



Canadian Agriculture Partnerships (CAP) AgriScience Program Performance Reporting Requirements (2019-2020) - Annual Performance Report

AgriScience Program

2019-2020 Annual Performance Report

Name of Recipient: Prairie Oat Growers Association Fay Wu (Program Officer, Programs Branch), Richard Escott (Senior Science Program Analyst, Science and Technology Branch (STB)), Scott Duguid (Acting DRDT)	
Project Title: ASP-004 POBC Prairie Oat Breeding Consortium/ASP-004 POBC Prairie Oat Breeding Consortium	
Project Number: CAP-J-002038 ASP-004 POBC	Period Covered by Report (YYYY-MM-DD to YYYY-MM-DD): 2019-04-01 to 2020-03-31
Activity #: Name of Activity: POBC	Principal Investigator: Jennifer Mitchell Fetch/Kirby Nilsen
Activity Start Date (YYYY-MM-DD): 2018-04-01	Activity End Date (YYYY-MM-DD): 2023-03-31

1. Performance Measures

In the performance measures table below, please provide the results and achievements that were finalized during the reporting period. Do not include results that are not final or that will continue to be developed. It is quite possible that in the first year or two, there may not be any results to report. Please see Annex A for a description of each performance measure.

	Performance Measures	Results Achieved	Provide a brief description of each final result achieved during the reporting period.
1.	Number of highly qualified personnel (HQP) working on funded activities (HQP refers exclusively to current Master and PhD students)	Not Collecting	
2.	Training/Knowledge transfer events		
	2.1 Number of training/knowledge transfer events organized by the recipient	Not Collecting	
	2.2 Number of presentations made in training/knowledge transfer events	5	Posters: 1. Nahkforoosh, A., Kumar, S. Mitchell Fetch, J. 2019. Peduncle Strength: a potential selection criterion to improve lodging tolerance in Oat. Poster. Plant Canada 2019 Communicating Innovation in Plant Science. July 7th – 10 th , 2019. U of G / Guelph, Ontario. >500 participants



			<p>Presentations:</p> <p>Nilsen, K. 2020. Leveraging Genomics for Sustainable Oat Breeding. Presented to POBC January 30 2020. 19 Participants</p> <p>Mitchell Fetch, J. 2020. Variety Development and Commercialization: Breeding and Registration System. Presented to CIGI's (Canadian International Grains Institute) 2020 Combine to Customer Programs - Variety Development and Commercialization, held in Winnipeg, MB. Presented February 12th, February 20, and March 10th to ~20 class participants each time</p>
3.	Number of participants at training/knowledge transfer events	Not Collecting	
4.	Number of new knowledge transfer products developed	0	
5.	Number of papers published in peer reviewed journals	5	<p>1. Yan W, Tinker NA, Bekele WA, Mitchell-Fetch J, Fregeau-Reid J. Theoretical Unification and Practical Integration of Conventional Methods and Genomic Selection in Plant Breeding. <i>Crop Breed Genet Genom.</i> 2019;1:e190003. https://doi.org/10.20900/cbgg20190003.</p> <p>2. Kebede, A.Z., Admassu-Yimer, B., Bekele, W.A., Gordon, T., Bonman, J.M., Babiker, E., Jin, Y., Gale, S., Wight, C.P., Tinker, N.A., Menzies, J.G., Beattie, A.D., Mitchell Fetch, J., Fetch, T.G., Esvelt Klos, K., McCartney, C.A. (2020). Mapping of the stem rust resistance gene Pg13 in cultivated oat, 133(1), 259-270. http://dx.doi.org/10.1007/s00122-019-03455-5</p> <p>3. Bekele, W.A., Itaya, A., Boyle, B., Yan, W., Mitchell Fetch, J., Tinker, N.A. (2020). A targeted genotyping-by-sequencing tool (Rapture) for genomics-assisted breeding in oat, 133(2), 653-664. http://dx.doi.org/10.1007/s00122-019-03496-w</p> <p>4. Zhao J., Kebede AZ, Menzies JG, Paczos-Grzęda E, Chong J, Mitchell Fetch JW, Beattie AD, Peng YY, McCartney CA. 2020. Chromosomal location of the crown rust resistance gene Pc98 in cultivated oat (<i>Avena sativa</i> L.). <i>Theor Appl Genet.</i> 2020 Jan 14. doi: 10.1007/s00122-020-03535-x. [Epub ahead of print]</p> <p>5. Nakforoosh, A. Kumar, S., Fetch, T. Mitchell Fetch, J. 2020. Peduncle breaking</p>



