

Participatory Plant Breeding for Wheat and Oats in Canada: Pathways for Direct Distribution and Variety Registration



a program of



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Abbreviations and Acronyms

The following is a list of abbreviations and acronyms used in this document:

AAFC	Agriculture and Agri-Food Canada
ASCIS	Authorized Seed Crop Inspection Service
BFICSS	The Bauta Family Initiative on Canadian Seed Security
CÉROM	Centre de recherche sur les grains
CFIA	Canadian Food Inspection Agency
CSGA	Canadian Seed Growers Association
PPB	Participatory Plant Breeding
U of M	University of Manitoba
DoV	Description of Variety form
RC	Recommending Committee
ARCCC	Atlantic Recommending Committee for Cereal Crops
OCCC	Ontario Cereal Crops Committee
PRCOB	Prairie Recommending Committee for Oat and Barley
PRCWRT	Prairie Recommending Committee for Wheat, Rye and Triticale
QRCC	Quebec Recommending Committee for Cereal
VRO	Variety Registration Office

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The Bauta Family Initiative on Canadian Seed Security

The Bauta Family Initiative on Canadian Seed Security (BFICSS), a program of SeedChange, is building a movement for resilient seed systems across Canada. The Initiative's mission: to build a Canadian seed system that promotes food security and is resilient in the face of climate change. Since 2013, we have been collaborating with farmers, seed producers, researchers, and more than 100 partners from civil society, government and businesses, to implement on-farm research and education programs on seed conservation, seed production, and plant breeding that will increase the quality, quantity, and diversity of regionally-adapted seed for organic and climate-resilient farming conditions in Canada.

Introduction

Since 2011, farmers across Canada have been taking part in a participatory plant breeding (PPB) program on wheat and oats with the University of Manitoba (U of M), Agriculture and Agri-food Canada (AAFC), and *The Bauta Family Initiative on Canadian Seed Security* (BFICSS). The goal of the PPB program is to support farmers in developing new varieties of wheat and oat adapted to organic and ecological farming conditions.

Participants have different goals driving their engagement in this program: some farmers want to learn about plant breeding, some want to develop a grain variety that is well-adapted to their farm, and others want to distribute¹ a variety at a local, regional, or national scale. Regardless of their personal motivation, all farmers participating in this program value farmer seed sovereignty and want to contribute to the development of grain germplasm that is adapted to organic and ecological farming conditions.

Participants engaged in the PPB program are currently at different stages of wheat and oat variety development. Some farmers who have completed three or more years of selection on their crops are having their material evaluated at demonstration sites managed by the U of M across Canada. Other participants in the program are continuing to select and adapt material on their own farms.

Participants are able to select the PPB material in ways make the material suitable to meet the requirements for variety registration², or they are welcome to keep the PPB material as an unregistered variety for their own consumption or direct distribution as grain to customers or processors.

In Canada, in order for most major agricultural grain crops³, including wheat and oats, to be distributed *as seed*, they must be registered. Successfully registering a variety involves undergoing a public process of peer-reviewed evaluation to ensure that said variety performs as well as or better than other registered varieties. These regulations are in place to prevent fraud, protect the public interest, and preserve the quality of seed in Canada.

¹ Please note that the term “distribute” is used in this guide instead of the word “sell”. The Seeds Regulations definition of “sell” includes many different ways of sharing propagation material. For example, one can gift, barter, exchange, etc. seed in Canada and it is all covered under the same definition of “sell” in the Seeds Regulations. The authors of this guide felt that use of the word “sell” may give the false impression that only commercial distribution is regulated in the Seeds Regulations, which is not the case in Canada.

² The definition of a “variety” according to the Seeds Regulations in Canada is: “an assemblage of cultivated plants, including hybrids constituted by controlled cross-pollination, that (a) are distinguished by common morphological, physiological, cytological, chemical or other characteristics, and (b) retain their distinguishing characteristics when reproduced”.

³ Grain and forage crops kinds that *require* variety registration are included in Seeds Regulations - Schedule III, Part 3: alfalfa (forage type), barley (six-row, two-row), faba bean (small-seeded), field bean, bird’s foot trefoil, bromegrass, buckwheat, canarygrass, canola, flax (oilseed), clover, fescue, lentil (grain type), lupin, mustard (brown, oriental, and Indian), mustard (white and yellow), oat (grain type), orchardgrass, field pea (commodity type), rye (grain type), ryegrass, safflower, soybean (oilseed), sunflower (non-ornamental), timothy (forage), triticale (grain type), common wheat, durum wheat, spelt wheat, wheatgrass, and wildrye.

For the PPB material to become a registered variety, participants will need to continue selecting and testing the population to ensure that it can qualify as a *variety* under the official criteria detailed in the Seeds Regulations. The regulatory definition of a variety is broad enough to include seed populations⁴ that are heterogeneous, as long as the population can be *distinguished* from other varieties and is *stable* enough to retain the range of characteristics detailed in the variety description provided for registration.

Farmers engaged in the PPB program are currently growing unregistered varieties of wheat and oat. This guide will provide an overview of the options available to farmers if they choose to distribute the varieties they are working with as grain and/or seed.

