

NATIONAL OAT RESEARCH STRATEGY 2018-2023

FINAL

January 2018

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Overview

Oats are a vital part of the Canadian cropping rotation. Canada is the largest exporter of oats in the world and has a premier reputation for quality production. This success is underpinned by good research, so a National Research Strategy for Oats has been developed with all parts of the value chain involved.

Throughout the visioning process, there was a thread of concern that oats are not always competitive with other cropping options. The crop acreage has remained relatively steady and yield gains have been made but, when compared to canola, lentils and soy, oats are not seeing the same returns for farmers.

Support for varietal development of oats as well as research into best crop practices are important. Getting vital information into the hands of farmers on growing oats, is part of the success in keeping oats in the crop rotation on the Prairies, which leads to getting consumers the quality products they want.

The action plan emphasizes the need to support the entire production cycle of oats from breeding to end use. It was also noted that any efforts to increase demand must walk hand-in-hand with efforts to increase productivity.

Emerging clearly, was the need to put more emphasis on the agronomic innovations that make oat production better. There is also the opportunity to heighten the communication of best practices and to hone in on the vital question of profitability.

The priorities in research were grouped in three agreed pillars:

1. Increase Yield Potential of Varieties
2. Improve Oat Agronomy
3. Improve and Maintain Milling Quality

An emphasis on variety development underpins the success in fostering productivity. It also reflects a will to focus more co-ordinating breeding programmes supported by bioinformatics and genomics to accelerate progress on oat breeding, while providing support for regional testing and infrastructure. Generally, in all areas, it was agreed that success depends on more focus on varieties and the packages needed to support them, as well as regional recommendations on best varietal performers.

Supporting innovation in increased oat yield, lodging resistance, weight, and disease resistance (particularly crown rust) are among the top priorities. End users mentioned qualities such as beta-glucan and farmers mentioned factors like yield and harvestability, but all shared a common interest in improving the crop and its returns and could see the merits of improvements in all aspects of the crop.

In particular, there was consensus that the “lowest hanging fruit” was more emphasis on agronomic recommendations that can be clearly communicated to producers. Plots show high yield potentials, but there are still low yields on many farms. It is time to encourage more investment into agronomics. The pillar to *Improve Oat Agronomy* needs greater action, and it was felt all parts of the value chain could contribute meaningfully to progress. Improvements in clear, concise recommendations and using multiple channels to convey them could have the most immediate results on oat yields. More ambitious goals to improve agronomy testing and extension are also in the longer-term plan. By using better strategies for knowledge transfer, including existing networks from other crops, it is possible to increase impact on the ground.

In the area of milling quality, key targets to meet specifications were reiterated. It was noted in some years the specifications have fallen below needed levels, particularly on beta-glucan.

Beyond this strategy, discussions of future aspirations to improve the role of oats in a healthy diet can also be explored, such as higher fibre content, etc. However, in the next five years, creating a greater level of consistency in meeting key milling criteria was seen as most important. To measure success in each area overarching goals, targets and measures were set.

1) Increase Yield Potential of Varieties

GOAL	TARGET	MEASURE
Continuous and coordinated investment in breeding and agronomy programmes to improve yield potential per year	Increase yields of new varieties by $\geq 2\%$ per year, relative to provincial checks, until 2023, while maintaining quality and desired agronomic characteristics.	Consolidated rolling 5-year average based on registration data (co-op performance trials) AAFC to set a measurement for advanced breeding lines of AAFC programme in east and west and test against these checks

1) Improve Oat Agronomy

GOAL	TARGET	MEASURE
Increase reliability of oat yield and quality through better use of agronomic information	$>3\%$ a year increase until 2023 Consider accelerating that rate after 2023.	Consolidated rolling 5-year average based on Stats Canada total yield by province and region.

▶ 1) Improve and Maintain Milling Quality

GOAL	TARGET	MEASURE
Improve entire value chain profitability	Ensure all quality measures are being met with a focus by 2023 to increase stability, predictability and reliability of β -glucan levels in milling oat varieties across environments	Crop meets the following specifications year after year: 04.5% β -glucan, minimum 75.0% Groat 13.0% Protein, minimum 07.5% Oil content, maximum 10.0% Total dietary fibre, minimum

*The list provided under “Measures” is reflective of the Prairie Grain Development Committee (PGDC) approved amounts. This list should be reflective of the latest PGDC standards at any time and therefore will change.