			resistance: a potential selection criterion to improve lodging tolerance in Oat. CJPS. (10.1139/CJPS-2019-0286). Accepted for publication, March 2020.
6.	Number of new technologies (new products, practices, processes and systems) that are developed	0	
7.	Number of new technologies (new products, practices, processes and systems) that are assessed under research conditions	Not Collecting	
8.	Number of new technologies (new products, practices, processes and systems) that are demonstrated on-farm or in-plant	Not Collecting	
9.	Number of new technologies (new products, practices, processes and systems) that attain Intellectual Property (IP) protection	0	
10.	Number of new technologies (new products, practices, processes and systems) that are utilized	Not Collecting	

2. Summary of Activity

Please provide a high-level summary of this activity that includes an introduction, objectives, methodology, deliverables, results and discussion. Technical language can be used in this section.

<p>Executive Summary</p> <p>The objective of the Prairie Oat Breeding Consortium (POBC) is to develop new oat cultivars suited to production in western Canada, and suited to end use markets identified by the Prairie Oat Growers Association (POGA) and the milling industry. These cultivars will be developed as efficiently and effectively as possible. The cultivars developed will have end-use quality identified as important by the industry and will carry genetic resistance to major diseases, pests and adverse environmental conditions prevalent in the planned production areas. This project will address several of the priority areas identified in the new Canadian Agricultural Partnership Policy Framework, including helping oat producers and the oat industry to use science and innovation to increase their productivity and become even more resilient. It could enable the farmers and oat food processors to become more competitive by increasing their export capacity and addressing the needs of new markets around the world. The project, through the development of cultivars that are genetically resistant to pests and adaptable to various climatic conditions, will help producers be more resilient by reducing the following: the cost of growing oats, the fossil fuel use and greenhouse gas emissions and the amount of pesticides used in oat production. Many of the industry partners in this project focus on adding value to the producers oat crop, directly addressing the priority for growth in Value-added Agriculture and Agri-Food Processing. Risks to the producers and the oat processing industry will be reduced by oat cultivars that perform better agronomically, are resistant to pests and produce reliably healthy products for the human and animal consumers, in Canada and around the world. This will also increase the Public Trust in the Canadian oat crop as a whole.</p> <p>2019-2020 Report Executive Summary</p> <p>By 2023, develop superior oat germplasm ideally suited for production in the variable environments in</p>
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western Canada, which will be eventually sought after by the oat processing and milling industry, for domestic and export markets. The superior breeding lines will respond to industry needs for improved yield, improved agronomy, resistance to major diseases, pests and other adverse environmental conditions that may become prevalent in the planned areas of production. If these breeding lines become registered cultivars, they will continue to make Canadian producers and North American end users consistently profitable.

The goals of this program will align with the National Oat Strategy which states "increased yields of new varieties by $\geq 2\%$ per year, relative to provincial checks, until 2023 while maintaining quality and desired agronomic characteristics" (through breeding) and $>3\%$ a year increase in oat yields through improved oat agronomy.

This ambitious goal may not be achievable, as a recent publication (Thomas & Graf, 2014) reported an annual 0.7% increase for Canadian Western Hard Red Spring from 1990 to 2013. However, this is the goal of the project and the researcher will strive to reach that goal.

The breeding program will utilize available advances in molecular markers and techniques to make selection more efficient while maintaining the quality specifications outlined by the Quality Evaluation Team of the Prairie Recommending Committee on Oat and Barley/Prairie Grain Development Committee.

Objectives

The objective of the Prairie Oat Breeding Consortium (POBC) is to develop new oat cultivars suited to production in western Canada, and suited to end use markets identified by POGA and the milling industry.

Description: The objective of the Prairie Oat Breeding Consortium (POBC) is to develop new oat cultivars suited to production in western Canada, and suited to end use markets identified by POGA and the milling industry. These cultivars will be developed as efficiently and effectively as possible.

Outcome: New oat cultivars that will be produced on a significant acreage and utilized by processors and the milling industry. The cultivars developed will have end-use quality identified as important by the industry and will carry genetic resistance to major diseases, pests and adverse environmental conditions prevalent in the planned production areas.