How does the PPB material fit into Canada's formal seed system?

Indigenous Peoples and farmers are the original plant breeders. The crop diversity all people benefit from today is a result of their seed stewardship and their deep knowledge of their land and food. While many farmers all over the world continue to adapt and develop varieties for their own farms, plant breeding has become increasingly institutionalized over the past century and most farmers are no longer engaged in this process.

The PPB wheat and oat program - in its current iteration - differs in several important ways from the institutional breeding practices that are common to the Canadian seed system:

1. Participants are engaged in selecting the parental lines for crosses
2. Parental lines have used a combination of registered varieties, unregistered heritage varieties, and pre-variety germplasm
3. All selections are being done by farmers on certified organic or ecologically-managed farms, and material is being selected to perform in those conditions
4. Participants have the option of bringing the PPB material through variety registration to be distributed as seed or to grain elevators, or they can maintain it as an unregistered variety to consume directly or distribute to local consumers and processors.

The wheat or oat material for the PPB program was bred by either the U of M⁵ or AAFC. In both cases, technicians made crosses from parental lines with desirable traits (see Appendices A and B for wheat and oat parental lines). For example, one of the wheat populations was a cross of AC Cadillac and Carberry wheat. This cross was made because some farmers wanted wheat that had good yield, resistance to fusarium, and good resistance to lodging.

⁴ This program has been referring to the PPB material as “populations” due the variability and heterogeneity of the materials distributed (Entz et al. 2018). However, since the definition of a variety in the Seeds Regulations accommodates heterogeneity in its description, we will refer to the PPB material as varieties for the purposes of this guide.

⁵ If the PPB material came from the U of M, there are no intellectual property restrictions on the wheat or oat populations or any propagating material derived from it. Farmers are free to pursue variety registration of this material if they choose to. If the PPB material came from AAFC, participant-farmers will have received a Material Transfer Agreement (MTA) and contract with AAFC to assess what was agreed upon for this material. If participants have questions about where the PPB material came from, they can contact Dr. Martin Entz at the U of M.

Since 2016, the U of M has been evaluating some of the PPB lines every year in different locations for the following attributes:

1. Agronomic responses: height, days to maturity, yield, lodging, etc.
2. Pests and stress: diseases, weed pressure, nutrient deficiencies, drought, etc.
3. End-use quality: protein, bushel weight, seed size, % plumps and thins for oats

This data is shared with participating farmers every year to help them make decisions about how they may want to use or distribute their material.

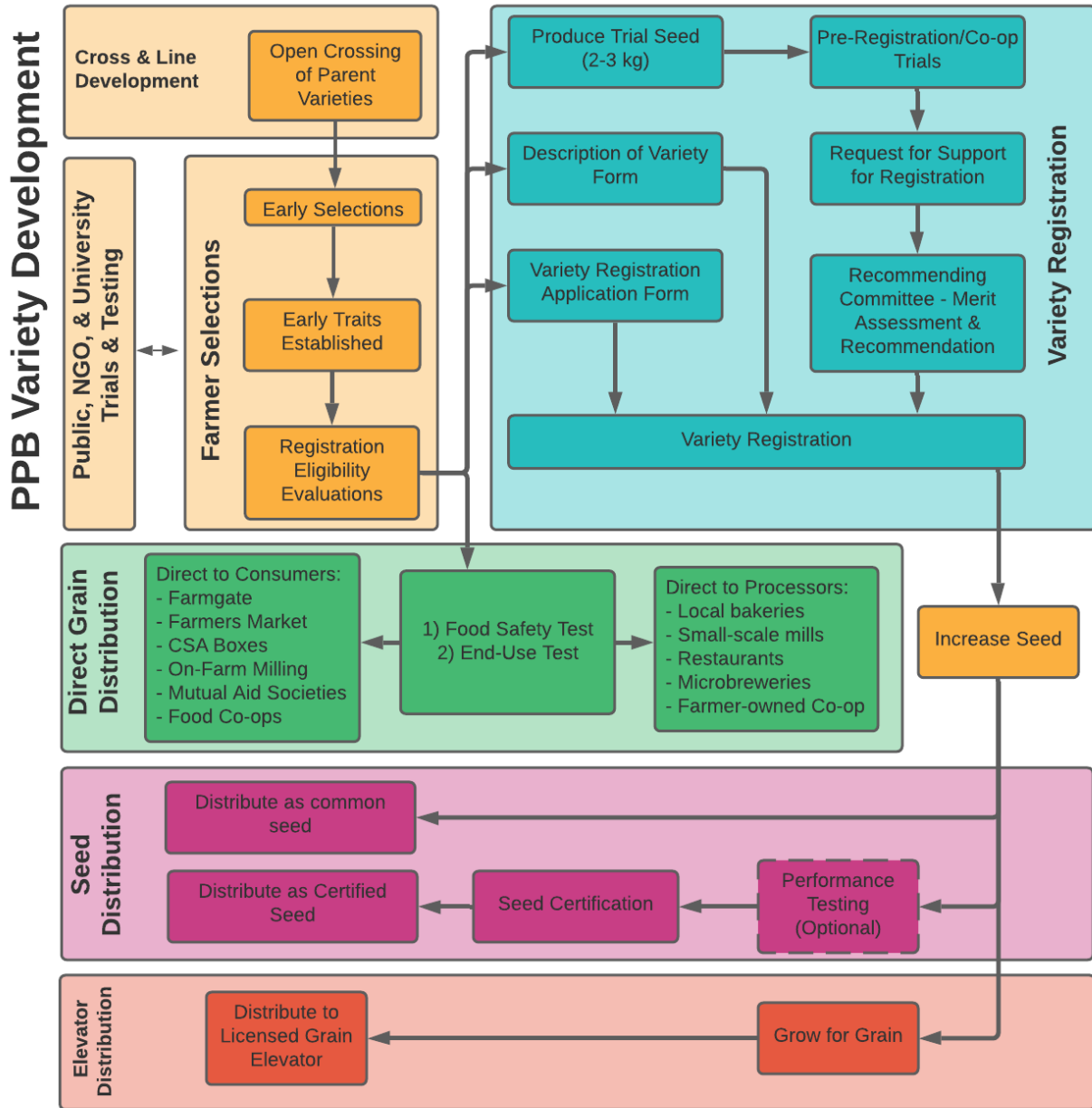
If participants want to distribute their PPB material *as seed* to other farmers or *as grain* through the grain elevator system, **the material has to qualify as a variety and has to go through Canada's variety registration system**. If participants want to distribute their PPB material *as grain* to direct markets the PPB material does not need to qualify as a variety, nor does it need to go through variety registration.

