ■

Figure 2. Field pea yield and economic response to foliar fungicide from 27 site-years of on-farm trials (2017–2020).

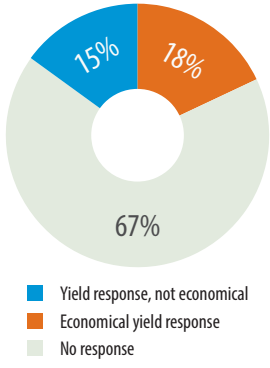


Table 6. Summary of on-farm field pea fungicide trial types over 27 site-years (2017–2020).

Trial Type	Site-Years with Significant Yield Response	Average Yield Response (bu/ac)	Site-Years with Economic Response*	Average Pea Price to be Economical ($/bu)
Single vs. None	4/17	3	1/4	9.2
Single vs. Double vs. None	1/2	8 (1x vs. none) 12 (2x vs. none)	1/1	2.4–3.3
Single vs. Double	3/7	6	3/3	4.4
Double vs. None	1/1	5	0/1	8.8

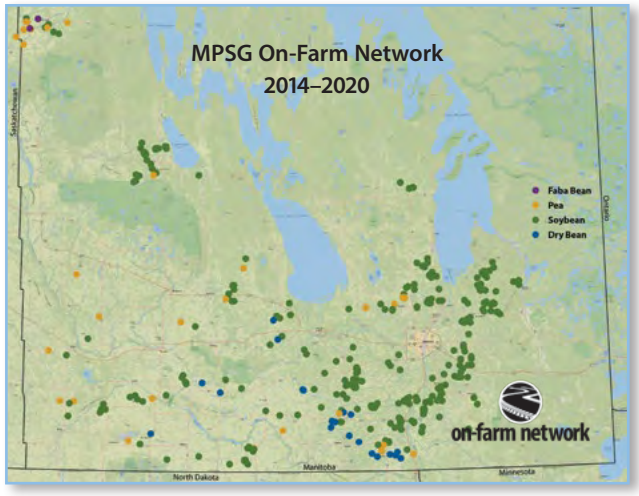
* The total number of site-years reported in this column are lower because economic analysis can only be conducted on statistically significant site-years.

Agronomists Answer Sessions

THE ON-FARM NETWORK (OFN) hosted the first-ever *Agronomists Answer* sessions in early March. These virtual sessions were designed to bring OFN participants, past and present, together in a small group setting to catch up on trial results and discuss production concerns with the OFN Agronomist, MPSG Production Specialists and fellow farmers. This farmer-only event included three sessions: (1) soybeans, (2) peas and faba beans and (3) dry beans.

The soybean session covered a wide range of OFN results from seeding rate and row spacing to inoculant trial results, in-season biological application and responsiveness to fungicide. The pea and faba bean session focused on fungicide decision making and crop responsiveness, with some discussion on pea nitrogen and boron fertility questions, which the OFN investigated in the 2020 season. With the dry bean farmers, the discussion focused on preliminary results of investigating different tillage systems for pinto bean production, nitrogen fertility considerations and findings from the OFN dry bean fungicide trials so far.

Results from all the OFN trials can be found at www.manitobapulse.ca/on-farm-network/on-farm-research-reports. While MPSG shares trial results widely to benefit the broader membership, participation in the OFN has many advantages. In addition to the benefit of results grown right in your fields and on your farm, being an OFN participant enables access to exclusive events such as the *Agronomists Answer* sessions.



The *Agronomists Answer* sessions were well received by the farmers in attendance and the OFN is looking forward to hosting more events with this format in the future. ■

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MANITOBA Pulse Soybean GROWERS

Guide to Conducting On-Farm Trials

WHAT IS AN ON-FARM TRIAL?

On-farm trials are replicated, field-scale strip trials that allow farmers to test products or practices in their own fields, using their own equipment. These trials are designed to answer production questions specific to a farm operation, producing yield and economic outcomes under each farm's unique set of management practices and growing season conditions.

WHY ARE ON-FARM TRIALS VALUABLE?

On-farm trials put farmers in control of the practices they test and offer straightforward, powerful scientific evaluation of farm management decisions. Information gained on agronomic and economic performance can be used to guide future management decisions. On-farm data can also be pooled across time and space through organizations like MPSG's On-Farm Network (OFN) to answer production questions at a larger scale and with greater confidence.

STEPS TO SUCCESS

1 FORM A RESEARCH QUESTION

The research question sets the foundation for meaningful results. Develop a specific question that leads to clear treatment selection and that has a defined end goal (e.g., yield and/or quality). The research question will also determine what data should be collected throughout the season to inform yield results. A question that can be answered from two or three treatments will produce the best results.

Example – *Can I reduce double inoculation to single inoculation without reducing nodulation and yield?*

2 SELECT AN APPROPRIATE FIELD AND TREATMENTS

Ensure the treatments answer the research question and that they are realistic for your farm operation. On-farm trial treatments usually include your normal farm practice compared to the new practice you are interested in testing. Treatments must differ enough from one another to potentially see an agronomic difference between them.

The success of your trial and potential application of results to your farm also depend on appropriate field selection. Think about what field scenarios are best suited to answer the research question. Choose a field that is representative of other fields on your farm where you might adopt management practices based on the trial findings.

Example

Treatments *– Single inoculant (on-seed) vs. double inoculant (on-seed plus in-furrow).*

Field selection considerations – *Field history, crop rotation and residual nitrogen. Select a field that has had a minimum of two well-nodulated soybean crops in the last ten years and <50 lbs/ac of residual nitrogen.*

3 PLAN AN EFFECTIVE TRIAL LAYOUT

Two factors are critical for success when planning a trial layout – *replication* and *randomization* (see Figure 1).

Replicate multiple strips of the same treatment in one trial to minimize variability. One replicate (or 'block') is comprised of one set of treatments. Aim to have four to six replicates in your trial. Replicates do not have to be directly adjacent to one another. However, keeping them close together will make the trial easier to manage.

Randomize the order of treatments within each replicate. Randomization helps you avoid patterns of treatments across the trial area, which prevents bias and protects the quality of trial results.

To randomly choose the order of treatments in the trial area, follow a suggested randomized trial layout or create your own randomization plan using a coin toss or online random number generator to determine what treatment will be implemented in each trial strip.

Replication and randomization strengthen your ability to draw statistically-sound conclusions from the results. Both factors account for field variability and enable statistical analysis. In other words, they allow you to confidently conclude that responses occurred due to treatments rather than field variability.

Once the treatment layout is decided, plan where the trial will be established within the field. Avoid areas of the field that introduce variability (e.g., sloughs, drains). If the drain cannot be avoided, arrange the trial so the drain runs equally across all treatments rather than parallel to a treatment strip. If you have complex topography in your field, run the trial across the slopes rather than along them, so each trial strip has the same amount of topographical variability.

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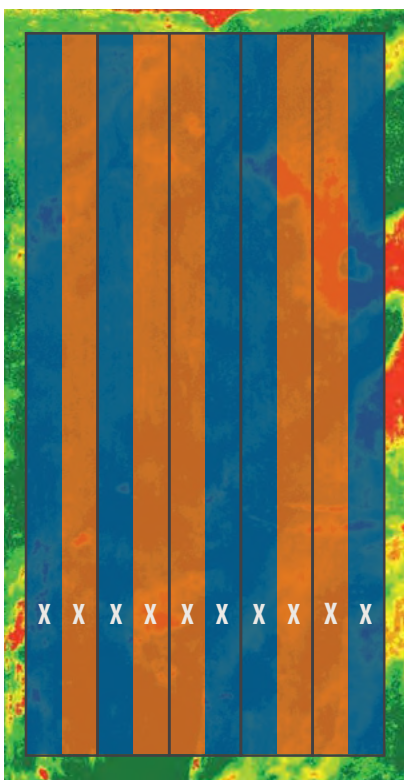

Figure 1. Randomized and replicated trial layout, with two treatments (orange vs. blue) and five replicates of the two treatments.

Choose an area that looks representative of the majority of the trial and scout within each strip along that transect (i.e., at each "x" in the image).

4 ESTABLISH AND MAINTAIN THE TRIAL

Following the trial layout, establish the trial at seeding or spraying time, depending on the trial type. Flag out the boundaries of each strip, or, at minimum, the four corners of the trial. GPS coordinates are also helpful to identify treatment areas. Record which treatments are in each strip of the trial – this should match the planned trial layout. Share the trial location and treatment layout with everyone who will be working in the field. Maintain the trial area as you would the rest of the field, in terms of pest control, seeding rate and other agronomic management considerations. Drive across the trial area, perpendicular to the strips, to equalize the area of each strip affected by wheel tracks.

5 COLLECT RELEVANT DATA

Depending on the trial type, in-season data collection may be necessary to help interpret yield results at the end of the season. Examples include plant counts, nodule counts and disease scouting. Collecting in-season data across representative transects within the trial is an efficient method for large-scale trials (see Figure 1).

Example – *To assess the effect of double vs. single inoculation on nodulation, dig up 10 plants at each 'X' across a representative transect in the trial to record the number of nodules and note if they are active (pink inside).*

A weigh wagon or grain cart with a scale should be used to collect accurate harvest data. Record the weight of each strip, or at least one combine pass worth of crop from each strip. Harvest all trial strips on the same day, in as short of a window as possible and using a single machine, to keep harvest conditions uniform across the trial area. If a handheld moisture meter is available, determine harvest moisture content using a sample of grain from each strip. Then, calculate yield at the standard moisture content for the crop (13% for soybeans, 16% for peas and faba beans and 17% for dry beans). Use the standardized yields for statistical analysis.

6 ANALYZE THE DATA

Statistical analysis and interpretation of the data are critical to determine the outcome of the trial. Yield naturally varies across a field. Statistics are the only way to determine if numerical differences in yield between treatments are the result of field variability or a result of the treatments. For most on-farm trials, a simple paired t-test is a sufficient statistical analysis. Fillable excel calculators to conduct statistics can be found at manitobapulse.ca. Alternatively, contact MPSG or Manitoba Agriculture and Resource Development to assist with analysis of your data.