Performance Summary: (Partially Met)

March 2019. In February 2019, 4 oat breeding lines were supported for registration at the PGDC-PRCOB Meetings. OT2122 is a good yielding line, earlier heading, with similar maturity to CDC Dancer in 2018. It has good test weight, thousand kernel weight, average %plumps and thins. OT2122 has excellent protein, betaglucan and TDF levels. It has average levels of oil, well within the range desired by the milling industry. OT2122 will be marketed by SeCan. Data for Variety Registration/Plant Breeders Rights will be created and submitted to the VRO as soon as possible.

Report 2020.

Data for Variety Registration was created and submitted to the VRO in December 2019. OT2122 was named AAC Douglas and received National Registration February 21, 2020 #8950. PBR Rights will be applied for in Fall 2020. One line remaining from 3 Breeding lines supported in Feb 2019 was posted for Requests for Proposal for Marketing in March-April 2020, but there was no interest. Two second-year entries in the 2019 WCORT, OT7095 and OT8007 performed well enough, but it was decided by the POBC that these lines would not be proposed for support for registration at the PGDC Meetings February 2020.

Milestones

POBC

Activity: Annual Meeting with Industry Partners

Milestone / Deliverable: Meeting with Industry Partner

An ANNUAL meeting is held with the industry partners (sometime during this period of time) to discuss merits of breeding lines being advanced within the program, and potential lines to possibly obtain support for registration.



Progress Summary: (In Progress) Report 2019. The annual meeting was held Wednesday, January 24, 2019 at the Richardson Kelburn Farm south of Winnipeg, in spite of the highway closures until that morning. The Western cooperative Oat Registration Trial Report data were presented so decisions could be made on which line(s) should be presented at the PGDC-PRCOB to request support for registration. It was decided that 2 lines would be presented for requests for support due to the improved agronomic, disease resistance and improved quality traits. Decisions were made to move one line from 1st year to 2nd year of testing in the 19WCORT. Data from the 18BOAT were presented and selections made by Jennifer were approved by the POBC for moving into the 19WCORT. Later, email discussions led to presenting 4 lines for request for support at the PRCOB meetings. All 4 were supported.

Report 2020. The annual meeting was held January 30, 2020 at the Richardson Kelburn Farm south of Winnipeg. The Western Cooperative Oat Registration Trial Report data were presented so decisions could be made on which line(s) should be presented at the PGDC-PRCOB to request support for registration. It was decided that no lines would be presented for request for support. Decisions were made to move 5 lines from 1st year to 2nd year of testing in the 20WCORT. Data from the 19BOAT were presented and selections made by Jennifer were approved by the POBC for moving into the 20WCORT. The “unofficially hired” new oat breeder was introduced to the POBC and gave a presentation on his vision for the future of the oat breeding program. The industry funding partners were extremely impressed with his desires to advance the molecular markers and genomic selection already being utilized in the program, as well as the potential for high throughput phenotyping to be incorporated into the oat breeding program. Dr. Nilsen was encouraged to pursue incorporation of these tools into the project.

POBC

Activity: Annual Report

Milestone / Deliverable: Information and data will be collected for an annual report submitted to appropriate recipients

Progress Summary: This is the submitted and approved report.

POBC

Activity: Annual Field Tour

Milestone / Deliverable: Field Tour

An ANNUAL field tour will be held by Mitchell Fetch and staff during the growing season, to inform Industry funding partners, interested producers and agronomists, provincial specialists, and media representatives of research and advances being made within the project.

Progress Summary: (In Progress) Report 2019. A field tour was held at the Lacombe Research & Development Centre August 9, 2018, with 22 people in attendance, including industry funding partners and representatives from POGA. Everyone was impressed with the facilities, equipment and great-looking plots. Lots of questions and discussions made the tour interesting for everyone.

Report 2020. A field tour was held at the Brandon Research & Development Centre August 8, 2019, with ~80 people in attendance, including industry funding partners and several representatives from POGA. There was a great deal of interest in the disease nursery symptoms and in the PCR machine. Several industry partners stayed after lunch to more thoroughly inspect the WCORT and advanced yield trials, plot by plot.

3. Issues

- Describe any challenges or concerns in achieving the results and deliverables of this activity during the reporting period. How were they overcome or how do you plan to overcome?
- Describe any potential changes to the work plan and the budget during the reporting period. How were or how will they be managed?

