



AgriScience Program - Projects Component

Final Performance Report

This template covers the annual performance reporting for the final year of the project and two additional questions to satisfy the final performance reporting requirements.

Section A: Annual Performance Reporting

This section is the same as previous Annual Reports completed to date, and is intended to capture only those results that were achieved during the final year of the project.

Name of Recipient: Shawna Mathieson	
Project Title: POBC Prairie Oat Breeding Consortium/Consortium de sélection d'avoine des Prairies	
Project Number: ASP-004	Final Period Covered by the Report: 2022/04/01 to 2023/03/31
Project Start Date: 2018/04/01	Project End Date: 2023/03/31

1. Performance Measures – Project Level

In the performance measures table below, please provide the results and achievements that were finalized during this final reporting period, that combines all the CA and CRDA activities. Do not include results that are not final. Please see Annex A for a description of each performance measure.

Performance Measure		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)		
2.	Training/knowledge transfer events		
	2.1 Number of training/knowledge transfer events organized by the recipient	1	Brandon Wheat and Oat Annual Field Day. Kirby Nilsen and Santosh Kumar. Agriculture and Agri-Food Canada, Brandon, MB. 2022/08/10.
	2.2 Number of presentations made in training/knowledge transfer events	2	Kirby Nilsen. Oat Breeding in Western Canada. Brandon Wheat and Oat Annual Field Day. Brandon, MB. 2022/08/10. Kirby Nilsen. Oat Breeding at AAFC. University of Manitoba - Department of Plant Science Seminar. Winnipeg Manitoba, 2023/03/09.



Performance Measure		Results Achieved	Provide a brief description of each final result achieved during the reporting period.
3.	Number of participants at training/knowledge transfer events	100	
4.	Number of new knowledge transfer products developed	1	Report: 2022 Western Cooperative Oat Registration Trial (WCORT), Conducted by the Prairie Grain Development Committee.
5.	Number of papers published in peer reviewed journals	2	J.W. Mitchell Fetch, K.T. Nilsen, N. Ames, T.G. Fetch Jr., C. McCartney, J. Menzies, X. Wang, A. Burt, S. Kumar, D. Green, K. Stewart, W. Yan, W. Dyck, and K.D. Hamilton. 2023. AAC Douglas oat. <i>Canadian Journal of Plant Science</i> . 103 (2): 238-242. https://doi.org/10.1139/cjps-2022-0248 Yan, W., Nilsen, K. T., & Beattie, A. (2023). Mega-environment analysis and breeding for specific adaptation. <i>Crop Science</i> , 63, 480– 494. https://doi.org/10.1002/csc2.20895
6.	Number of new technologies (new products, practices, processes and systems) that are developed		
7.	Number of new technologies (new products, practices, processes and systems) that are assessed under research conditions		
8.	Number of new technologies (new products, practices, processes and systems) that are demonstrated on-farm or in-plant		
9.	Number of new technologies (new products, practices, processes and systems) that attain Intellectual Property (IP) protection.	3	AAC Douglas registration #8950, Feb 21, 2020. AAC Wesley registration #9663, Jul 8, 2022. AAC Neville registration #9835, January 13 th , 2023.
10.	Number of new technologies (new products, practices, processes and systems) that are utilized	3	AAC Douglas, licensed AAC Wesley, licensed AAC Neville, licensed