Goals, targets and measures were set in each area and will be reported on by all oat researchers to the group as a whole at an annual conference call of the organisations participating in the strategy (see Appendix A).

The action plan developed surrounding these research priorities will be used to guide research, mobilize activities to steward funds with integrated long-term solutions in mind. Specific actions were identified and groups were allocated leadership for them.

1 Increase Yield Potential of Varieties

2017 to 2023	GOAL	TARGET	MEASURE
	Continuous and coordinated Investment in breeding and agronomy programmes to improve yield potential per year	Increase yields of new varieties by $\geq 2\%$ per year, relative to provincial checks, until 2023, while maintaining quality and desired agronomic characteristics.	Consolidated rolling 5-year average based on registration data (co-op performance trials) AAFC to set a measurement for advanced breeding lines of AAFC programme in east and west and test against these checks

Area of Focus	Action	Lead
BREEDING	To achieve or better AC Morgan yield or (eastern "check" for Eastern Canada) through a comprehensive collaborative advanced line testing effort between Canadian oat breeders.	<ul style="list-style-type: none"> • Mitchell Fetch, Yan
	Address shattering resistance through breeding	<ul style="list-style-type: none"> • AAFC (Brandon and Ottawa) • U of S • Oat Advantage (Dyck)
	Explore new technologies and new breeding tools (such as gene editing)	<ul style="list-style-type: none"> • AAFC

Area of Focus	Action	Lead	
GENOMICS	Resequencing oat exons (1-2 years) and full genome sequence of multiple oat varieties in 5 years	<ul style="list-style-type: none"> • AAFC (Tinker) and global projects 	
	Plan and conduct strategic genotype/phenotype testing of appropriate germplasm to provide a shared baseline for genomic selection, particularly selection for yield in defined target environments	<ul style="list-style-type: none"> • AAFC (Tinker) 	
	To achieve AC Morgan yields with better quality through disruptive technologies, such as gene identification and editing (long-term collaborative and multidisciplinary goal)	<ul style="list-style-type: none"> • AAFC (Tinker, Mitchell Fetch, Yan) 	
	GENOMICS	Improve data collection, input provincial performance trial data into a genomics database	<ul style="list-style-type: none"> • AAFC (Tinker)
		Continued testing of the genomics selections in the Ottawa and Manitoba breeding programme and report on the successes to the group	<ul style="list-style-type: none"> • AAFC (Tinker) • CDC (Beattie)
PATHOLOGY	Develop a coordinated survey system for current and emerging oat pathogens across Canada to improve management strategies, screen varieties, and identify and validate new sources of resistant germplasm	<ul style="list-style-type: none"> • AAFC (Brandon, Morden and Ottawa) • CDC (Beattie) 	
	Improve disease tolerance resistance to stem and crown rust in particular	<ul style="list-style-type: none"> • AAFC (Brandon, Morden, Ottawa) 	
	Incorporate durable disease resistance into new varieties, breeding against current and emerging pathogen profiles in a variety's adapted region	<ul style="list-style-type: none"> • AAFC (Brandon, Morden and Ottawa) • U of S • Oat Advantage (Dyck) 	
OTHER	Improve information management (testing phenotypes) for genomics and for meta analysis	<ul style="list-style-type: none"> • AAFC 	
	Formalize the process for "Plant Scale" milling trials of new varieties	<ul style="list-style-type: none"> • AAFC • Millers 	

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Improve Oat Agronomy

2017 to 2023	GOAL	TARGET	MEASURE
	Increase reliability of oat yield and quality through better use of agronomic information	>3% a year increase in yield until 2023 Consider accelerating that rate after 2023.	Consolidated rolling 5-year average based on Stats Canada total yield by province and region.