Report 2019. Late release of budget funds prevented full spending, but as presented in the report, the



milestones were met, and the project health is good. At the beginning of July 2018, the project lead indicated intentions to retire in January 2020, in the hope that a replacement breeder could be identified quickly and put in place to have at least a year of overlap, for a smooth succession, according to the wishes of the industry funding partners.

Report 2020.

1. The NIR machine being utilized at the Cereal Quality Lab in Winnipeg was repaired and returned in January 2020, but because it cannot be repaired again, according to the manufacturer, a request to replace the equipment was put on the 2020-2021 AAFC Equipment call. It is hoped that unspent funding from the 2019-2020 fiscal year can be utilized to purchase this essential piece of equipment prior to the 2020 harvest season.
2. The Covid-19 Pandemic, which required the closure of all AAFC Centres on March 17, 2020 is presenting numerous issues, concerns, and uncertainties.....will staff be able to/feel safe to return to work in a timely fashion to prepare for spring planting, will planting happen, and so many other concerns. Scientific activities have been deemed "non-critical". It will take potentially up to 10 years to realize the damaging effects of this current situation.
3. In January 2020, the Project Lead agreed to delay retirement until July 30, 2020, and the replacement was hired Feb 6, 2020. However, the outgoing breeder leaves for vacation as of April 1 2020, so the overlap will be ~2 months. This is not ideal.
4. Issues affecting the Wheat Breeding program at Brandon directly affect the Oat Breeding program due to the highly effective interaction and efficiencies of the programs. Pressure to delineate the Wheat funding and staff, from the Oat funding and staff has led to concerns regarding delivery of project milestones.

4. Key Achievements

A key achievement represents a significant achievement or tangible result that could potentially be applied either by farmers or industry or the science community. In one to three paragraphs, please provide key achievements that meet one of the following criteria:

- 1) The item has commercial potential (all testing and piloting has been completed);
- 2) The item has been commercialized; or
- 3) The item has been adopted by sector.

Examples of tangible results could include increased sustainability (beneficial management practice), reduced costs, improved productivity or increased profitability. Please note that the information provided will be used for communication purposes only.

If no key achievements have been realized at this stage, please leave this section blank.

Report 2020. 4 lines received support for registration at the PGDC PRCOB meetings in February 2019. AAC Douglas (OT2122) is registered now, with PBR being sought during the coming growing season. As the acreage of Summit climbed quite long after it was first commercially available; it is yet to be seen how much acreage the recently developed and released cultivars will command.



Annex A

Performance Measures Table	
Performance Measures	Description
1. Number of highly qualified personnel (HQP) working on funded activities	<p>This only includes individuals who are registered in Master or PhD programs and are working on activities that receive funding through the Canadian Agricultural Partnership. They are only counted in their first year working on projects.</p> <p>For each reported HQP, please provide the following: the name of the student, level of degree, field of study and name of the institution.</p>
2. Training/knowledge transfer events	
2.1. Number of training/knowledge transfer events organized	<p>This includes events completed in the reporting year that were organized under the project to share results of the activities with audiences who may use that knowledge in the future. Examples could include training events, scientific meetings, symposia, conferences, workshops, industry meetings, field days or webinars.</p> <p>Annual General Meetings do not normally qualify for this category as they are considered to be part of normal day-to-day business.</p> <p>For each reported item, please provide the following: name of the event, name of the organizer and organization, location, and year/month/day.</p>
2.2. Number of presentations made in training/knowledge transfer events	<p>This includes oral presentations and poster presentations at events that are not organized by the recipient, for example conferences, symposiums or training events.</p> <p>For each reported item, please provide the following: name of presenter, title of presentation, name of the event, location, and year/month/day.</p>
3. Number of participants at training/knowledge transfer events	<p>This includes individuals who attend the events listed and who may use that knowledge in the future.</p>
4. Number of new knowledge transfer products developed	<p>New knowledge could include, but is not limited to:</p> <ol style="list-style-type: none"> 1) newly acquired knowledge that differs significantly from previously acquired knowledge; 2) existing knowledge that is enhanced to meet different requirements; 3) existing knowledge that is applied in different situations. <p>These are knowledge transfer materials created under the project that have been disseminated to transfer information to audiences who may use that knowledge in the future. Examples could include brochures, factsheets, flyers, guides, articles in trade magazines, technical bulletins and social media items. Only the number of products developed should be reported, not the number of copies that were printed and disseminated.</p> <p>For each reported item, please provide the following: author(s), title of the item, type of the reported item (e.g. brochure), name of the trade magazine/publisher and page number(s) if applicable, and year/month/day.</p>
5. Number of papers published in peer reviewed journals	<p>This includes scientific papers that are published in peer reviewed journals. Papers that are not yet published (ex. manuscripts in preparation, under review or accepted) should not be reported.</p> <p>For each reported item, please provide the following: author(s), year of publication, article title, title of journal, volume (issue), and page</p>