Continued on-farm selection and bulking up seed

Whether participants choose to distribute their materials or not, participants are free to select, save, and replant any saved PPB materials on their own farms as often as they like. There are no laws that prohibit replanting the PPB material on one's own farm and continuing to select and improve their variety or population. The U of M also stores back-up samples of farmer-selected lines each year, so farmers are able to go back to earlier generations of their material if they want to make new selections.

If participants want to increase their supply of the PPB material, either for their own use or for distribution as seed or grain, they can bulk up their wheat or oat population once they have developed it to the desired extent. There are no regulatory requirements that prohibit participants from scaling up the PPB materials indefinitely for future replantings.

Pathways for Distributing PPB Wheat and Oat Material



Pathway	Short Answer	More Information
Eat or share with friends and family?	Farmers can eat the grain they have bred and share it with their friends and family.	<u>Pathway 1</u>
Feed to animals or distribute as feed or forage?	Farmers can feed the PPB materials to their animals. Farmers can also distribute the material directly as feed to other farmers for their livestock, but first they should communicate with the user about their expectations and needs for the feed.	<u>Pathway 2</u>
Distribute as grain directly to users and processors?	Farmers can distribute the material directly to users and processors as food grain, but first they should communicate with the user or processor about their expectations and needs for milling or processing the grain.	<u>Pathway 3</u>
Distribute as grain to grain elevators?	Farmers can distribute the PPB material to an elevator if it is a registered variety. Some elevators in eastern Canada are allowed to accept unregistered grain varieties, but participants will have to accept the lowest grade and price for it.	<u>Pathway 4</u>
Register as a variety and distribute as common seed?	Farmers can only distribute the PPB material as seed after successfully registering their variety. Once registered, participants may distribute the material as common wheat and oat seed. They cannot have a label or tag on the bag, nor advertise or distribute by variety name, grade, or crop characteristics.	<u>Pathway 5</u>
Distribute as certified seed by variety name?	Farmers can distribute the PPB material by variety name if the variety is registered and the seed is grown in accordance with pedigree seed certification requirements.	<u>Pathway 6</u>

Pathway 1: Consume and share with family and friends

In this program participants have selected a wheat or oat population that suits their farm and learned a great deal about plant breeding. A great loaf of bread or a delicious bowl of oatmeal is an excellent reward. Having an on-farm source of grains that participants have bred themselves to share with family and friends is an amazing accomplishment and worth celebrating! If this is the only option a participant is pursuing, then they do not have to worry about any regulatory considerations.

New varieties may experience a susceptibility to fusarium head blight, which can result in grain contamination, rendering it unsafe for human consumption. Participants are therefore advised to test the wheat for mycotoxins and aflatoxins before consumption.

Consuming the PPB grain is also something participants can do in addition to all of the other options. In fact, consuming the grain from the PPB wheat and oat can help inform decisions about what further options participants would like to pursue. Whatever options participants choose for the PPB materials, it is encouraged to consume the grain they have bred for no other reason than that it is deeply enjoyable and rewarding.

Pathway 2: Use or distribute as forage or feed

Participants can feed the PPB material as forage or feed to their animals, or distribute it as feed directly to other farmers. The wheat and oat lines in development under the PPB program have been created with the intention of being used for human consumption. End-use markets for milling have informed the crosses used for the material and on-farm selections to date. However, participants may be seeking a reliable and affordable grain or forage that suits the nutritional needs of farm animals. If selected for these characteristics, PPB material can become a reliable source of forage or feed on their farms. The PPB material can also be improved to meet the specific nutritional needs of animals raised by participants. There are no regulatory restrictions to growing unregistered varieties to feed it to animals⁶.