Statistical analysis and interpretation allow you to draw conclusions about the agronomic effects of the treatments. The next step is to examine the economics. Simple economic analysis can follow a formula like this:

Example – *[Yield difference (bu/ac or lbs/ac)* Expected market price ($/bu or $/lb)] – Treatment cost ($/ac) = Economic outcome ($/ac)*

If this calculation results in a positive $/ac value, the treatment and resulting yield change were profitable. If the outcome is a negative $/ac value, then the change in yield was not enough to justify the cost of the treatment and the outcome was not economically favourable. Economic analysis can only be applied when there is a significant yield difference between treatments. If there is no statistical significance, any numerical differences in yield are the result of random variation and the increased cost of the treatment is simply a loss in profit per acre.

Example – *Interpreting the results of a double vs. single inoculant trial with a statistically significant yield difference (scenario 1) and without a significant yield difference (scenario 2).*

	SCENARIO 1	SCENARIO 2
Double Inoculant	31.6 bu/ac	21.0 bu/ac
Single Inoculant	30.1 bu/ac	20.0 bu/ac
Yield Difference	1.5 bu/ac	1.0 bu/ac
Statistical Significance?	**Yes**	**No**
	To determine if double inoculation was profitable, calculate the expected revenue increase minus the cost increase from double inoculation compared to single inoculation. *[1.5 bu/ac * $12/ bu] – $10/ ac = $8/ac → profitable*	While there was a numerical yield difference, double inoculation did not significantly increase yield compared to single inoculation. The cost increase from double inoculation resulted in a loss in profit.

7 LEARN FROM THE DATA AND SHARE WITH OTHERS

After using statistics to determine the trial's outcome and proceeding with economic analysis in cases where significant differences occurred, take time to evaluate the impact of the trial results for your farm operation. Do the results suggest that you could benefit from changing your practices? Consider the growing season conditions and any mid-season observations and measurements you collected. Do you think it would be valuable to run the same trial in a different year and a different field?

Pooling trial results with other farmers and learning from the experience of others is also beneficial when evaluating your farm's agronomic management practices. Participating in the OFN is a great way to facilitate this networking and grow a large database of site years to determine the response to various agronomic decisions across time and space.

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Late-Season Weed Scouting. So Many Questions.

Kim Brown-Livingston, Crop Specialist – Weeds, Manitoba Agriculture and Resource Development

IT'S LATE SUMMER. You've sprayed for weeds. Between now and harvest, there's nothing left to watch for except insects and diseases, right? Not necessarily. Your weed control program doesn't end when the sprayer pulls out of the last field. Late season scouting for weeds is crucial for a couple of reasons. First of all, most weeds are annuals, so anything still growing after spraying is very likely setting seed this year. Knowing which weeds will be growing in that field next year helps you plan a spray program for the 2022 crop. When choosing a pre-emergent herbicide with residual weed control, you have to know what weeds are being targeted. This gets the right product on the right field to set up a good weed control program. Late-season scouting also gives us the opportunity to evaluate the effectiveness and weaknesses of this year's weed control program. Are there weeds in the field, what are they and why are they there?

A kochia carcass (left) next to a thriving, resistant kochia plant (right).

Where do we start? Aerial imagery can give you an idea of where potential problem areas could be. Drone video and photos get you a closer look, followed by a good old field walk. Scout several areas of the field. Can you compare *good* weed control areas to parts of the field where you can still find weeds? There can be several reasons why weeds are present after an in-crop herbicide application. It's time to start asking questions...

- How well does your herbicide work on the weeds you've found? Was it labelled for control or suppression? Some products do a great job of burning off top growth, but regrowth can occur late in the season. Are those weeds on the label at all?
- Was weed pressure really high? You may have gotten good control, but you never get 100% of the weeds and under heavy pressure there could be a substantial number of weeds not controlled.
- Was there enough rainfall to activate the herbicide? This is crucial for many pre-emerge herbicides. Less than adequate precipitation with some pre-emerge products can mean poor weed control and shorter residual activity.
- How big were the weeds when you sprayed? Growth stage is critical. You have to spray when weeds are the right size—smaller is better. No matter how effective a herbicide is on a particular weed, if large weeds are sprayed past the appropriate stage, you can expect poor control or outright failure.
- And was the correct rate used? Some labels have higher rates for different weeds or larger-sized weeds. Under-spraying leads to misses and poor control.
- Did you use enough water? Coverage is crucial, especially for contact herbicides. Make sure you have the proper nozzles and enough water to get the weeds covered.
- What were conditions at the time of spraying? Cool nights, hot daytime temperatures, low humidity—these conditions can reduce efficacy depending on the herbicide. If weeds were under stress for any reason, they do not take up and/or translocate the herbicide as they would under normal conditions.
- Did it rain shortly after herbicide application? Rainfast periods for pulse crop herbicides range from one hour for clethodim (Select, Centurion) and sethoxydim (Poast Ultra) to eight hours for bentazon (Basagran brands).
- Is there a pattern, such as something mechanical, like plugged nozzles, or can we see sprayer skips? Was there dust on the leaves? Dust along the roadsides or in tracks and headlands, kicked up by sprayer wheels, can affect herbicide efficacy, particularly glyphosate.

Advanced wild oats late in the season.

Maybe nothing went *wrong* at spraying. Late season weeds could be present simply because they emerged after your herbicide application. Pigweed species like waterhemp emerge all season long, and you rely on a competitive crop to reduce their impact. Healthy, vigorous crops that canopy quickly will choke out late-emerging weeds. If weeds emerged after spraying, they will be worse in areas of the field where crop growth is poor. But worst of all, late-season weeds may be present because they're herbicide-resistant. Watch for patches of weeds, particularly where the rest of the field is quite clean. Or if you see big healthy weeds next to carcasses and other weeds of various sizes showing varying signs of herbicide damage, it's likely a sign of herbicide resistance. All these weeds were sprayed at the same time with the same herbicide—if they're affected differently, you should suspect herbicide resistance.

So you've got late-season weeds—hopefully, you've figured out why they're here. What do we do about them? Rescue treatments are limited. Bentazon may be an option depending on the weeds present and their size. Weeds present for reasons other than resistance might end up sticking around till harvest time.

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Remove them to reduce seed return if it is feasible. If you have late-season weeds in your fields due to gaps in your herbicide program, from errors while spraying or from less than optimal conditions when spraying, then hopefully, those issues can be *fixed* for next time. Make adjustments to next year's weed control plan to reduce or eliminate these late-season weed escapes.

However, if you suspect herbicide resistance and you don't destroy those weeds to prevent seed return, the problem *will* get bigger next year. Individual plants and small patches can be hand rogued, and larger areas can be mowed. Consider not harvesting areas with resistant weeds, and instead mow several times during the season. Harvesting patches or infested areas of fields will spread resistant weed seeds over the rest of the field and combines will be contaminated with resistant weed seeds that will spread across the farm. If you choose to harvest a field with resistant weeds, do it last and clean the combine thoroughly.

Resistant weeds like kochia and wild oats on your farm can cause tremendous yield loss and increase the cost of herbicide programs. They can influence crop rotation as it becomes more and more difficult to grow crops where herbicide options are limited or options may be non-existent to tackle those weeds. Weeds like waterhemp and Palmer amaranth, whether resistant or not, are Tier 1 weeds under the Noxious Weeds Act, and as such, must be destroyed without condition. Tier 1 weeds are considered a significant threat to the agricultural community and, by law, *must* be destroyed. Resistance in waterhemp and Palmer amaranth develops very quickly and we cannot allow these weeds to become established here. If you suspect herbicide resistance in any weeds, get them tested, so you know which herbicides will still work and which ones won't. Once resistance is confirmed, sit down with your agronomists, industry advisors and company reps to develop a plan that deals with all weeds on your farm, especially the resistant ones. ■

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Fine-Tuning Management of Dry Bean Diseases

Jonathan Reich and Dr. Syama Chatterton, Lethbridge Research and Development Centre, Agriculture and Agri-Food Canada

Figure 2. A cyclone sampler collecting air samples in a bean field in southern Alberta.

PREDICTING WHITE MOULD OUTBREAKS IN DRY BEAN FIELDS

Disease forecasting models have been hugely successful for some crops and diseases, with benefits including increased yields and reduced fungicide use. However, some plant diseases have been fiendishly difficult to predict and manage using disease forecasting methods up to this point. White mould, the most economically important disease in dry bean production in Canada, is one of these difficult to predict diseases and is currently one of the areas of research of a CAP Pulse Cluster project at the Lethbridge Research and Development Centre aimed at optimizing disease management of dry beans.

White mould is caused by the fungus *Sclerotinia sclerotiorum*, which infects many other crops on the prairies, most notably canola. *S. sclerotiorum* has a relatively simple life cycle (Figure 1). It spends the vast majority of its life dormant in the soil as small (< 1 cm diameter), hard, black structures called sclerotia. Following a cold period like winter and in the presence of abundant soil moisture, these sclerotia germinate to produce small (< 1 cm in diameter), mushroom-like structures called apothecia. Once mature, a single apothecium releases hundreds of thousands of infectious spores into the air over its two-week life span. The spores are transported on the wind and, once they land on a susceptible host plant, can infect and cause white mould. As the disease progresses in the host plant, *S. sclerotiorum* develops sclerotia which drop to the soil and remain there until conditions are conducive to germination once again.

Despite its well-understood biology — at least in lab conditions — the spread and growth of *S. sclerotiorum* under field conditions has been much more difficult to understand. In some years or locations, it causes devastating disease, while in other years, it is hardly noticeable. This seemingly sporadic appearance of disease is one reason why white mould epidemics have been so difficult to predict. Many factors are known or hypothesized to contribute to disease development under field conditions (e.g., irrigation, soil type, crop rotations, bean variety, fungicide applications), but these factors do not always explain white mould levels in bean fields. We hypothesized that the missing piece of this puzzle is the levels of airborne spores present in a field throughout the growing season. Simply put, fields with no spores will have no disease and fields with lots of spores will have lots of disease.

So, how do you sample airborne spores? It turns out there are lots of ways to collect air samples, but we are using *cyclone samplers* manufactured in the U.K. (Figure 2) — the birthplace of research into airborne microbes. The cyclone samplers are essentially vacuums that suck in air and deposit all particles, including spores of *S. sclerotiorum*, into a small vial. The vial is taken back to the lab for DNA extraction and quantification of *S. sclerotiorum* DNA. Collaborators in Manitoba and Ontario are replicating this procedure in each of those provinces to make this a pan-Canadian research project.