	<p>number(s).</p> <p>If the item is a book or a book chapter, add name of publisher.</p> <p>If the item is an article for conference proceedings, add title of published proceedings, location, and year/month/day.</p>
<p>6. Number of new technologies (new products, practices, processes and systems) that are developed</p>	<p>A new technology could include, but is not limited to:</p> <ol style="list-style-type: none"> 1) a newly created technology that differs significantly from existing technologies; 2) an existing technology that is modified to meet different requirements; 3) an existing technology that is tested in different situations. <p>New products are goods and services that differ significantly in their characteristics or intended uses from products previously produced and used. Examples could include equipment, software, novel foods or consumer goods.</p> <p>New practices are new agronomic techniques or methods that can be applied directly by producers.</p> <p>New processes are the set of operations performed by equipment in which variables are monitored or controlled to produce an output in labs or processing facilities.</p> <p>New systems are the set of detailed methods, procedures and routines created to carry out a specific activity, perform a duty, or solve a problem.</p> <p>Development consists of the creation of a new product, the generation of a new practice, or the demonstration of utility of a new process or system.</p> <p>This category does not include new varieties. New varieties are only reported under 'Number of new technologies that attain Intellectual Property protection' and/or 'Number of new technologies that are utilized'. Gene sequences, breeding lines and populations are not eligible under this category.</p> <p>To avoid duplication, for any new technologies, only set a target that represents the last stage in the innovation process. For example, a new technology is either developed, or assessed, or demonstrated or utilized.</p>
<p>7. Number of new technologies (new products, practices, processes and systems) that are assessed under research conditions</p>	<p>See the definition of new technologies under #6.</p> <p>Are assessed: when new technologies are evaluated or tested under research conditions.</p> <p>This category does not include new varieties. New varieties are only reported under 'Number of new technologies that attain Intellectual Property protection' and/or 'Number of new technologies that are utilized'. Gene sequences, breeding lines and populations are not eligible under this category.</p> <p>To avoid duplication, for any new technologies, only set a target that represents the last stage in the innovation process. For example, a new technology is either developed, or assessed, or demonstrated or utilized.</p>
<p>8. Number of new technologies (new products, practices, processes and systems) that are demonstrated on-farm or in-plant</p>	<p>See the definition of new technologies under #6.</p> <p>Are demonstrated: when new technologies are presented to the sector by experiments, prototypes, examples or pilot on-farm or in-plant.</p>



	<p>This category does not include new varieties. New varieties are only reported under 'Number of new technologies that attain Intellectual Property protection' and/or 'Number of new technologies that are utilized'. Gene sequences, breeding lines and populations are not eligible under this category.</p> <p>To avoid duplication, for any new technologies, only set a target that represents the last stage in the innovation process. For example, a new technology is either developed, or assessed, or demonstrated or utilized.</p>
<p>9. Number of new technologies (new products, practices, processes and systems) that attain Intellectual Property (IP) protection</p>	<p>See the definition of new technologies under #6.</p> <p>Examples for IP protection could include, but are not limited to: plant breeder rights, patents filed, registered trademarks and copyrights, and registered germplasms and released varieties (excluding breeding lines and gene sequences).</p> <p>For each new variety, please provide the registration number, the variety name and year/month/date.</p>
<p>10. Number of new technologies (new products, practices, processes and systems) that are utilized</p>	<p>See the definition of new technologies under #6.</p> <p>Are utilized: when new technologies are adopted or implemented for use within the sector. Examples may include, but are not limited to: a signed license agreement, a signed letter of intent, a new product that is available on the market, and a new practice which is adopted by farmers.</p> <p>Gene sequences, breeding lines and populations are not eligible under this category.</p> <p>To avoid duplication, for any new technologies, only set a target that represents the last stage in the innovation process. For example, a new technology is either developed, or assessed, or demonstrated or utilized.</p>