Pathway 3: Distribute as grain directly to users and processors

Participants can distribute the material directly to users and primary processors as grain, but first they need to communicate with potential customers about how well it might meet their milling or processing requirements.

Some farmers are interested in distributing the grain harvested from their PPB material to processors, mills, maltsters, breweries, and distilleries so that it can be processed and sold as flour, rolled oats, or other primary processed foods and beverages. For example, participants can seek out artisanal bakeries or craft brewers that have an interest in buying good quality, unique, organic, and local grain. Participants can negotiate a production contract with a local mill, bakery, brewery, commercial grain buyer, or do their own on-farm processing and distribute directly to consumers.

⁶ Government of Canada. *Feeds Act* 3(1)(2) & 4

Some participants have had success with direct distribution of their PPB wheat and oat materials. One participant in BC has included the PPB grain into their farm's community supported agriculture (CSA) box program⁷. Another participant in Quebec has been milling the grain on their farm and selling it directly to customers as flour. Two participants - in Manitoba and Ontario - have partnered with local, small-scale mills and bakeries who offer customers specialty flour and baked products.⁸

The production chains participants enter into can vary greatly in scope and degree of formality. It could be as simple as selling grains at the farmers' market and to a bakery or brewery for a seasonal product, or it could involve formal supply contracts and participation in a co-operative that spans the chain of production. While these relationships are unorthodox for many farmers growing grains at a large scale, regionally-focused grain economies and food systems are well-positioned to support innovative emerging production chains.

Pathway 4: Distribute as grain to a licensed elevator

The Canadian Grain Commission (CGC) establishes classes and grades for different grain crops in order to safeguard the quality standards of Canadian grain for both domestic and export customers. All grain is graded according to established grading factors for its crop kind (and class for wheat). Grading evaluates end-use qualities that affect the grain's performance during processing or the quality of the end product. Generally, the price farmers are paid is based on the grade of the grain. Unregistered varieties are automatically given the lowest priced grade, "sample".⁹

Producers in the Prairies can only sell registered varieties to a licensed facility.¹⁰ Producers in eastern Canada are allowed to sell unregistered varieties to an approved licensed facility¹¹ (called the "seeding by importer exemption"), but they are only eligible for the lowest grade and price for their grain.¹² In both eastern and western Canada, licensed facilities are not required to accept unregistered varieties.¹³

Pathway 5: Register as a variety and distribute as common seed

If a participant wants to distribute or sell their PPB wheat or oat material as seed, it must meet the requirements for variety registration under Canada's Seeds Regulations.¹⁴ Canada's seed laws establish two categories of selling field crop seed: common and certified. Common seed¹⁵ is

⁷ Helen Jensen and Iain Storosko. 2020. Evaluation of selection methods and efficacy in on-farm breeding of organic wheat and oat varieties

⁸ Manitoba Organic Alliance. Season 3, Episode 2 - Grain on the Brain Podcasts interview with Iain Storosko and Aabir Dey, 2020

⁹ CGC. "Grain Quality" Webpage: <https://www.grainscanada.gc.ca/en/grain-quality/>

¹⁰ CFIA - Requirement to Make and Provide - Order No. 2020-43

¹¹ To sell an unregistered variety to an eastern licensed elevator the elevator must be granted an exemption from the CFIA to require variety eligibility declarations from grain farmers (CFIA - Order No. 2020-43)

¹² Government of Canada. Canada Grain Act, s.28

¹³ Government of Canada. Canada Grains Act, s. 58.1

¹⁴ Government of Canada. Seeds Act Section 3(1)(b) & Seeds Regulations, Part III

¹⁵ Please note the difference between uses of the term "common seed". For this document, when capitalized, "Common Seed" refers to the lowest grades that can be given to certified seed in accordance with the standards detailed in the Seeds Regulations grade tables. When written in lower-case, "common seed" refers to grain that was harvested and cleaned by a farmer to use as seed without any certification through the CSGA.

produced from registered varieties and distributed as seed without a variety name or grade. Certified seed is produced from a registered variety that is inspected by a CSGA-authorized agency, which can then be distributed as seed by a variety name.

The following section will explain how to prepare the PPB wheat and oat material to be distributed as common seed in accordance with Canada's seed laws and variety registration process. This process typically takes about three years to complete and can cost between \$912.14 and \$16,412.14 per variety, depending on the crop kind, region, and availability of services.

Variety Registration Overview

Variety registration requires that the propagating wheat and oat material is both stable enough from generation to generation and distinguishable enough from already registered varieties to be considered a new variety. The PPB material will also need to perform as well as, or better than, specific existing varieties called "check varieties" in the same grain class. It will need to be grown in test plots according to the relevant Recommending Committee's procedures to generate pre-registration trial data¹⁶ that demonstrates acceptable agronomic, disease, and end-use merit qualities. This test data is then evaluated by the appropriate Recommending Committee (RC) and then voted upon whether to recommend it for registration.¹⁷ Once a participant has obtained an RC recommendation for national or regional registration, they can send in an application package to the Variety Registration Office (VRO). Once the variety is registered, the participant is allowed to distribute the PPB material as common seed, but not under a variety name.

