A Organic Science Cluster Proposal Summary

A.1 Executive Summary

The Organic Science Cluster (OSC) will mobilize organic science, innovation and technology transfer across Canada. It is designed to increase profitability and competitiveness by addressing production barriers, developing leading production technologies, and characterizing Canadian organic production for the national and international organic markets.

A.1.1 The Benefits to Canada

Currently, the Canadian organic sector is the only significant growth area of the Canadian agri-food system. Nevertheless, targeted science for this sector is still limited. Past indicators show that science in organic systems underpins the capacity to increase Canadian organic product quality and quantity. The Organic Science Cluster (OSC) is expected to meet this goal and also benefit conventional farmers and processors who want to improve their cost effectiveness and environmental management and thus, increase their competitiveness and profitability. The organic market in Canada, currently estimated to exceed $2 billion, is growing at a rate of 15-20% per year but approximately 80% of organic food consumed in Canada is imported. The OSC will lead the Canadian organic sector towards a position of domestic and international competitiveness in this expanding market, while expanding the national science capabilities in sustainable, low-input production systems.

The largest constraint to growth of organic agriculture in Canada is capacity for production. Approximately 7% of farmers in Canada are in certified organic production and almost twice that number indicated they are farming organically but are not certified. This means that OSC is directly relevant to over 20% of all farmers in Canada, while the low-input technologies and practices used in organic can be cost effectively applied throughout farms in Canada. Among its advancements, the science in this cluster will set the groundwork for significant improvements in phosphorus use efficiency in crops, lead organic into an era of low-till production without herbicides, provide a landmark breakthrough in organic greenhouse production systems including energy efficiency, characterize the contribution of organic production to reducing greenhouse gas emissions, establish benchmarks for animal health and welfare in dairying, develop new meat preserving methods and address barriers in high value fruit production. OSC science will also characterize and enhance consumer driven values and help Canadian farmers to capture emerging markets at the nexus of local and organic demand.

A.1.2 The Applicant

OSC is the product of a tri-partied collaboration between the **Organic Federation of Canada** (OFC, applicant), the **Organic Agriculture Centre of Canada** (OACC, facilitator and administrator of the OSC) and the **Organic Value Chain Roundtable** (OVCRT, strategic contributor). These three national bodies have jointly led the regulatory, applied science and market development of the organic sector (respectively) over the last few years, defining priorities, developing and implementing strategic action plans, and linking leaders across the country. The representation and activities of these organizations have spanned the country geographically, sectorally and vertically through the value chain. These organizations have a

track record for building collaboration and success. The organic sector is organized and forward-thinking; striving to increase the competitiveness and profitability of Canadian agriculture.

A.1.3 The Plan

The OSC is industry led through this application from OFC, supported by the identification of science needs through a national farmer survey and prioritization process, and the support of the OVCRT. The organic sector has shown unprecedented support for the OSC initiative, providing 25% matching cash contributions. Most of the projects and activities in the OSC have been developed with the input of industry cash contributors. The industry driven science priorities will address: soil fertility, grain cropping systems, vegetable cropping systems, greenhouse production, dairy production, high value fruits, food processing and consumer-driven environmental value of organic.

The science program engages all major agricultural universities in Canada, spans the country with activities in nine provinces, and enlists the collaboration of AAFC scientists amounting to approximately 50% of the research funds. The OSC includes the longest standing and leading scientists in organic agriculture, while also drawing scientists who are leaders in their respective disciplines. With over 50 scientists participating in over 40 science activities, the OSC clearly spans the country and sector priorities in a coordinated fashion.

The science plan outlined in this proposal will be subject to a rigorous peer review process that has already been designed. The OSC includes a communication plan designed to transfer the results of the applied science to producers, processors and retailers to support capacity development in conjunction with increasing competitiveness and profitability. The OSC has also developed a comprehensive strategy for implementing the cluster activities with timely reporting and a comprehensive financial management framework.

A.1.4 The Outcomes

By March 2013, OSC is expected to:

- Increase competitiveness of Canadian farmers in domestic and international markets.
- Increase profitability of Canadian farmers by improving cost effectiveness and expanding their capacity to supply growing markets.
- Remove barriers for Canadian practitioners in the organic and conventional food systems.
- Establish Canada as a leader in the production of high quality and safe organic food.
- Support the increase of Canadian organic farm capacity with current organic operators and having more conventional farmers become certified.
- Support development of sustainable production systems that reduce business and environmental risk by using ecologically sound management.
- Validate claims of environmental benefits from Canadian organic agriculture, encoded with the new national Canadian organic standards.
- Support branding efforts of the organic sector nationally to link the ‘Canada organic’ brand with the attributes of (i) environment and stewardship (ii) superior products (iii) dedication to excellence, and (iv) knowledgeable, trustworthy people.
- Inform the Canadian organic regulatory process and Permitted Substances List (PSL) as it evolves such that amendments are based on science.
- Increase and support Canada’s scientific capacity in organic agriculture.