What have we found so far? First, as expected, white mould disease surveys in southern Alberta show that the disease is widespread but varies significantly in its intensity between fields. Many fields had no symptoms of white mould, but highly infected fields had almost every plant infected. Second, because the fungus only releases spores at one point in its lifecycle, we expected to see a single spike in the number of spores over the course of the growing season but found the opposite: *S. sclerotiorum* spores are commonly present throughout the growing season (Figure 3). This could be because microclimates cause the fungus to grow at different rates or that the spores are coming from other fields with different environments.

Some evidence comes from the trends in the three provinces where mean daily ascospore numbers were highest in southern Alberta (irrigated production) compared to Manitoba and Ontario (Figure 4). Unexpectedly, there is no clear relationship between the number of ascospores present in a field and the final disease level in that field.

This last finding has prompted us to continue expanding the search for contributing factors to disease development. In addition to the surveys and air monitoring, we are performing more in-depth interviews with growers to tease out management practices that could be contributing to differences in disease levels between fields. For instance, it is no secret that certain market classes of beans are less susceptible to white mould, findings which were supported in the 2020 growing season. The 2021 field season

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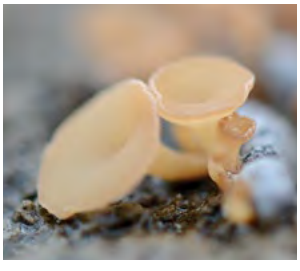
Figure 1. Stages of S. sclerotiorum*'s life cycle. Left: Apothecia emerge from a sclerotium in the soil (diameter of the largest apothecium is less than 1 cm). Centre:* S. sclerotiorum *has infected a bean plant and shows characteristic white, fluffy growth. The dark circles are sclerotia that have formed. Right: The fungus can infect the inside of bean pods and sclerotia may develop inside.*



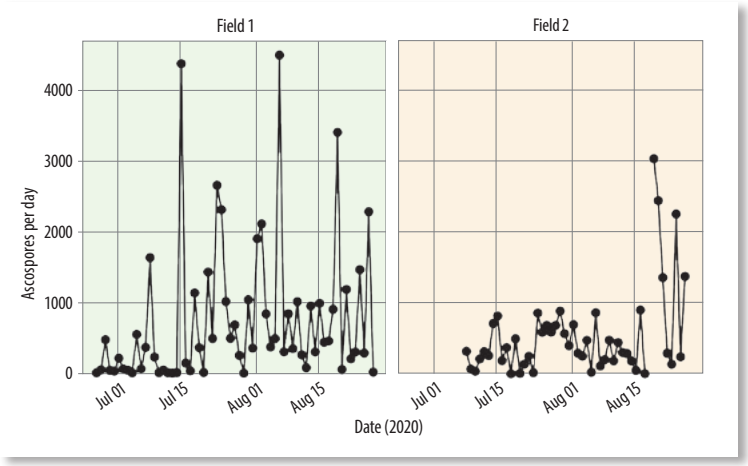


Figure 3. Spore release patterns from two dry bean fields in southern Alberta in 2020. While the number of spores in Field 1 throughout the growing season was much greater than in Field 2, the final disease incidence was still relatively low in both fields: 4% of plants infected in Field 1 and 8% in Field 2.

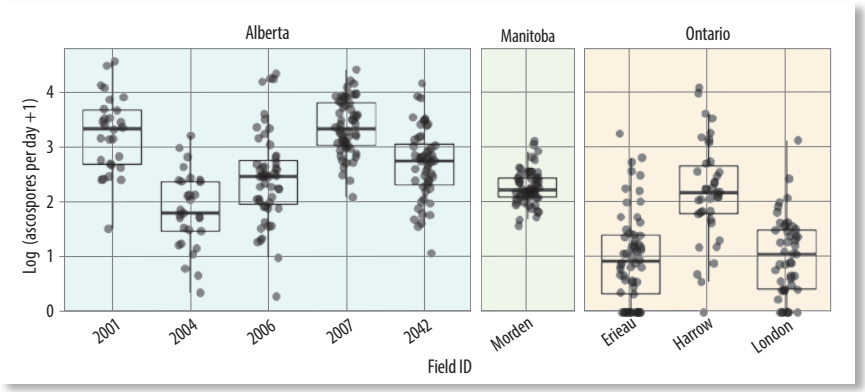


Figure 4. Boxplots of the log (number of ascospores per day + 1) in each field monitored with a Burkard spore sampler in 2020. Ascospore levels differed significantly between provinces, with Alberta having, on average, greater numbers than both Manitoba and Ontario. The boxes represent the first and third quartile, and the horizontal line is the median.

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will be the most comprehensive yet, with researchers hoping to find trends that will greatly enhance white mould prediction in dry beans.

EFFECT OF SEED TREATMENT AND SEED SOURCE ON BACTERIAL DISEASES OF DRY BEANS

The other activity in our Pulse Cluster project is evaluating whether some new experimental seed treatments and seed source will reduce bacterial diseases of dry beans. With the loss of streptomycin for agriculture usage, there are no seed treatments available for seed-borne bacterial pathogens.

Field trials were conducted in 2019 under irrigation in Vauxhall, AB; Harrow, ON; and Morden, MB. Seven cultivars were used in this trial — AAC Explorer, AC Black Diamond, AAC Black Diamond 2, L16PS461 and AC Island were sourced from Alberta and Idaho, and Envoy and Portage were sourced from Manitoba and Idaho. While Portage and Envoy were only planted in Morden and Harrow, AC Island was only seeded in Vauxhall. All seed batches were treated with three experimental seed treatment products or not treated control. Plots were assessed for four bacterial diseases: halo blight, common bacterial blight, bacterial brown spot and bacterial wilt (Figure 5) over the growing season.

Bacterial disease progression in the small-plot field trials was low, likely due to the hot and dry growing conditions in Vauxhall and Harrow in 2019. There were higher disease levels in Morden, but the severity and incidence were still below economic threshold levels. At Morden, halo blight occurred early in the season (mid-June) in 5–10% of plants, but at very low severity. Common bacterial blight appeared in late July to early August in 15–20% of plants, but disease severity was also low (less than 5% of leaf surface with lesions, on average). Due to low disease incidence and severity, there were no differences in bacterial disease levels or yields observed due to seed source or seed treatment (Figure 6). The trials will be repeated in 2021 and 2022 with hopefully higher bacterial disease pressure. ■

Figure 5. Bacterial brown spot (A), halo blight (B) and common bacterial blight (C) lesions on dry bean leaves, and (D) dry bean seeds contaminated with the bacterial wilt pathogen.

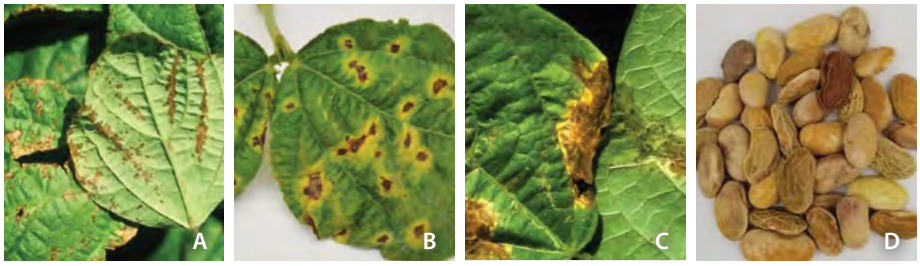
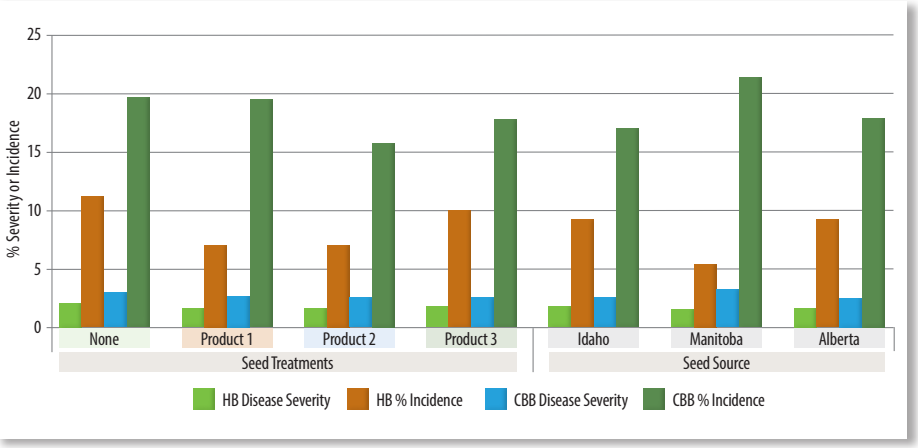
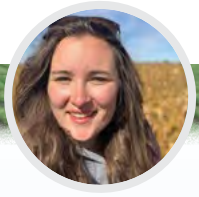


Figure 6: Halo blight (HB) and common bacterial blight (CBB) disease severity and incidence at a field trial in Morden, combined across all cultivars with different seed treatment products or seed sources.





Megan Bourns, Agronomist – On-Farm Network

A LOGICAL APPROACH TO BIOLOGICALS

Seeding rates, granular inoculant, fungicides – the financial implications of these decisions, both favourable and unfavourable for the bottom line, are obvious. But what about those products that slide onto the market right around $5/ac? Some lower-cost inputs, such as biologicals, might fall into the *cheap enough to try it* category. Especially the ones with great marketing strategies. The trouble is, unless you're putting these products to the test, you really have no idea whether they are providing a return on investment. Imagine trying out a biological at $5/ac. The sales guy has been on you to give it a try, your interest is piqued, so you spray 80 acres. The crop looked good, yielded well…so you decide to put it on double the acres next year, and double again the year after that and, well, you can see where this is going. The initial *give it a try* cost might be small, but what are the financial implications over time?

The good news is, with science on your side, you can confidently and efficiently determine whether a product is worth your money. On-farm trials are the best tool to evaluate things like this and can be quite simple to implement. Check out the new *Guide to Conducting On-Farm Trials* on page 37 for more information!