Cost of Variety Registration

The cost of registering a new variety depends on many factors. Institutional plant breeding programs cover the costs of preparing a variety for registration with funding sources that are not available to PPB participants. PPB program participants who wish to register a variety will need to build a relationship with a Canadian Seed Grower Association (CSGA)-recognized breeder who is willing to help prepare an application. Participants may also be responsible for finding their own fee-for-service trial sites and accredited labs if the region's RC does not have any trial spots available at the time.

The variety registration costs detailed in this guide are based on estimates provided by various RCs, crop development institutions, and accredited labs. **We estimate the variety registration process for wheat and oats to cost between \$912.14 to \$1,320 per variety if the variety is accepted into a co-op trial program. However, it can cost up to approximately \$16,412.14 per variety if the participant has to use private, fee-for-service (FFS) labs for pre-registration trial data. There is also a yearly \$104.24 fee to maintain the variety once it has been registered.** This estimate does not include the labour of the participant and breeders involved, nor the materials used to develop the variety.

¹⁶ CFIA, Model Operating Procedure (MOP) guide for Recommending Committees, Trial Procedures section: <https://www.inspection.gc.ca/plant-health/variety-registration/registration-procedures/model-operating-procedures/eng/1449020233503/1449020234811?chap=1>

¹⁷ A panel of independent experts for the specific crop kind.

Variety registration trial requirements and estimated costs for wheat and oats in Canada

Region and Crop		Recommending Committee	Possible Trial Hosts ¹⁸	Trial Site Locations	Total Trial Site Years	Minimum Program Years ¹⁹	Registration Trial Cost	Variety Registration Fee	Total Cost
Atlantic (sponsored) ²⁰	Wheat	ARCCC	ARCCC	4	9	4	\$870.00	\$912.14	\$1,782.14
	Oats			3	9	3	\$710.00		\$1,622.14
Quebec (sponsored) ²¹	Wheat	QRCC	CÉROM	3	19	3	\$1,900.00		\$2,812.14
	Oats			2	10	3	\$1,300.00		\$2,232.14
Ontario (sponsored) ²²	Wheat	OCCC	OCCC	2	20	2	\$1,800.00		\$2,712.14
	Oats			2	14	2	\$1,200.00		\$2,112.14
Prairies (sponsored) ²³	Wheat	PRCWRT	PRCWRT	8	24	3	\$0.00		\$912.14
	Oats	PRCOB	PRCOB	3	6	2	\$0.00		\$912.14
FFS Estimate ²⁴	Wheat and Oats	-	Private Labs in Canada	-	-	-	\$15,500.00	\$16,412.14	

Once a variety is registered there is a yearly cost of \$104.24 to maintain a variety.

¹⁸ Trial host refers to the institutions actually hosting the co-op trials. In some situations, the RC will be hosting the trials directly, and in others they will partner with other institutions to host the trials.

¹⁹ "Minimum program years" means the shortest permitted duration in which all trial site years can be completed.

²⁰ ARCCC "Operating Procedures"; Communications with Dan MacEachern of AAFC (Dan.Maceachern@canada.ca)

²¹ CRCQ "Procédures opérationnelles", pp. 9 & 19; Communications with Michel McElroy of CÉROM (Michel.McElroy@cerom.qc.ca)

²² OCCC "Operating Procedures", p.10; Communications with Joanna Follings of OMAFRA (Joanna.Follings@ontario.ca).

²³ PRCWRT Operating Procedures, p. 10; PRCOB Operating Procedures, pp. 13 & 38-9.

²⁴ Value based on: (1) Agronomic Test Data Trials quote (\$9,000) provided by AgQuest Inc. based on 2016 rates. (2) Disease Test Data Trials quote (\$1,200) provided by AAFC. (3) Quality Test Data Trial quote (\$5,300) provided by CIGI.

Variety Registration Process

The variety registration process is complex. In the proceeding sections of this document, we have attempted to distill the most important factors participants will need to consider when pursuing this pathway. Detailed descriptions of the operating procedures for each crop kind's recommending committee can be found on their respective websites.

Step 1: Define region and end-use grain class

The first thing to identify when registering a variety is the region and grain class under which the material will be registered. The wheat material developed through the PPB program predominantly comes from crosses of *hard red spring wheat* varieties. This means that the wheat material can be designated as either a Canada Western Red Spring (CWRS) or Canada Eastern Red Spring (CERS),²⁵ depending on the geographic location of the participant.