Area of Focus	Action	Lead
OUTREACH	Need top 5 recommendations for conventional oat production and top 5 recommendations for organic oat production that are framed in a clear, farmer-friendly manner.	<ul style="list-style-type: none"> • AAFC (May) to Chair • UofA (Hall) • Lakeland College (Perrott) • POGA (Butuk) • General Mills (Rabaey) • Cereals Canada (Churchill) • Grain Millers Inc. (DeBlieck) • Oat Advantage (Dyck)
	Develop fungicide and fertilizer recommendations for high yield, improved standability, and consistent quality across multiple environments and identify optimum seeding rates for high yielding oat management systems	<ul style="list-style-type: none"> • AAFC (May) to Chair • UofA (Hall) • Grain Millers Inc. (DeBlieck) • POGA (Butuk) • General Mills (Rabaey) • Cereals Canada (Churchill) • Oat Advantage (Dyck)
	Integrate with other cereals in the field day	<ul style="list-style-type: none"> • Cereals Canada

Area of Focus	Action	Lead
	Establish a single portal of agronomy research	<ul style="list-style-type: none"> • Cereals Canada
	Develop a strategy for herbicide resistant wild oats	<ul style="list-style-type: none"> • AAFC (May) • UofA (Hall)
	Streamline Agronomic Practices on Wild Oat Management, Provide details of row width X N (placement sideband vs. midrow)	<ul style="list-style-type: none"> • AAFC (May) • UofA (Linda Hall)
OUTREACH	Utilize currently existing extension networks to reach farmers, including seed companies, miller recommendations, certified crop advisors, public and private sectors	<ul style="list-style-type: none"> • Cereals Canada
	Describe the benefits of oats in crop rotation	<ul style="list-style-type: none"> • AAFC (May) • UofA (Hall)
AGRONOMY	Create variety-specific agronomy packages by using and use new research on: <ul style="list-style-type: none"> • New fungicide • Fertilizer • Seeding date, etc. 	<ul style="list-style-type: none"> • AAFC • Seed Companies
	Improve disease packages	<ul style="list-style-type: none"> • AAFC • UofS
	Conduct research to improve lodging resistance	<ul style="list-style-type: none"> • AAFC
	Explore use of plant growth regulators	<ul style="list-style-type: none"> • UofA • Lakeland
PATHOLOGY	Develop new tools to predict and reduce pest's impact on crops	<ul style="list-style-type: none"> • AAFC (May)

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Improve and Maintain Milling Quality

2017 to 2023	GOAL	TARGET	MEASURE
	Improve entire value chain profitability	Ensure all quality measures are being met with a focus by 2023 to increase stability, predictability and reliability of β -glucan levels in milling oat varieties across environments	Crop meets the following specifications year after year: 04.5% β -glucan, minimum 75.0% Groat 13.0% Protein, minimum 07.5% Oil content, maximum 10.0% Total dietary fibre, minimum

Area of Focus	Action	Lead
BREEDING	Reconfigure the oat kernel to increase milling yield such as: <ul style="list-style-type: none"> • Shallow crease • Groat to hull ratio • Test weight & plumps • Kernel uniformity • 4.5% beta glucan 	<ul style="list-style-type: none"> • AAFC (McElroy, Mitchell-Fetch, Yan) • UofS • Oat Advantage (Dyck)
BREEDING AGRONOMY	Establish adequate β -glucan levels to keep total crop above 4.5%, year over year	<ul style="list-style-type: none"> • AAFC • UofS • Oat Advantage
	Measure milling quality characteristics in each agronomy trial	<ul style="list-style-type: none"> • AAFC (May) • UofA
PROCESSING TECH	Provide safe crop storage with humidity and pest control	<ul style="list-style-type: none"> • AAFC (May) • UofA (Hall)
PROCESSING TECH NUTRITION	Improve processing technology to better achieve quality parameters rather than relying solely on breeding parameters	<ul style="list-style-type: none"> • Millers and equipment manufacturers
	Create a think tank for more ambitious nutrition targets and products to create market opportunities	<ul style="list-style-type: none"> • AAFC (Ames)
NUTRITION OTHER	Foster more oat food product development in Canada	<ul style="list-style-type: none"> • Millers

Other Activities

In addition to these three pillars, the group discussed overarching activities that further research.