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Insecticide Resistance in Soybean Aphids

John Gavloski, Entomologist, Manitoba Agriculture and Resource Development

WITH ANY INSECT, pathogen or weed, repeated exposures to the same chemical will eventually lead to some individuals developing resistance to the chemical. Over time these can become the dominant portion of the population, reducing the effectiveness of the chemical. Resistance can be defined as a genetically based decrease in susceptibility to a pesticide. Insecticide resistance is common with aphids, which reproduce quickly and can have many generations within a year.

In 2015 in Minnesota, failures of foliar-applied pyrethroid insecticides against soybean aphids were reported and pyrethroid resistance was confirmed with laboratory bioassays. Research conducted in several northcentral U.S. states and Manitoba in 2017 confirmed resistance to pyrethroids in soybean aphid from Manitoba, Minnesota, North Dakota, South Dakota and Iowa.

WHERE WOULD THIS RESISTANCE HAVE COME FROM?

Soybean aphids are not an annual insect concern in Manitoba. Since soybean aphid was first found in Manitoba in 2001, there have been four years where there were more widespread insecticide applications (2006, 2008, 2011, 2017), and two years where there was some localized insecticide applications (2014 and 2015). Would this have been enough to build up insecticide resistance in Manitoba?

Soybean aphids do not overwinter well in the more northern areas of their range, and it is likely that populations of soybean aphids establishing in Manitoba have blown in from areas further south. If people are making annual insecticide applications for soybean aphids in some areas, and aphids from these populations are being blown into other areas, the areas the aphids arrive in could inherit problems developed in the source areas. I suspect that the pyrethroid-resistant soybean aphids detected in Manitoba in 2017 were not a problem that developed here, but that pyrethroid-resistant soybean aphids were part of the population that blew in that year. Regardless, there are lessons that can be learned and recommendations that are essential to keep insecticides working well for when they are truly needed.

MANAGEMENT STRATEGIES FOR MINIMIZING THE RISK OF RESISTANCE

In response to the challenge posed by insecticide-resistant soybean aphids, the entomologists studying these resistant aphids encourage growers, consultants and applicators to evaluate their soybean aphid management practices carefully. They also recommend several

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Tolerance to Iron Deficiency can be Enhanced by Altering the Level of the Phytoglobin Gene

Dr. Claudio Stasolla, Department of Plant Science, University of Manitoba — Bethany Asmundson and Dr. Mohamed Mira conducted this work under the supervision of Dr. Stasolla.

IRON IS AN essential micronutrient, and despite its relatively high abundance in soils, it is often a limiting factor for plant growth and development that can cause crop yield loss. Due to its chemical properties, iron often exists as insoluble forms, especially in calcareous soils with high pH (common to Manitoba and comprising more than 30% of soils worldwide), and it can therefore be unavailable to plants. Even when taken up and acquired by plant cells, iron is often immobilized or rendered inactive.

Most (80%) of leaf iron is present in photosynthetic tissue, where it is needed for the development of chloroplasts, as well as for the synthesis of chlorophyll. A common iron deficit symptom is, in fact, iron deficiency chlorosis (IDC), characterized by the yellowing of leaves ascribed to impaired chlorophyll production and accompanied by stunted growth and reduced seed yield.

THE SCIENCE BEHIND IDC

Being a constituent of the electron transport chain, iron, when limited, can disrupt the electron flow leading to the accumulation of reactive oxygen species (ROS), which are deleterious to cell functionality. Over-production of ROS linked to iron depletion has been the cause of lipid peroxidation and depression of photosynthetic rate in several species. Several studies have demonstrated that accumulation of ROS in iron-deficient plants co-localizes precisely with chlorophyll. A further consequence of iron deficit, favouring ROS accumulation, is the depression of the antioxidant redox system comprising the enzymes catalase, superoxide dismutase and ascorbate peroxidase, and the production of antioxidants such as ascorbic acid and glutathione, all of which are needed to counteract oxidative stress by reducing the levels of ROS.

SOYBEAN RESEARCH FINDINGS

Our work in soybean demonstrates that altering a single gene producing phytoglobin (Pgb) is sufficient to influence tolerance to iron stress. Phytoglobins are heme-containing proteins found in several plant tissues which are responsive to stress and control how plants respond to sub-optimal environmental conditions, including excess or limited moisture. Their role during iron deficiency has never been investigated before.

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management strategies for minimizing further development of resistance and subsequent pest-induced crop losses:

1. Scout and use the economic threshold to determine when to apply insecticides. Treating fields only when needed will reduce the selection pressure for further development of resistance. Fields should be scouted on a regular schedule (every seven to 10 days). The economic threshold is when there are at least 250 aphids per plant, the population is increasing and plants are in the beginning bloom (R1) to beginning seed (R5) growth stages. Treat within five to seven days of exceeding the economic threshold to protect yield. Tank mixing insecticide with herbicide applications regardless of pest populations is a practice that is best avoided, as it can result in multiple problems developing.
2. If a field exceeds the threshold, make sure the insecticide is applied correctly. Use a rate recommended on the label. Applying insecticides below the labelled rate is not recommended. Use proper nozzles, spray volume and pressure, and spray under favourable conditions.
3. After applications, scout fields again after three to five days to ensure the product provided the level of management expected.
4. Alternate to a different insecticide group if another application is required. Before assuming resistance, try to rule out other potential causes for an insecticide failure (such as incorrect rate or application method or unfavourable environmental conditions). The *Guide to Crop Protection* can be used to determine registered insecticides for soybean aphids and what chemical group they belong to. Insecticide rotation needs to be done between different chemical groups; choosing a different insecticide in the same group is not considered a proper insecticide rotation.

In the long term, soybean aphid management must move beyond insecticide-based management to true integrated pest management by incorporating multiple tactics. An app called *Aphid Advisor* incorporated levels of six natural enemies of soybean aphids counted on 10 randomly selected soybean plants into the decision-making process. Using this app can help determine if the natural enemies present will likely be capable of maintaining the soybean aphids below economically damaging levels. We now have some selective insecticides registered to control soybean aphids, which kill aphids but not their natural enemies. Use of such products, should an insecticide application be necessary, will preserve biological controls that will help prevent any flare-ups of aphid populations, plus control other potential pests of soybeans. Wise use of insecticides will enable you to manage crop feeding insects when economically damaging levels exist, while reducing the risk of resistance developing and help maintain the many beneficial insects that help maximize yields and profits. ■

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Our studies show that relative to susceptible cultivars, tolerant soybean plants, when exposed to iron deficiency, can retain a higher amount of chlorophyll and photosynthetic capacity and are characterized by lower levels of Pgb in leaf tissue. The negative correlation between resilience to iron deficit and Pgb level was also demonstrated using transgenic plants characterized by pronounced changes in the levels of Pgb in shoot tissue (80-fold increase or 8-fold decrease relative to the *natural*, untransformed plants). Transgenic soybean lines suppressing Pgb were able to tolerate iron deficiency, while lines overproducing Pgb showed the highest susceptibility to this condition (Figure 1).

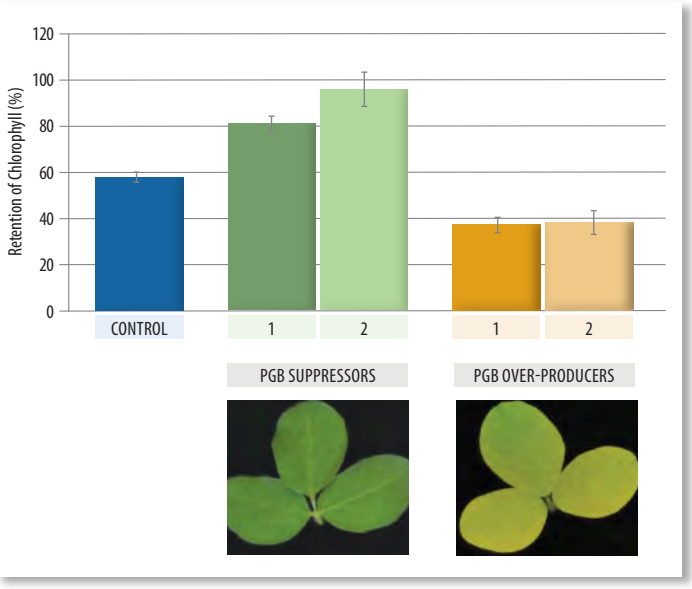

Figure 1. Retention of total chlorophyll (%) in transgenic soybean plants suppressing vs. over-producing Pgb compared to control plants with a natural level of Pgb. Plants were exposed to iron deficiency (Fe= 15µM) for seven days.

NITRIC OXIDE HELPS SOYBEANS COPE WITH IDC

The main function of Pgbs during conditions of stress is to modulate the level of nitric oxide—an important molecule regulating plant response to stress conditions. Plants tolerant to iron deficiency characterized by a lower Pgb content, accumulated nitric oxide in their cells. We demonstrated that nitric oxide is required for the acquisition of tolerance to iron deficiency, as applications of nitric oxide to susceptible plants elevated their ability to cope with low iron. This observation demonstrated that soybean response to iron depletion is controlled by Pgb through nitric oxide.

THE ROLE OF ASCORBIC ACID (VITAMIN C)

We further elaborated a model whereby high levels of nitric oxide, associated with tolerance, are required to activate antioxidant responses limiting the accumulation of ROS, which are responsible for the damage of photosynthetic tissue during iron deficiency.

In lines suppressing Pgb (and exhibiting tolerance to iron deficit), we observed the activation of important ROS-removing enzymes such as catalase and superoxide dismutase. Induction of these enzymes removed ROS and elevated the ability of plants to cope with low iron conditions. One important antioxidant molecule that was produced in leaves of tolerant plants (suppressing Pgb) was ascorbic acid (vitamin C). Besides its function in removing ROS, ascorbic acid is required to convert iron from Fe(III) to Fe (II). This conversion is crucial for plant survival to iron stress.