Classes for PPB wheat material		
End-Use	Eastern	Western
Grain	Canada Eastern Red Spring (CERS)	Canada Western Red Spring (CWRS)
Feed	Canada Eastern Feed (CEF)	Canada Western Special Purpose (CWSP)

Oat varieties used for grain production are not given classes in the same way that wheat varieties are. There are two different categories that are given to oat varieties for the purpose of grading, and they are based on geographic location: Canada Eastern and Canada Western.²⁶

Participants can distribute unregistered oat varieties as common seed for forage-use only without going through variety registration. This specific category of oat seed does not require variety registration if the seed is used for the sole purpose of forage production. However, in order to distribute forage-use oat seed by variety name, participants will need to have it certified through an application with the CSGA (for certification of unregistered grain varieties).²⁷

Step 2: Identify and contact the appropriate Recommending Committee

After identifying the appropriate grain class for their materials, participants need to reach out to the appropriate Recommending Committee (RC) based on crop and region. RCs are a group of volunteer experts that meet to assess the trial data from pre-registration trials for merit testing and determine

²⁵ CGC Wheat Classes and Varieties

<https://grainscanada.gc.ca/en/grain-quality/grain-grading/wheat-classes.html>

²⁶ CGC Oats: Primary and export grade determinants tables

<https://www.grainscanada.gc.ca/en/grain-quality/official-grain-grading-guide/07-oats/primary-grade-determinants-tables.html>

²⁷ Oats, for all uses, are listed as a Schedule II crop in the Seeds Regulations, which means they must undergo pedigree certification to be sold by variety name [Seeds Regulations s. 10(3)]. Crops that are required to go through variety registration are listed in Schedule III of the Seeds Regulations. Schedule III only includes "Oat (grain type)", which means that oat seed that is distributed for non-grain purposes (i.e. forage use only) must be certified but does not require variety registration to be sold by variety name.

a cultivar’s eligibility for registration. They are also responsible for approving trial and data analysis procedures. To successfully register a new wheat or oat variety, participants will need to obtain a *Letter of Recommendation* from the appropriate RC in their region. They will therefore need to work with the appropriate RC to establish a plan for the coordination of pre-registration trials. Contact information for the different RCs can be found on the Canadian Food Inspection Agency (CFIA) website.²⁸

Recommending Committees for Wheat	
Atlantic	Atlantic Recommending Committee for Cereal Crops (ARCCC)
Quebec	Quebec Recommending Committee for Cereal (QRCC)
Ontario	Ontario Cereal Crops Committee (OCCC)
Prairies	Prairie Recommending Committee for Wheat, Rye and Triticale (PRCWRT)
Recommending Committees for Oat	
Atlantic	Atlantic Recommending Committee for Cereal Crops (ARCCC)
Quebec	Quebec Recommending Committee for Cereal (QRCC)
Ontario	Ontario Cereal Crops Committee (OCCC)
Prairies	Prairie Recommending Committee for Oat and Barley (PRCOB)

Step 3: Select and test PPB material until eligible for registration

Participants will need to continue making selections until the wheat or oat population meets the Seeds Regulations standards to be registered as a new variety. The Seeds Regulations require new varieties to meet the following two conditions:

1. **Distinguishable:** They “are distinguished by common morphological, physiological, cytological, chemical or other characteristics”.
2. **Stable:** They “retain their distinguishing characteristics when reproduced”²⁹

Farmers will need to partner with a CSGA-recognized plant breeder to formally assess the eligibility of the material as a variety. While a participant is making selections, it is also useful to gather on-farm data and observations on the performance of the material, or to request that the material be evaluated through the U of M’s evaluation trials. Early evaluation before entering the RC trials can provide a good indication of whether there is a reasonable chance of demonstrating merit during test trials and receiving a recommendation from the RC.

²⁸ CFIA - Crop Specific Registration Recommending Committees webpage: <https://inspection.canada.ca/plant-varieties/variety-registration/registration-procedures/recommending-committees/eng/1359958262947/1359958370983>

²⁹ Government of Canada. Seeds Regulations, Interpretations “Variety”

Step 4: Produce pre-registration trial seed

Participants will need to produce 2-3 kg of seed that is sufficiently stable for pre-registration trials and variety registration. Breeder seed certification is recommended to ensure the seed is stable enough to pass merit testing, but it is not required; as long as the seed submitted for testing is distinguishable and stable it will qualify as an eligible variety. A CSGA-recognized breeder can help participants produce seed that meets these standards. Participants have the option of having their seed officially certified by an Authorized Seed Crop Inspection Service (ASCIS) but seed produced by a CSGA-recognized breeder automatically qualifies as “breeder seed” for the purposes of pre-registration trials and variety registration. The CSGA keeps a list of ASCISs that provide farmers with a quote for crop inspection services for the production of breeder seed.³⁰

Step 5: Description of Variety form

RCs require a Description of Variety (DoV) form when one requests a recommendation for variety registration. A CSGA-recognized breeder can help a participant meet the requirements to formally describe the variety in botanical and morphological terms. This DoV form for wheat³¹ or oats is submitted to the VRO along with the application for registration.³²

Types of information included in a DoV form:	
Wheat	Oats
Type and season of wheat	Type of oat
Three varieties used for comparison	Two varieties used for comparison
Sprouting, leaf, straw, spike, and seed characteristics	Sprouting, leaf, straw, panicle, and seed characteristics
Lodging characteristics	End-use quality characteristics
How many days it takes to form a head	Pest resistances
Pest resistances	Variability within the variety
Variability within the variety	

Step 6: Merit assessment test data trials

If early trial data (i.e. on-farm data or data gathered by the U of M) shows enough promise to be eligible for a recommendation from an RC (i.e. variety distinguishability, stability, performance relative to check varieties), then a participant can enter the PPB material in pre-registration trials to

³⁰ CSGA. Contact an Inspection Service

<https://seedgrowers.ca/seed-growers/resources/contact-inspection-service/>

³¹ CFIA. DoV Form for Wheat is titled Form CFIA/ACIA 5865.