A. Accelerating Innovation

It is possible to accelerate innovation in oats. One step is to increase the funding and efficiency of existing research, as well as to create a regular funding platform.

Improving international collaboration is one of the most important aspects of accelerating innovation. It was agreed by the group that research should not be duplicated unnecessarily, but instead increase and improve collaboration internationally by forming partnerships with other countries (e.g.: Sweden) and academic institutions (e.g.: University of North Carolina), who are already sequencing the oat genome and engaged in other work.

Organizations that agreed to be the lead on these ideas were the POBC, CFCRA, AAFC, and Oat Global.

B. Fostering Collaboration

Encouraging more engagement and alignment of goals and targets along the whole value chain is imperative to the successful collaboration and advances to be made within the National Oat Research Strategy.

Regular communication and meetings were key points discussed and agreed to by the group. The suggested schedule of meetings is summarized in the chart below.

Meeting Description	Frequency/Timing	Recommended Attendees
Hold annual conferences calls. May (AAFC) to organize and look at major measures.	Arrange near PGDC timing	At least 1 representative from each sector of the Value Chain
Utilize existing industry meetings to capture a wide range of parties to discuss progress/resource requirements on the current strategy actions	Multiple / Various times throughout the year	Various, depending on existing meeting/conference. Pick items from strategy to advance specific actions.

In-person strategic planning meeting	3-5 years	All sectors of the value chain to be present
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It is worthwhile to develop an agronomy testing network by creating a working group of all industry players to avoid duplication of research and trials amongst seed companies, agronomists and millers. It was suggested that Researchers can work with millers to arrange larger field scale trials in more areas.

C. Facilitating Knowledge Transfer

Knowledge Transfer was a theme that arose multiple times in the discussion of priorities. In particular, the ability to transfer research knowledge to the field is seen as a limiting factor. Longer term a knowledge transfer strategy may be needed. It was also suggested a network could be created to showcase knowledge.

Finally, long term actions to perform data mining of crop insurance data for agronomics recommendations for oats were suggested. Overall, Provide streamlined information management systems and deployment of big data for genomics

D. Improving Sustainability

To improve sustainability, oats, must be placed in to the crop rotation more often. It was also suggested that information should be provided on the impact of oats on soil health, it was recommended that a review of the Scandinavian examples would be helpful.

Background on the Process

A strategic planning process was convened in 2017 to develop a National Oat Research Strategy until 2023 encompassing the needs of the entire oat value chain. It is informed by research priorities developed by the Canadian Field Crop Research Alliance (CFCRA) at the CFCRA Research Summit held in November 2016 in Gatineau, QC. The CFCRA Research Summit brought together industry representatives, government officials, and members of the scientific research community in Canada to determine to what extent Canada has the capacity to address research needs, and what research approaches could be taken to meet them with the best outcomes. The CFCRA assessed how to best set meaningful, measurable targets for research projects in this sector and measure performance against those targets, taking into account the risks inherent in scientific research as well as the need for return on investment. A report summarizing the 2016 CFCRA Research Summit can be found at www.fieldcropresearch.ca/cfcra-research-summit.html.

In preparation for the National Oat Strategic Planning Session a survey was prepared to gather input from potential attendees on topics of discussion and items that they felt were a priority. On October 26, 2017, a National Research Strategy Planning Session was held in Saskatchewan to develop a 5-year National Oat Research Strategy. A draft strategy was compiled based on the workshop outcomes. The draft strategy underwent a peer review and the review comments were discussed and amalgamated on a conference call in December 2017.

A complete list of participants and contributors to the National Oat Research Strategy can be seen in Appendix A to this report.