2. Activity-level Information

CRDA Activity Number: 1
Name(s) of Activity: Prairie Oat Breeding Consortium
Principal Investigator: Kirby Nilsen
<p>Summary of Activity</p> <p>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>
<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 producer's 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.</p> <p>2022-2023 Report Executive Summary</p> <p>The 2022 season was back to 100% after several challenging seasons spanning the pandemic. Growing conditions were much improved over 2021 resulting in more reliable data for selections vs a year prior. Strong natural disease pressure was observed in sites across Manitoba allowing resistant breeding lines to be identified. Good disease establishment was also seen in early generation nurseries at Brandon, allowing for any susceptible material to be discarded. The regular summer field tour resumed this year after a 2-year hiatus. Travel to New Zealand contra season nursery was possible for the first time since 2020, allowing for efficient selection and discards to be made improving the efficiency of the breeding pipeline. PBR and VRO trials have been concluded for AAC Wesley and AAC Neville supported for registration in 2021 and 2022, respectively. For 2023, no new lines will be brought forward for registration. Strong results from the oat B test and the preliminary yield test have identified several exciting candidates to move forward in the program over the next 2 years.</p> <p>Overview of 2022 breeding operations</p> <p>Crossing: 42 new parental combinations</p> <p>Agronomic Testing (yield plots):</p> <ul style="list-style-type: none"> • Western Cooperative Oat Registration Test (WCORT): 36 entries at 12 locations (Brandon, Kelburn Farm, Indian Head, Melfort, Morden, Portage, Beaverlodge, Lacombe, Kernen, Swift Current, Lethbridge, Westlock). • BOAT: 49 entries at 9 locations (Brandon, Lacombe, Avonlea, Indian Head, Melfort, Morden, Beaverlodge, Lethbridge, Westlock).



- Preliminary Yield Test (PRELP): 176 entries at 2 locations (Brandon, Lacombe).
- Early Generation Yield Test: 650 F5 and F6 at two locations Brandon and or Lacombe

* For all agronomic tests, selections were made based on yield, heading, maturity, height, lodging, TWT, KWT, plumps, and thins.

Collaborative Tests:

- ENCORE : 209 entries at 4 locations (Brandon, Lacombe, Saskatoon, Ottawa).
- UMOPN : 34 entries at 2 locations (Brandon, Lacombe).
- Quaker Area Test: 21 entries at 1 location (Brandon).
- MCVET: 18 entries at 1 location (Brandon).
- Alberta Variety Trial: 1 location at Lacombe

Pathology:

- 326 advanced breeding lines evaluated in rows at the Morden RDC for smut, crown rust, and stem rust (WCORT, BOAT/ENCORE, UMOPN, PRELP).
- 36 entries evaluated for FHB/DON (WCORT).
- 85 entries (WCORT, BOAT) were evaluated for BYDV under contract at University of Illinois.

* For advanced generation breeding lines, selections were made based on resistance to crown rust, stem rust, smut, BYDV and FHB.

Grain Quality Analysis (Cereal Quality Lab)

- 2593 harvested CODEMA dehulled whole-meal oat samples were scanned with NIR.
- 984 F4 whole oat samples were scanned with NIR
- Selections were made based on hull percentage, beta-glucan, protein, and oil content.

Genomics

- 1157 early generation (F4) lines from 9 populations were sampled for genomic selection.
- 80 selections were advanced based on genomic predicted grain yield and beta-glucan.
- Molecular activities resumed at Brandon with the hiring of a term EG-03 technician to support the work. Screening of parental and breeding lines was initiated targeting crown rust resistance genes *Pc94* and *Pc98*.

Early Generation Nurseries

- 21,000 early generation single seed hills (F2-F4), planted at Brandon Beach location, were artificially inoculated with smut, crown rust, stem rust. Single plant selections were made based on disease resistance, height, and lodging.
- 1254 F3-F4 multi-seed hills were planted at Brandon Beach location. Hill selections were made based on disease resistance, height, and lodging.
- UEOPN: 1 location (Brandon Beach).

Contra Season Increase (Palmerston, NZ, 2022/23):

- 6262 paired hills (F2-F5).
- 1325 multi-seed hills (F6)
- 334 Single seed hills (F1)
- 46 – 5m increase plots (F3-F5)
- 354 bulk increase plots.
- Ratings and selections were made for crown rust, BYDV, lodging and height

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: (Met) Kirby Nilsen - 2023/02/28. Over the course of the project, we have registered and licensed three new varieties of oat. AAC Douglas, AAC Wesley and AAC Neville. All three have significant improvements in agronomics, disease, and quality, relative the checks.

Milestones

POBC

Activity: Annual Field Tour

Milestone / Deliverable: Field Tour

An ANNUAL field tour will be held by Dr. Nilsen 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: (Completed) Kirby Nilsen - 2023/02/28 The annual field tour was held on August 10th, 2022, after two years hiatus due to the pandemic. There were approximately 80 attendees including funding partners, producers, provincial and federal government employees. On the tour, the entire breeding program was discussed from early generation selection to advanced generation yield testing.