ASCORBIC ACID IMPROVES PLANT TOLERANCE TO IRON STRESS

Within the plant tissue, iron can exist in different forms: Fe(III) is the less mobile and unavailable form while Fe(II) is more mobile and active, being able to cross cells and reach sites where iron is needed, such as the photosynthetic tissue. Under conditions of iron deficiency in the soil, plant survival is often dependent upon the ability to mobilize the internal pool of iron present in the cells by converting Fe(III) to its more mobile form Fe(II). This conversion was indeed observed in tolerant plants suppressing Pgb, as well as susceptible plants sprayed with ascorbic acid—a treatment that elevated tolerance to iron stress.

SUMMARY OF FINDINGS

Collectively, this work shows that tolerance to iron deficiency in soybeans can be enhanced by suppression of the protein Pgb. This occurs through 1) a rise in nitric oxide, which influences antioxidant responses that reduce the deleterious effects of ROS, and 2) an elevated level of ascorbic acid at the same, which is required to make iron more available to the plant by converting Fe(III) to Fe(II). Our data indicate that the level of Pgb, easily measurable in plant tissue, could be used as a reliable marker to predict plant response to iron stress and select/screen germplasm that is better able to cope with iron deficit. Furthermore, applications of ascorbic acid to leaf tissue could be used as an effective treatment to limit iron deficiency stress. ■

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Oat-pea trial plot near Deloraine, MB

Oat-Pea Mixed Grain Intercropping on the Canadian and Northern U.S. Prairies

Luke Struckman, PhD, Oat-Pea Intercropping Project Lead, South East Research Farm

DURING THE PAST decade, mixed grain intercropping has become a commercially significant practice for some farm operations on the Canadian and Northern U.S. prairies. Proven mixed grain intercrop combinations can provide significant agronomic and financial benefits. In 2020, the South East Research Farm and General Mills conducted a study to investigate the commercial viability of the oat-pea intercrop combination. The study combined farmer interviews with on-farm oat-pea trials in order to provide starting points for farmers interested in adopting oat-pea intercropping.

MIXED INTERCROPPING ON THE CANADIAN AND NORTHERN U.S. PRAIRIES

Intercropping practices, such as inter-seeding wide-row grain corn with cover crops or small grain-soybean relay cropping, are being used successfully in some regions of North America. Similarly, mixed intercropping has been relatively common on the Canadian and Northern U.S. prairies through small grain-clover or pea-brassica combinations. However, seeding two or three grain, oilseed and pulse cash crops at the same time, harvesting them together at the end of the growing season, separating the seed and marketing each cash crop for grain, is a relatively new practice. This is referred to as *mixed grain intercropping*.

Farmers practicing mixed grain intercropping have reported significant agronomic benefits, such as reduced fungal and insect pressure, overyielding and increased post-harvest residue. Some proven mixed grain intercrop combinations include canola-pea and chickpea-flax.

The oat-pea intercrop combination is typically used for greenfeed or hay. It has not been common for the oat-pea combination to be grown for grain oat and dry pea production for human consumption. As the study findings demonstrate, the oat-pea mixed grain combination can be commercially viable thanks to the agronomic benefits it provides, in addition to the relatively strong market demand for both grain oats and dry peas in recent years.

INTERVIEWS

To better understand current oat-pea intercropping practices, twenty-five interviews were conducted with farmers in Canada, the U.S. and the U.K. on their experiences growing oat-pea intercrops. Interview questions focused on production methods, grain separation, obstacles and profitability.

Production methods

The vast majority of farmers stated that synthetic nitrogen applications can be reduced or eliminated in oat-pea intercrops. Fungicides were shown to not be necessary. Herbicide use was significantly reduced, but a number of growers mentioned that this was due to a lack of available in-season herbicide options.

Seeding rates were informed by the experiences of other farmers and on-farm experimentation. There were a wide range of seeding rates provided, but growers tended to favour peas and reduce oat seeding rates to 60% or less of monocrop. Otherwise, oats tend to dominate peas as the growing season progresses. Several growers have selected lodge-prone pea varieties to intercrop because varieties such as 4010 forage peas or Austrian winter peas can be incredibly difficult to grow as monocrops, and oats help to keep them standing until harvest.

Grain separation

Grain cleaning and separation are typically done on-farm using a wide range of cleaning equipment, although rotary cleaners tend to be the most common. Growers cite higher quality grain samples, lower grain shipping costs, as well as significantly lower dockage, as benefits to cleaning and separating oat-pea mixed grain on farm. Additionally, screenings can be kept or sold as livestock feed. Grain separation costs can be offset by higher quality grain samples in addition to reduced input costs.

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Obstacles

Although oat-pea intercropping does provide attractive benefits, there are significant obstacles to making oat-pea intercropping practical for cash crop production. Crop insurance was cited as one major obstacle to oat-pea intercropping (and mixed intercropping in general), since most insurance policies only allow for a limited acreage of novel cash crops each season. Weed control can be a serious issue since no herbicides are labelled for use with both crops in-season.

On-farm storage can be another obstacle. Mixed intercrops must be stored separately from monocrops. Oat-pea mixed grain takes up significantly more storage space than other mixed grain intercrops (such as canola-pea) due to the bulkiness of grain oats. Along the same lines, separation is more difficult in comparison to other intercrops due to the large size of oat and pea seeds and the possibility of peas splitting during cleaning and separation.

Marketing can pose an additional barrier, since some grain oat buyers will not purchase oats that have had peas separated out of them due to potential allergen cross contamination. Finally, a lack of information—both from other farmers and published research on the oat-pea combination—can make it difficult to implement.

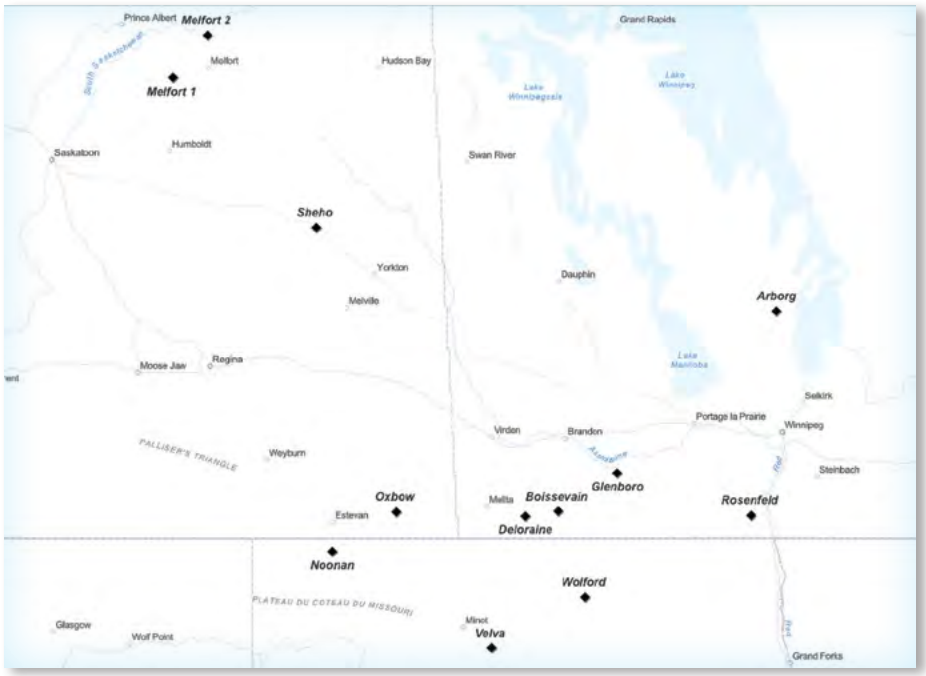
Profitability

Despite significant obstacles, oat-pea intercrops have the potential be more profitable than monocrop oats. This is due to a reduction in synthetic inputs, lower grain shipping costs, higher quality grain samples and the possibility of growing higher-value, lodge-prone pea varieties. At the same time, oat-pea intercrops provide benefits to farm cash crop rotations and soil health, such as producing large amounts of biomass, increasing cash crop diversity and helping to mitigate adverse weather conditions through combining two different cash crops that thrive in varying soil moisture conditions.

FIELD TRIALS

Twelve on-farm oat-pea trial sites were located in Saskatchewan, Manitoba and North Dakota during the 2020 growing season (see Figure 1). The trials placed 10-acre oat-pea plots adjacent to 10-acre monocrop oat plots, allowing for side-by-side comparisons of oat-pea intercrop production with monocrop oat production at each site. Appreciable variation exists across soil types and precipitation levels in the broad geographic area covered by the trial sites.

Figure 1. Locations of the 12 oat-pea field trial sites in Saskatchewan, Manitoba and North Dakota.



Participating farmers chose seeding rates along with fertility and herbicide treatments. The non-replicated, single-year nature of these trials does not provide enough data to make agronomic recommendations for oat-pea intercropping. However, some key findings can provide starting points for farm operations interested in oat-pea intercropping for grain oat and dry pea production.

Participating farmers provided information on seeding rates, input rates and yield. Across the 12 sites, the oat-pea intercrop trials yielded 3561 lbs/ac, on average, while the oat monocrop trials yielded 3907 lbs/ac, on average. Importantly, increased seeding rates did not lead to a linear increase in yield across sites.

General Mills conducted grain quality tests comparing intercropped oats to monocrop oats. Oat samples were tested for percentage of oat plumps and protein content. While the oat-pea intercrop plots scored consistently higher with regards to percentage of oat plumps and oat protein content versus the oat monocrop trials, the differences were not significant.

A cost/benefit analysis demonstrated that the oat-pea intercrop was more profitable than the oat monocrop at Deloraine, MB, Boissevain, MB and Melfort, SK. There were no significant differences in profitability when comparing oat-pea intercrop plots to oat monocrop plots at Arborg, MB, Noonan, ND and Sheho, SK. At the six remaining trial sites, oat-pea intercrop plots were significantly less profitable than oat monocrop plots.

FINDINGS

As this study demonstrates, the oat-pea combination can be a viable means for improving farm profitability, increasing cash crop diversity and building soil health. At the same time, appropriate seeding rates, the lack of in-season herbicides, post-harvest storage and separation, and marketing, along with other issues, need to be given serious consideration. Growers interested in adopting the oat-pea combination should consult with experienced intercropping farmers and experiment at small scales on-farm for at least one year before adopting oat-pea intercropping at a production scale. ■

This project was a team effort among researchers from the South East Research Farm, General Mills and Agriculture and Agri-Food Canada.