³² CFIA. The DoV Form for Oats is titled Form CFIA/ACIA 5862.

produce test data for merit evaluation by an RC. Most RCs across Canada facilitate “co-op trials”³³ themselves (i.e. Prairie Grain Development Committee, OCCC, and the ARCCC). Quebec works with crop development institutions like *Centre de recherche sur les grains* (CÉROM) to conduct test data trials. These committees and institutions host co-op trials for fees ranging from \$0 - \$1,900. Participants can also pay for private trials on a fee-for-service basis, which we estimate can cost up to \$15,500. Once all of the trials are completed, the test data is reviewed by the RC and shared with prospective registrants.

Step 7: Request recommendation for registration

After the RC has received the test data, participants can request a recommendation from the RC for variety registration. Participants working with the PPB materials can apply for National or Regional registration. The request for registration triggers the process of merit testing which takes the test data from co-op or private trials and compares it to performance data from similar and recently registered (“check”) varieties. RCs delegate evaluation to three internal evaluation teams (ETs) who look at agronomy, disease, and end-use characteristics.

The three Recommending Committee evaluation teams are:

1. Breeding and Agronomy (ETA)
2. Disease (ETD)
3. Quality (ETQ)

The whole RC comes together to vote on whether to recommend the variety for that region. If an applicant has requested national registration, then other RCs can review the variety’s test data and decide if it should be registered in their region. If a region’s RC takes issue with the recommendation of a variety in their region (i.e. for reasons of pest vulnerability) they can request that it not be registered in their region. Applicants can also request to have a variety registration limited to particular regions. Registered wheat and oat varieties can only be produced and distributed in regions where the variety is approved.

Step 8: Variety registration & distribution

The final step for variety registration is to submit a full application for variety registration to the variety registration office (VRO).³⁴ This requires an application form, an application fee (\$912.14),³⁵ a breeder seed sample, a DoV form, trial data, pedigree information, and a recommendation letter from an RC.

It takes the VRO up to 120 days to review an application for variety registration. Once the process is complete, the VRO will make a decision to accept or deny the participant’s application for registration. If they accept the application, the variety will be entered into the Plant Variety Journal and a Certificate of Registration will be given to the participant to serve as proof that the variety has

³³ “Co-op trial” is a term used in some regions for pre-registration trials that are coordinated by the RCs.

³⁴ CFIA. Variety Registration Application Form

<https://inspection.canada.ca/plant-varieties/variety-registration/registration-procedures/application-form/eng/1363059428910/1363059623297>

³⁵ CFIA. Fees Notice 2021

<https://inspection.canada.ca/about-cfia/acts-and-regulations/list-of-acts-and-regulations/cfia-fees-notice/eng/1582641645528/1582641871296>

been registered.

Once the variety is registered, the participant can sell the PPB material as common seed. It cannot be given a certified seed grade, labelled or tagged, or advertised as a variety. It can only be advertised and sold as a bag or bulk container of wheat or oat seed with no variety name or description. If a participant wants to label the PPB seed with a tag, the variety must be grown by a pedigreed seed grower in accordance with the procedures required for certified seed (see Pathway 6).

Pathway 6: Distribute as certified seed by variety name

Participants can distribute the PPB material by variety name if it has a) gone through variety registration and b) been certified for varietal purity through a third-party inspector authorized by the CSGA. Selling the registered PPB material as certified seed means that participants are allowed to sell the seed with its variety name, grade, and product claims. This guide does not cover how to distribute the PPB material as certified seed because the process for eligible crop varieties is contained in CSGA's Circular 6 Document.³⁶

If a participant is interested in making the PPB material eligible for seed certification, they can contact the CSGA. The administrative costs involved with certified seed production start at \$291.10 including \$240 for a CSGA membership, \$50 for land use inspection, and \$1.10 per acre of seed crops for certification.³⁷ Upon successful certification, seed growers receive a crop certificate indicating the grade of the certified seed crop.

In addition to seed certification, many seed companies have a variety performance tested for the region in which it is being sold after it has either been recommended for registration or has been registered. In Ontario, for instance, the performance testing protocol is determined by the Performance Trial and Data Coordinators of the OCCC. For spring wheat, it costs between \$790 and \$1,590 depending on how many sub-regions require performance data. For oats, it costs between \$530 and \$1,170. Similar programs are delivered in other regions by the Atlantic Grain Council, réseaux des grandes cultures du Québec (RGCQ), Saskatchewan Advisory Council on Grain Crops (SACGC), and the Alberta Regional Variety Advisory Committee (ARVAC). Seed Manitoba conducts the Manitoba Crop Variety Evaluation Trials (MCVET), which is free for the sponsor submitting the variety for testing.

³⁶ CSGA. Canadian regulations and procedures for pedigreed seed crop production (Circular 6).