Appendix - List of Invitees and Contributors to Survey, Workshop and Review of Strategy, including December 12, 2017 Call

Name	Organization
Ames, Nancy	Agriculture and Agri-Food Canada
Anderson, Robynne	Emerging Ag Inc
Armstrong, Erin	Canterra Seeds
Beattie, Aaron	University of Saskatchewan
Boettger, Brad	POGA
Butuk, Alan	POGA
Churchill, Karen	Cereals Canada
Churko, Chris	Alliance Seed
Cowan, Josh	Grain Farmers of Ontario
Czerwinski, Matthew	Grain Farmers of Ontario
Dahl, Cam	Cereals Canada
DeBlieck, Eric	Grain Millers Inc.
Downey, Jim	SeCan Association
Enns, Art	POGA
Entz, Peter J.	Richardson International
Ferdette, Jason	Agriculture and Agri-Food Canada
Fetch, Tom	Agriculture and Agri-Food Canada
Galbraith, Dennis	Emerson Milling
Gusmini, Gabe	PepsiCo Quaker
Hainstock, Wade	POGA
Hall, Linda	University of Alberta
Hansen, Britta	Oat Global
Johanson, Jenneth	POGA
Katepa-Mupondwa, Felicitas	Agriculture and Agri-Food Canada
Kutcher, Randy	University of Saskatchewan
Martin, Richard	Atlantic Grains Council
Mathieson, Shawna	POGA
May, Bill	Agriculture and Agri-Food Canada
McCartney, Curt	Agriculture and Agri-Food Canada

Name	Organization
Menzies, James	Agriculture and Agri-Food Canada
Merryweather, Rod	FP Genetics
Moats, Josh	FP Genetics
Perrott, Laurel	University of Alberta
Rabaey, Tom	General Mills
Roskens, Bruce	Grain Millers Inc.
Russell, Heather	Atlantic Grain Council
Salvano, Esther	Agriculture and Agri-Food Canada
Shiels, Scott	Grain Millers Inc.
Shirtliffe, Steve	University of Saskatchewan
Tiede, Tyler	PepsiCo Quaker
Tinker, Nicholas	Agriculture and Agri-Food Canada
Weik, Ron	FP Genetics
Yan, Weikai	Agriculture and Agri-Food Canada
Zoghiami, Salah	Producteurs de grains du Québec

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Appendix – List of Workshop Attendees – October 26, 2017

Name	Organization
Ames, Nancy	Agriculture and Agri-Food Canada
Anderson, Robynne	Emerging Ag Inc
Beattie, Aaron	University of Saskatchewan
Boettger, Brad	POGA
Butuk, Alan	POGA
Churchill, Karen	Cereals Canada
Churko, Chris	Alliance Seed
DeBlieck, Eric	Grain Millers Inc.
Downey, Jim	SeCan Association
Dyck, Jim	POGA
Enns, Art	POGA
Fradette, Jason	Agriculture and Agri-Food Canada
Galbraith, Dennis	Emerson Milling
Gusmini, Gabe	PepsiCo Quaker
Hainstock, Wade	POGA
Hall, Linda	University of Alberta.
Hansen, Britta	Oat Global
Johanson, Jenneth	POGA
Katepa-Mupondwa, Felicitas	Agriculture and Agri-Food Canada
Mathieson, Shawna	POGA
May, Bill	Agriculture and Agri-Food Canada
McCartney, Curt	Agriculture and Agri-Food Canada
Merryweather, Rod	FP Genetics
Mitchell Fetch, Jennifer	Agriculture and Agri-Food Canada
Moats, Josh	FP Genetics
Rabaey, Tom	General Mills,
Rundel, Chris	POGA
Salvano, Esther	Agriculture and Agri-Food Canada
Shiels, Scott	Grain Millers Inc.
Tinker, Nicholas	Agriculture and Agri-Food Canada
Zoghiami, Salah	Producteurs de grains du Québec



Appendix – Survey Participants

Name	Organization
Armstrong, Erin	Canterra Seeds
Czerwinski, Matthew	Grain Farmers of Ontario
Galbraith, Dennis	Emerson Milling
May, Bill	Agriculture and Agri-Food Canada
Mathieson, Shawna	POGA
McCartney, Curt	Agriculture and Agri-Food Canada
Menzies, James	Agriculture and Agri-Food Canada
Moats, Josh	FP Genetics
Tinker, Nicholas	Agriculture and Agri-Food Canada
Zoglami, Salah	Producteurs de grains du Québec

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Appendix – POBC Members as of April 1, 2018



AustGrains, Emerson Milling, FP Genetics, General Mills, Grain Millers, The Prairie Oat Growers Association (POGA), Richardson Milling and SeCan Association