Production Guidelines

FIELD SELECTION

Moisture

Peas thrive in relatively dry soil conditions and are susceptible to root rot in wet soils. Choose fields with well-drained, coarse-textured soils that are not prone to compaction or waterlogging. Under optimum soil moisture conditions, peas will use 12–15 inches of water.[1]

Salinity

Peas are more sensitive to salinity than soybeans. Plant peas in soil with soluble salt levels < 1.7 mmho/cm.[2]

Field History

Crop rotation is important for maximizing yield. Field peas should follow dissimilar crops, like cereals or oilseeds. Peas generally yield highest when grown after winter/spring wheat or barley.[3] Ensure at least four years between field peas or other pulse crops to help reduce disease problems, particularly root rots.

Field peas are poor competitors with weeds. Select fields where good control of aggressive perennial weeds, like Canada thistle and quack grass, has been achieved.

SEEDING

Seeding Date and Soil Temperature

Seed peas from late April to mid May. Field peas are very tolerant of cool soil temperatures and will germinate and emerge at lower temperatures than warm-season crops like soybeans or corn. Peas are more tolerant to spring frost than other crops because pea cotyledons remain underground. If frost injury does occur, new shoots will emerge from axillary buds protected under the soil surface. Later seeding may be necessary if pre-plant tillage for weed control is used. However, avoid planting in late May or early June. Late seeding can result in > 20% yield loss due to flower blasting during hot weather.[4]

Target Plant Stand and Seeding Rate

Target 120 live plants/m^2.[5] Adjust the seeding rate (lbs/ac) to account for expected seedling survival and seed weight, which varies considerably among market class, variety and seed lot. Typical seedling survival for peas is 85%, meaning 140 seeds/m^2 would be required to obtain 120 live plants/m^2.

Seeding Depth

Rapid and even emergence of field peas is important for maximizing yield. Prepare a firm seedbed and ensure good seed to soil contact when planting. Seed peas 1.5–2 inches deep, ensuring they are planted into moisture.

Rolling

Land rolling should be done to improve harvestability and reduce earth tag, even on soil without stones. Rolling can be done immediately after seeding or post-emergence up to the 2nd–3rd true node stage. If rolling post-emergence, roll during the warmest part of the day. Avoid rolling as the crop is emerging, just after emergence or if the crop is stressed due to frost.

CROP NUTRITION

Inoculant

Inoculate peas with *Rhizobium leguminosarum* bacteria, even on fields with a history of peas, to facilitate root nodule development and biological nitrogen fixation. Consider double-inoculating (e.g., liquid on-seed plus granular in-furrow) fields with no history of peas or using a granular inoculant when seeding conditions are unfavourable (drought, excess moisture or acidic soils). Check nodulation at the 6–9th true node stages.

Fertility

Peas can, on average, biologically fix 55–80% of their N requirement, making the use of soil amendments to increase soil N supply unnecessary. Soils with high N levels (> 50 lbs/ac) can inhibit N fixation and increase crop lodging. Ensure fields are adequately supplied with P and K before growing peas. Since P is often yield-limiting, composted manure or other nutrient sources approved for organic production may be required.

AVERAGE FIELD PEA NUTRIENT REMOVAL RATES

Nutrient	Removal	
	lbs/bu	lbs/ac*
Nitrogen (N)	2.3	117
Phosphorus (P_2O_5)	0.69	34.5
Potassium (K_2O)	0.71	35.5
Sulphur (S)	0.13	6.50

*Based on 50 bu/ac field pea crop

PEST MANAGEMENT

Weeds

Yield loss in peas can be as high as 80% in the absence of effective weed control. There are several options for timing and method of mechanical weed control. Multiple passes are usually necessary to obtain acceptable weed control.[6]

Pre-plant: A variety of tillage tools can be used once or multiple times before planting to control early-emerging weeds. Depending on soil moisture conditions, such operations can dry soils to seed depth, leading to delayed and uneven emergence that will reduce crop competitiveness with weeds.

Pre-emergent: Before crop emergence, a rotary hoe or flex tine harrow can be effective at controlling small-seeded annual weeds

Post-emergent weed control using a combination of harrowing and cultivation (left) and a flex tine harrow (right).


Photo: David Rourke


Photo: Jason Peters

continued

such as green foxtail and wild mustard. Inspect fields to ensure weeds are at the "white thread" stage as this will maximize performance of either implement. The rotary hoe is most effective on dry soil surfaces and on warm, windy days with sunny conditions. With flex tine harrows, ensure that weeds are either uprooted or buried.

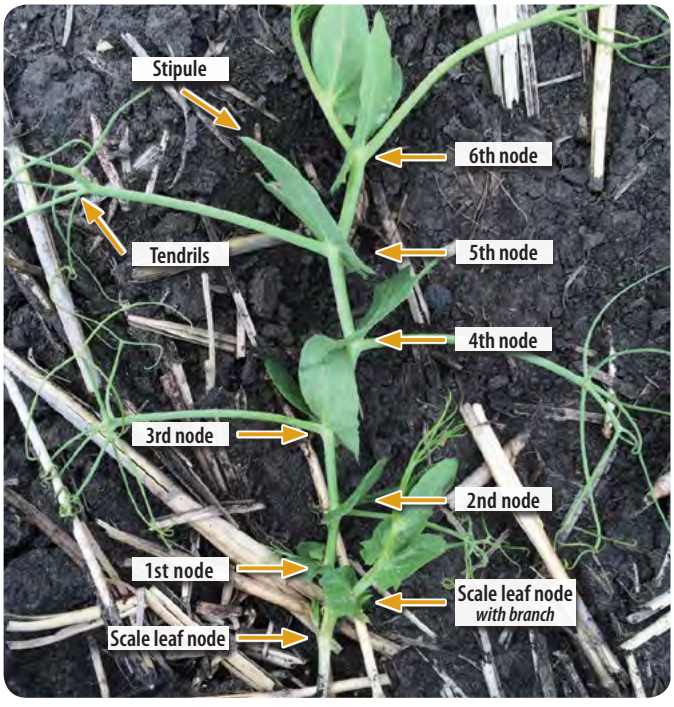
Post-emergent: The rotary hoe has a narrow post-emergence window. Effective weed control is achieved until the first leaf stage in grassy weeds and the cotyledon stage in broadleaf weeds.

Flex tine harrows can be used up to the 5th true node stage in peas. Adjusting tine angle can improve weed removal while minimizing crop damage. Tines adjusted 45% backwards to the direction of travel perform well.

Inter-row cultivation can be used from the 5–10th true node stages in peas and requires mechanical or electronically-guided equipment to prevent crop damage, particularly with narrow row spacings. It is effective at controlling large weeds between crop rows, but provides little control of weeds located within crop rows.

Post-emergent mechanical weed control should occur during the heat of the day when plants are less turgid. Inspect the job after an initial pass to ensure weeds are controlled and crop damage is minimized.

FIELD PEA STAGING This semi-leafless pea cultivar is at the 6th (true leaf) node stage. Stipules, which resemble elephant ears, are true leaves at the base of each node along the main stem. Scale leaf nodes may be above or below ground and are not counted when assessing pea node stages.



INSECTS AND DISEASES

Wireworms, cutworms and pea leaf weevil can cause seedling damage in peas. Reduced crop emergence is common if wireworms and cutworms are present. Pea leaf weevil root feeding reduces crop vigour and makes the crop more susceptible to root diseases. Pea aphids are a sporadic pest in Manitoba. Yield loss results from aphid feeding during pod formation and elongation.

To reduce seedling losses from root rots, employ production practices that contribute to rapid emergence and growth of seedlings. Mycosphaerella blight is the most prevalent and economically important foliar disease in Manitoba field peas. Cool, wet weather and short rotations favour disease development. Sclerotinia and downy mildew are found less frequently in field peas and symptoms are seldom severe. All yellow pea varieties registered in Canada are resistant to powdery mildew. Further information on pests can be found at manitobapulse.ca.

HARVEST

Swathing can be used to hasten the dry down of both weeds and the crop. Field peas are ready to swath when most pods (75–80%) are yellow to golden brown, seeds in the bottom pods become detached and rattle in the pod, and overall seed moisture is < 30%. Another option is to swath 3–4 days before combining to allow any green plants to dry down enough to go though the combine. Swathers are usually equipped with a pick up reel and vine lifters to handle lodged peas. Swathing can be risky as pea swaths are easily blown around by strong winds.

Peas are ready to harvest once average seed moisture is < 20%. If peas are harvested at 20% seed moisture, aerate to 15–16% moisture and 15°C to ensure quality and safe storage. Field peas can be swathed or straight cut when harvest-ready, but this is rarely an option due to green weeds and uneven maturity. With swathing, the combine should follow immediately behind to prevent pod shatter and keep swaths from blowing around. Combining during the humid parts of the day can reduce shatter loss, but tougher plant material may not feed as well. Matching the pick-up header or reel speed to ground speed will also reduce shatter.

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Winter Rye Preceding Dry Beans and Soybeans

Overview of North Dakota research

Greg Endres, NDSU Extension Cropping Systems Specialist, Carrington Research Extension Center, ND

FARMER INTEREST WITH cover crops in North Dakota is high and utilization is increasing. North Dakota State University has been conducting research to help support cover crop adaptation and use. Winter rye is a common cover crop that provides benefits including soil protection from erosion, soil moisture management and weed suppression. NDSU Extension has recently published the circular *Growing Rye as a Cover Crop in North Dakota.*

At the NDSU Carrington Research Extension Center (CREC), several multi-year studies are being conducted with winter rye as part of a production system with soybeans and dry beans. The following are overviews of two selected studies.

WINTER RYE PLANTING DATES AND RATES PRECEDING SOYBEANS

Winter rye has a wide fall planting period and range of rates, depending on goals for the cover crop. Rye is normally planted August through October at rates ranging from 30 to 60 lbs/ac. A study was commenced at the CREC in 2018 to examine impact of rye planting dates and rates on following year rye plant stand, ground cover, weed suppression and impact on soybean production.