³⁷ CSGA. Service fees webpage. <https://seedgrowers.ca/about-csga/fees/>

Conclusion

We hope that this document was able to clarify different commercial and non-commercial options that are available for the PPB material, and that it has also given readers a better idea how the formal seed system works in Canada. There is a lot of behind-the-scenes work that happens to create a new variety and ensure that variety adds value to Canadian agriculture. These regulations are in place with the intention of maintaining seed quality for farmers and consumers.

Taking farmer-bred materials through the formal seed system is mostly uncharted territory. The PPB program presents us with an opportunity to both register farmer-bred materials within the formal seed system and to advocate for progressive support from the federal government to make the variety registration system more accessible to farmers engaged in plant breeding.

Greater engagement among farmers with the variety development process in Canada is a step towards building a more participatory and inclusive seed system. However, PPB and farmer-led plant breeding is not a substitute for Canada's well-established public breeding programs - instead, we hope that this model of variety development signals to the federal government that farmers should be engaged and supported in the development of public varieties for the public good. In doing so, we hope to build a seed system in Canada that is more farmer-led, diverse, and resilient.

Appendix A: Sample list of parents used in PPB wheat crosses

Legend:

FHB - Fusarium head blight

Ldg - Lodging

YLD - Yield

TW - Test weight

SR - Stem rust

PSR - Pre-harvest sprouting resistance

TKW - Thousand kernel weight

LR - Leaf rust

mdg - Midge resistance

PPB Line	Pedigree	Characteristics (female parent / male parent)
BL17A-N	Vesper/Shaw	LR, Midge/LR, ST, Midge
BL17B-N	BW415/Shaw	LR, Midge/LR, ST, Midge
BL19B-N	BW415 (Vesper) /BW431	LR, FHB, Midge
BL22A-N	BW415 (Vesper) /BW461	LR, SR, YR, FHB, Midge
BL28A-N	BW462/BW431	LR, SR, FHB, Midge
BL28B-N	BW462/BW431	LR, SR, Midge / LR, FHB, Midge
BL48A-N	BE29A-31-2/BW455	FHB, Midge / LR, FHB, Midge
PA05A	Cadillac / Carberry	yield, FHB, quality / FHB, ldg R, good bunt, poor yield
PA12	AAC Scotia / Norwell	yield, FHB, quality / yield, TW
PWA05A	Cadillac / Carberry	yield, FHB, quality / FHB, ldg R, good bunt, poor yield
PWA10	ERA131-R3 / Sable	excellent FHB, good for stone ground bread / YLD, TW, LDG, short
PWA14	Unity / Red Fife	yield, mat, SR, LR, FHB, mdg, PSR / heritage, tall, late
PWA16	Red Fife/Mckenzie	heritage, tall, late / SR, LR, TW, yield, bunt
PWA16	AAC Scotia / Acadia (awned)	yield, FHB R, baking quality, poor LDG / baking quality
PWA16A	Red Fife / McKenzie	heritage, tall, late / SR, LR, TW, yield, bunt
PWA17	Superb / Helios	yield / yld, SR, FHB, smut, PSR
PWB02	AC Walton / AAC Scotia	Susceptible to septoria and rust, tall, good milling characteristics / Yield, FHB R, quality, tall, susceptible to lodging
PWB05	AC Tradition / Unity	Yield, short, good tkw, later maturity / Yield, early maturity, good SR and LR, FHB, midge resistance, PSR
PWB06	AC Barrie / Acadia	Test weight / baking quality
PWB09	Champlain / Brandon	Lodging resistance, good LR, good FHB, yield
PWB16	AAC Scotia / Acadia	yield, FHB R, baking quality, poor LDG / baking quality

Appendix B: Sample list of parents used in PPB oat crosses

Legend:

Twt - Test weight

TKW - Thousand kernel weight

Bglu - Betaglucan

OSR - Oat stem rust

OCR - Oat crown rust

BYDV - Barley yellow dwarf virus

Ldg - Lodging

S - Susceptible

R- Resistant

PPB Line	Pedigree	Characteristics (female parent / male parent)
POC04	Cantal/Alymer	Twt, TKW, tall / Twt, TKW, yield
POC05	Summit/Jordan	ldg, OCR R, good bushel weight / yield, TKW, ldg, BYDV
POA04	OT8001/05P14-OA01	High yield, early maturity, OSR S, BYDV S / High yield, good OCR and OSR, high % plumps, late
POA05	OT3063/OT8003	yield, high % groat, very low oil, OCR & OSR S / TW, OCR
POB02	OT8003/Prescott	Twt, OCR / septoria R
POA07	N0070182 / OT7073	Hi yld, lo oil, g OCR&OSR/Hi yld, MKW, % groat & Bglu; lo oil; poor OSR & smut
POA06	Gehl / 05P14 -OA02	Hulless and hairless, R to lodging, Twt, early maturity, S to OCR and OSR, S to BYDV, tall / YLD, R ot OCR and OSR, good % plumps, late maturity
13P13	OT7073 / WIX9082-1	High yield, TKW, % groat & Bglu; low oil; poor OSR & smut / low yield, very low oil, good smut, OCR, OSR
13P26	Horsepower / Wix9082-1	High Bglu, good OSR / low yield, very low oil, good smut, OCR, OSR

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