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: (Completed) Kirby Nilsen - 2023/02/28. The annual meeting with industry partners was held on January 31st, 2023.

POBC

Activity: Annual Report

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

Progress Summary: (Completed) Kirby Nilsen - 2023/02/28 The annual report will be completed and submitted to appropriate recipients by the specified deadline.



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?

Kirby Nilsen - 2023/02/28

Issue: None to report.

Impact: N/A

Action Plan: N/A

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 the 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.

Kirby Nilsen - 2023/02/28

Key Achievements / Success Story: As a result of this research, the project team has released and licensed three new varieties of Oat for Western Canada. AAC Douglas, AAC Wesley, and AAC Neville. AAC Douglas is starting to gain commercial acres in production. It will be exciting to see the impact that all three varieties will have on the western Canadian oat industry in the years ahead.



Section B: Final Performance Reporting

The following three questions are supplemental to the standard APR questions, to gather additional information as required for the final year of performance reporting.

3. Results Variance

The table below presents the performance measure targets initially identified in the project’s work plan, as well as the results achieved by this project as reported in previous Annual Performance Reports. The targets and results achieved include all the CA and CRDA activities. To easily see whether there is a variance between the targets set and the results achieved over the life of the project, you may add the value in the Previous Results column to the results achieved this year (as recorded in the table at the beginning of this document) and note the sum in the Total Results column.

Performance Measure		Targets (as set out in the CA work plan)	Previous Results (as reported in previous APRs)	Total Results (previous results + results achieved this year)
1.	Number of highly qualified personnel (HQP) working on funded activities (HQP refers exclusively to current Master and PhD students)			
2.	Training/knowledge transfer events			
	2.1 Number of training/knowledge transfer events organized by the recipient	10		1
	2.2 Number of presentations made in training/knowledge transfer events		14	17
3.	Number of participants at training/knowledge transfer events	500	790	890
4.	Number of new knowledge transfer products developed	5	1	2
5.	Number of papers published in peer reviewed journals	1	8	10
6.	Number of new technologies (new products, practices, processes and systems) that are developed			
7.	Number of new technologies (new products, practices, processes and systems) that are assessed under research conditions			
8.	Number of new technologies (new products, practices, processes and systems) that are demonstrated on-farm or in-plant			



Performance Measure		Targets (as set out in the CA work plan)	Previous Results (as reported in previous APRs)	Total Results (previous results + results achieved this year)
9.	Number of new technologies (new products, practices, processes and systems) that attain Intellectual Property (IP) protection.	1	0	3
10.	Number of new technologies (new products, practices, processes and systems) that are utilized		0	3

Please provide a brief explanation of the variance for any performance measures for which the **total results achieved** are less than the target set.

The project team has met or exceeded the targets in nearly all categories.

4. Knowledge and Technology Transfer (KTT)

What is your target audience for sharing information about the results of your project? Describe your strategy and success in reaching this target audience.

The primary mechanism for KTT has been through the annual field tour, presentations at grower meetings, and presentations to the public through webinars/seminars. The pandemic impacted our ability to a great extent to connect in person, but efforts were made to continue KTT via virtual options. Now that the pandemic is over, resumption of in person events has happened. In most cases virtual options are no substitute for in person events. The target audience is growers, researchers, and public. Through these events, the project team has been successful in communicating the important work that we do in developing new varieties that bring economic value to western Canadian producers and industry.

5. Gender-Based Analysis Plus (GBA+)

To the best of your knowledge, how many of the HQP who are working on the project meet the GBA+ categories outlined below? Please indicate the total number for each category. If a HQP fits in more than one category, please count them in as many of the categories as appropriate. Only indicate a number and not the names of the individuals.

	Female	Indigenous peoples	Visible minority	LGBTQ2+	Person with disability
Number of HQP	3		1		



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 academic institution.</p>
2. Training/knowledge transfer events	
2.1. Number of training/knowledge transfer events organized by the recipient	<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>



<p>5. Number of papers published in peer reviewed journals</p>	<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 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 germplasm 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>