Rye (ND Dylan) planting dates: 1) October 2, 2018 and September 26, 2019, and 2) October 31, 2018 and November 1, 2019. Averaged over two years (2019–20), rye plant densities (measured in May) with the first planting date and rates of 25, 50 and 75 lbs/ac were 236,200, 561,400 and 882,200 plants/ac, respectively. The late planting dates and three rates resulted in 101,000, 284,600 and 412, 700 plants/ac. Ground cover percentage with the first planting date ranged from 32 to 43% and late date ranged from 8 to 19%.

In 2020, foxtail and kochia suppression (visually evaluated late May prior to soybean planting) ranged from 0 to 10% with late rye planting during the fall of 2019, compared to 52 to 83% with the first planting date. Weed control generally improved with increasing rye planting rates. For example, kochia control was 83% with the early rye planting at 75 lbs/ac.

Rye was terminated with glyphosate one to seven days prior to soybean planting (late May). Averaged over two years (2019–20), soybean plant density (166,300 to 184,100 plants/ac) and seed yield (45.2 to 49.6 bu/ac) were similar among rye planting dates and rates.

In summary, rye planted earlier in the fall and at rates of 50 or 75 lbs/ac increased ground cover and weed suppression, while providing the environment for satisfactory soybean yield. The study continues in 2021, following rye planting dates of September 17 and October 8, 2020.

WINTER RYE PRECEDING PINTO BEANS

A study was started during the fall of 2016 at the CREC to examine impact of winter rye preceding pinto beans. Basic questions to be answered: 1) impact on bean plant growth and seed production, 2) termination timing of rye based on bean planting and 3) level of weed suppression.

During the four years of the study, winter rye was planted during the period of the last-half of September to early October at a rate of at least 60 lbs/ac. Pinto beans (Lariat or ND Palomino) were direct seeded in late-May to early June to establish a targeted stand of 70,000 plants/ac. Treatments were based on spring timing of rye termination, primarily with glyphosate: 1) conventional pinto bean production system check including use of preemergence (PRE) herbicide, 2) rye termination four to five weeks before pinto bean planting, 3) rye termination four to five weeks

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Cassandra Tkachuk, Production Specialist – East

PHACELIA

If you are interested in cover crops, phacelia is a nice choice for pollinator attraction, N-scavenging (to hold N in plant tissue rather than moving through the soil profile) and erosion control, among other benefits. Its alien-like, yet beautiful, flowers immediately caught my eye while scouting. That, and the fact that it was buzzing with activity. It is such a desirable crop for pollinators because it flowers for a long time throughout the season.

Phacelia does well under dry conditions and establishes quickly. Growing it as part of a mixture is an option, but it has been reported to perform better as a solid-seeded cover crop. It's a warm season crop, meaning it is best suited to spring or summer planting. According to the Prairie cover crop survey led by Dr. Yvonne Lawley at the U of M, it is one of the most common cover crops in Manitoba, Saskatchewan and Alberta, next to oats, clover, peas, radish, hairy vetch and fall rye. Whether you choose phacelia or another type will depend on your cover crop goals. After you've set your goals and identified your crop(s), be sure to source high quality seed from a known supplier.

Phacelia in Manitoba in July.

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Figure 1. Pinto bean yield with conventional check and several spring termination timings of winter rye at Carrington from 2018 to 2020 (three site-years).

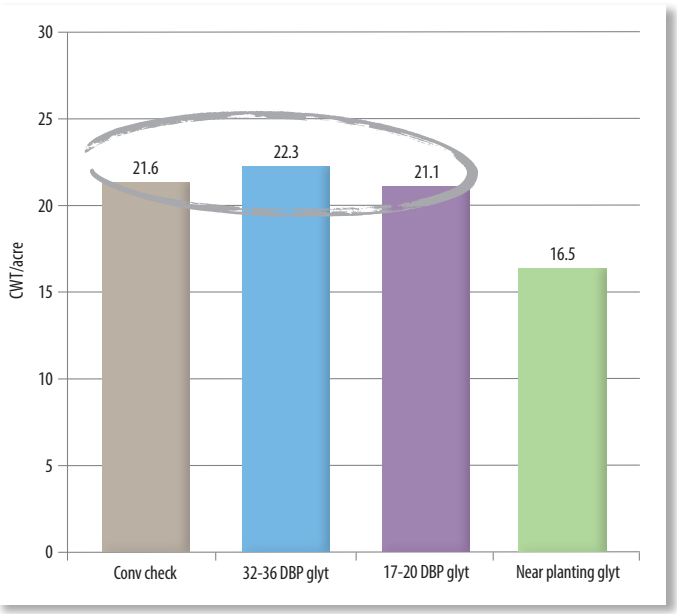
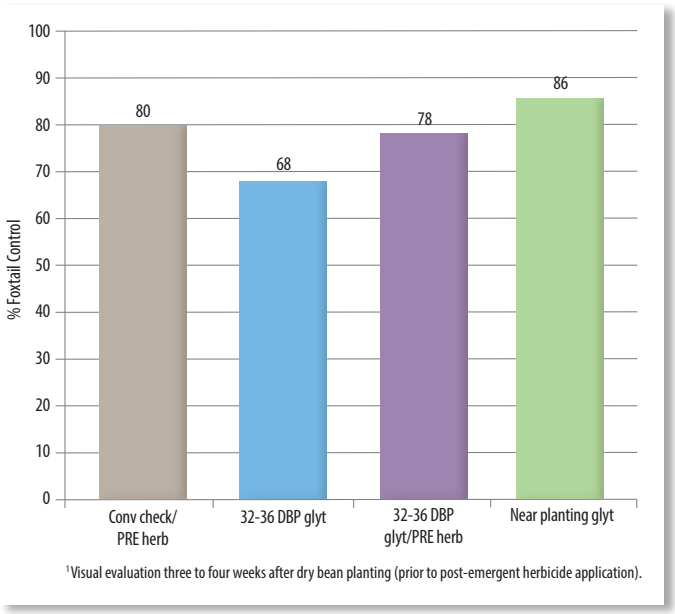


Figure 2. Foxtail control[1] (%) in pinto beans with conventional check and several spring termination timings of winter rye at Carrington, ND from 2018 to 2020 (three site-years).



[1]Visual evaluation three to four weeks after dry bean planting (prior to post-emergent herbicide application).

before pinto bean planting plus PRE herbicide, 4) rye termination two to three weeks before pinto bean planting, 5) rye termination near bean planting (*green-planted* bean) and 6) rye termination 10 to 14 days after bean planting.

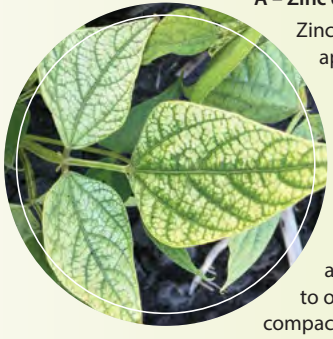
Averaged over four years (2017–20), the greatest pinto bean seed yield among rye treatments was 24.0 cwt/ac compared to 22.5 cwt/ac with the conventional check. Dry bean yield averaged over three years (2018–20) ranged from 21.1 to 22.3 cwt/ac with preplant rye termination (about 2.5 to 5 weeks before bean planting) compared 16.5 cwt/ac with rye termination near bean planting (Figure 1). Reduced yield with delayed rye termination was primarily due to reduced topsoil moisture needed for bean seed germination and plant establishment. Excessive soil moisture was used by the rye and not replenished by timely rain.

Foxtail control (evaluated three to four weeks after bean planting) averaged 68% over three years with early preplant terminated rye (treatment 2, Figure 2). The delayed rye termination near bean planting (treatment 4) provided an average of 86% foxtail control compared to 78 to 80% control with treatments (1 and 3) of preplant glyphosate plus PRE herbicide.

In summary, properly managed winter rye as a cover crop preceding pinto bean can provide benefits, including soil protection from erosion, while dry bean yield potential can be maintained. Termination of rye must be carefully timed to maintain bean yield potential during plant establishment with dry conditions. Winter rye can compliment herbicides for weed management. ■

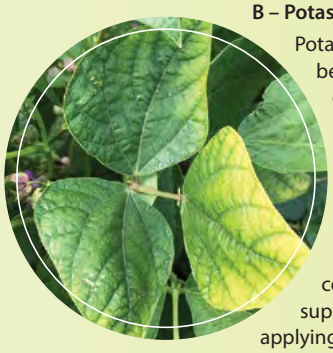
Dry Bean Scout ANSWERS

A – Zinc deficiency



Zinc (Zn) micronutrient deficiency appears most prominently on lower, older leaves. Symptoms include pale green interveinal colour of leaves and yellowing of leaf tips and the outer leaf margin. In severe cases such as this, the interveinal colour may be white. Severe symptoms later on may look like sunscald or appear rusty. Zn deficiency tends to occur on low organic matter, sandy, compacted, high pH or eroded soils. Dry beans respond to Zn fertilizer if soil levels are low (< 1 ppm or a rating of < 15). If this deficiency should occur, it can be corrected in-crop with foliar application early in the season.

B – Potassium deficiency



Potassium (K) macronutrient deficiency in dry beans appears as yellowing of leaf margins on older leaves. This yellowing may later appear scorched or necrotic. K deficiency of beans tends to occur on sandy or low pH soils. It may be seen early in the season or later when leaves remobilize K for pod-fill. Soil test K levels < 100 ppm are considered low. There is no in-season correction, so K must be adequately supplied before growing the crop. If you are applying K fertilizer in-crop with beans, it must be placed away from the seed, as dry beans are very sensitive to injury.

Manitoba Pulse and Soybean Buyer List – May 2021

COMPANY	EDIBLE BEANS	FABA BEANS	LENTILS	PEAS	SOYBEANS	PHONE	LOCATION	CGC REGULATED
Alliance Pulse Processors Inc. dba AGT Foods Canada	✓	✓	✓	✓	✓	306-525-4490	Regina, SK	✓
• AGT Foods St. Joseph	✓		✓	✓	✓	204-737-2625	St. Joseph, MB	✓
All Commodities (AC) Trading Ltd.			✓	✓		204-339-8001	Winnipeg, MB	✓
Avena Foods Ltd. dba Best Booking Pulses Inc			✓	✓		204-857-4451	Portage la Prairie, MB	✓
Belle Pulses Ltd.		✓		✓		306-423-5202	Bellevue, SK	✓
Besco Grain Ltd.		✓		✓		204-745-3662	Carman, MB	✓
Brett-Young Seeds				✓	✓	204-261-7932	Winnipeg, MB	
BroadGrain Commodities Inc.	✓	✓	✓	✓	✓	416-504-0070	Toronto, ON	✓
C.B. Constantini Ltd.				✓		604-669-1212	Vancouver, BC	✓
Cargill Ltd.					✓	204-947-6219	Winnipeg, MB	✓
Columbia Grain Inc. (CGI) (Walhalla Bean Co.)	✓					701-549-3721	Walhalla, ND	✓
Delmar Commodities Ltd.	✓		✓	✓	✓	204-331-3696	Winkler, MB	✓
ETG Commodities	✓	✓	✓	✓	✓	416-900-4148	Mississauga, ON	✓
G3 Canada Limited				✓		204-983-0239	Winnipeg, MB	✓
Gavilon Grain LLC					✓	816-584-2210	Omaha, NB	✓
Global Food and Ingredients Inc.		✓	✓	✓		416-840-8590	Toronto, ON	✓
Global Grain Canada Ltd.	✓					204-829-3641	Plum Coulee, MB	
Hensall District Co-op	✓			✓		204-750-0529	Winnipeg, MB	✓
Horizon Agro Inc.					✓	204-746-2026	Morris, MB	
Kalshea Commodities Inc.			✓	✓		204-272-3773	Winnipeg, MB	✓
Knight Seeds			✓	✓		204-764-2450	Hamiota, MB	
Linear Grain Inc.	✓	✓		✓	✓	204-745-6747	Carman, MB	✓
Louis Dreyfus Company Canada ULC				✓	✓	403-205-3322	Calgary, AB	✓
Marina Commodities Inc.			✓	✓		204-937-2300	Roblin, MB	✓
Lyft Commodities Inc.	✓	✓	✓	✓	✓	604-355-4275	Vancouver, BC	✓
Masterfeeds		✓		✓		403-327-2555	Lethbridge, AB	
McDougall Acres Ltd.	✓	✓	✓	✓	✓	306-693-3649	Moose Jaw, SK	
Monsanto					✓	–	Winnipeg, MB	
Natural Proteins Inc.					✓	204-355-5040	Blumenort, MB	
Nu-Vision Commodities	✓			✓	✓	204-758-3401	St. Jean Baptiste, MB	
Parrheim Foods				✓		306-931-1655	Saskatoon, SK	✓
Parrish & Heimbecker Ltd.				✓	✓	204-987-4320	Winnipeg, MB	✓
Paterson Grain	✓			✓	✓	204-956-2090	Winnipeg, MB	✓
• FeedMax Corp.				✓		204-523-0682	Killarney, MB	✓
Pipeline Foods, ULC				✓	✓	204-594-8750	Winnipeg, MB	✓
Prairie Fava Ltd.		✓				204-721-4715	Glenboro, MB	
Providence Grain Group			✓	✓	✓	780-997-0211	Fort Saskatchewan, AB	✓
PS International, LLC DBA Seaboard Special Crops		✓	✓	✓		306-565-3934	Regina, SK	✓
Richardson International Ltd.				✓		204-934-5627	Winnipeg, MB	✓
• Richardson Pioneer Limited				✓	✓	204-934-5627	Winnipeg, MB	✓
• Tri Lake Agri Limited				✓		204-523-5380	Killarney, MB	✓
Roquette Canada Ltd.				✓		204-428-3722	Portage la Prairie, MB	✓
Rudy Agro Ltd.	✓		✓	✓		306-867-8667	Outlook, SK	✓
Scoular Canada Ltd.	✓	✓	✓	✓		403-720-9050	Calgary, AB	✓
Seed-Ex Inc.				✓	✓	204-737-2000	Letellier, MB	✓
Semences Prograin Inc.					✓	450-469-5744	Saint-Césaire, QC	
Shafer Commodities Inc.	✓	✓	✓	✓	✓	204-822-6275	Morden, MB	✓
Simpson Seeds Inc.			✓			306-693-2132	Moose Jaw, SK	✓
Southland Pulse Inc.			✓	✓		306-634-8008	Estevan, SK	✓
The Andersons Inc.			✓	✓		419-891-6464	Maumee, OH	✓
Vandaele Seeds Ltd.		✓		✓		204-665-2384	Medora, MB	✓
Vanderveen Commodity Services Ltd.				✓	✓	204-745-6444	Carman, MB	✓
Viterra Inc.	✓		✓	✓	✓	Contact your local Viterra sales representative		✓
Western Harvest Bean ULC	✓					204-515-7331	Winnipeg, MB	
Wilbur Ellis Company of Canada Ltd.	✓		✓	✓		204-867-8163	Minnedosa, MB	✓
XPT Grain Inc.	✓			✓		306-525-0205	Regina, SK	✓

The Canada Grain Act requires some elevators and grain dealers to have a Canadian Grain Commission (CGC) license and post security to cover their liabilities (what they owe) to farmers. Grain dealers and operators of primary, terminal and process elevators in western Canada are licensed by the CGC. Seed cleaning plants, which do not purchase grain, and feed mills do not have to be licensed.

It is the responsibility of farmers to satisfy themselves that any company they deal with is financially sound. Questions regarding licensing and security should be directed to the CGC at 800-853-6705 or 204-983-2770.

MPSG's pulse crop buyers list contains the names of companies that have registered with MPSG and are actively purchasing pulse and soybean crops in Manitoba. The word registered does not imply endorsement. The complete list is available on our website manitobapulse.ca.

Recipe Corner

Oat Crusted Chickpea Cheesecake with Saskatoon Berry Glaze

Servings: 8 | Prep time: 60 minutes | Cook time: 50 minutes | Total time: 1 hour & 50 minutes

Ingredients

Filling

2 cups soaked cashews

1 can chickpeas – drained (400 g)

1 tsp vanilla extract

2 tbsp tahini

2 lemons – zest and juice

1/3 cup maple syrup

1 tbsp apple cider vinegar

1 can coconut milk (400 ml)

2 tbsp cornstarch

Oat Crust

3/4 cup large flake oats

1/4 cup sliced almonds

1 cup dates

1 tbsp water

1 tsp salt

Berry Glaze

1 ½ cups Saskatoon berries (fresh or frozen)

1/3 cup orange juice

1 tbsp cornstarch

Method

Crust

1 Preheat oven to 320°F.

2 Place oats and almonds in food processor and pulse until you have a fine flour.

3 Add remaining crust ingredients and blend to a sticky dough.

4 Line springform pan with parchment paper and press the dough evenly into the bottom of the pan.

Place in fridge to set until filling is complete.

Filling

5 Prepare filling by adding all ingredients to a blender and mix on medium speed until smooth.

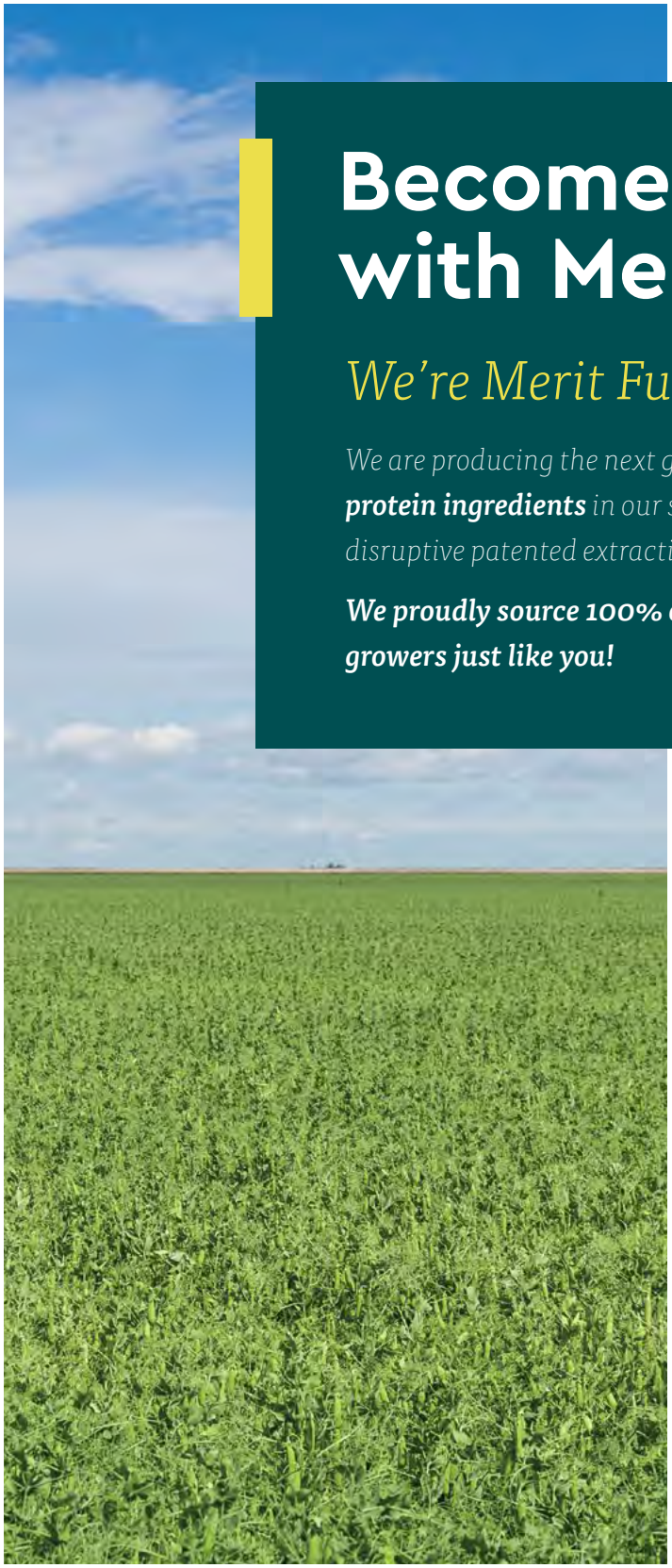
6 Remove crust from fridge, add filling into pan and bake for 45 minutes.

7 Remove from oven and cool it to room temperature. *Store in refrigerator overnight to fully set.*

Sauce

8 Place all ingredients into small sauce pan and simmer on medium heat until thickened.

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



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