A.2 Organic Science Cluster Proposal - Summary for Communication

The Organic Science Cluster (OSC) will make more organic research and innovation possible and therefore, provide specific information to help Canadian farmers. Science applied to organic systems underpins the capacity to increase the quality and quantity of Canadian organic products. OSC scientific inquiries are expected to meet this goal and also to benefit conventional farmers and processors who want to improve their cost effectiveness and environmental management and thus, increase their competitiveness and profitability. OSC innovation in Canadian organic systems will also characterize and enhance consumer driven values. Canadian farmers can then capture emerging markets at the nexus of local and organic demand.

Currently, the Canadian organic sector is the only significant growth area of the Canadian agri-food system. The organic market in Canada, currently estimated to exceed $2 billion, is growing at a rate of 15-20% per year. Nevertheless, about 80% of organic food consumed in Canada, is imported. OSC is designed to help Canadian farmers capture more of this growing Canadian market, while improving their international competitiveness. At the same time, national scientific capabilities will grow in sustainable, low-input production systems.

OSC scientists will set the groundwork for significant improvements in phosphorus use efficiency in crops, lead organic into an era of low-till production without herbicides, provide a landmark breakthrough in organic greenhouse production systems including energy efficiency, characterize the contribution of organic production to reducing greenhouse gas emissions, establish benchmarks for animal health and welfare in dairying, develop new meat preserving methods and address barriers in high value fruit production.

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OSC engages all major agricultural universities in Canada, spans the country with activities in nine provinces, and enlists the collaboration of AAFC scientists. OSC includes the longest standing and leading scientists in organic agriculture, while also drawing scientists who are leaders in their respective disciplines. With 29 research activities including over 90 lead and collaborating scientists OSC clearly spans the country and sector priorities in a coordinated fashion.

The OSC communication plan is designed to transfer the results of the applied research to producers, processors and retailers to support capacity development in conjunction with increasing competitiveness and profitability.

B Cluster Information

B.1 Sector profile

Organic agriculture has grown to a market value of over **$1 billion in 2006**[1] and was projected to be over **$2 billion in 2008**[2]. Over the last 15 years, organic has emerged from small scale production and direct marketing of raw materials to an important part of the retail market that links the purchaser with a standardized production system. The national standards for organic agriculture in Canada will become regulated on June 30 2009, ensuring product integrity and facilitating international trade. Organic agriculture encompasses all sectors of agriculture, but with a unique system of production that is independently certified and labeled.

For the past decade, annual growth rates of organic agriculture have been estimated at 15-25% [3,4] bringing its market presence from a few tenths of a percent to its current level of penetration. Consumers are increasingly demanding food they know is healthy and has been produced in a sustainable fashion with environment, human health and animal welfare in mind, but without the use of synthetic pesticides, genetically engineered organisms, synthetic fertilizers, and antibiotics. The consumer willingness to pay premium prices, coupled with rising costs of synthetic inputs has resulted in the **tripling of the number of organic farms** in the last 10 years. The low input production practices and the labeled marketing system have been used as a model for sustainable development of all of agriculture.

Organic is a branded production system with successful farms at all scales. It has become part of conventional markets (from farm gate sales to major retail chains and international export), and has successfully applied new marketing models such as community supported agriculture (CSAs) or box programs. A philosophical connection between consumers and the farmer(s) (or at least the farming system) that supplies their food has been captured through the branding of a production system and the diversity of marketing options. This connection drives consumer willingness to pay more for food, especially local food, to support farmers with whom they have developed a 'relationship'. Organic has transcended traditional supply chain models and provides a multitude of vertical entries to the market. The opportunity at this juncture is to strengthen these vertical entries equally in order to maintain the diversified business potential.

Organic Statistics from 2007[5]

- Market value projected to be $1.65 billion in 2007 (over $2 billion in 2008)
- 3,782 farms in Canada (increase of 200 farms from previous year, approximately 6.8% of all farms in Statistics Canada 2006 Census of Agriculture) (See also Table 1)
- > 556,273 ha of land under organic management (plus 352,000 ha of wild land)
- Saskatchewan has the largest number of farms and land area under organic production followed by Quebec, Ontario and British Columbia (See also Table 1)

[1] Retail Sales of Certified Organic Food Products, in Canada, in 2006 Compiled by Anne Macey for the Organic Agriculture Centre of Canada.
[2] Canada's Organic Market. M. Holmes and A. Macey. 2007. http://cog.ca/documents/CdnOrganicMkt2007.pdf
[3] Holmes, M. and Macey A. 2007. Canada's Organic Market. Accessed 17 June 2009. http://www.cog.ca/documents/CdnOrganicMkt2007.pdf
[4] Macey, A. 2007. Retail Sales of Certified Organic Food Products,in Canada, in 2006. Accessed 17 June 2009.
[5] Canada's Organic Market. M. Holmes and A. Macey. 2007. http://cog.ca/documents/CdnOrganicMkt2007.pdf

    - Wheat is Canada's largest organic crop with over 75,000 ha
- > 1012 certified organic processors and handlers (highest in Quebec, British Columbia and Saskatchewan)
- Mainstream supermarkets now sell > 40% of organic products in Canada followed by large natural food store chains and smaller grocery stores, warehouse clubs, pharmacies, specialty stores, farmers markets and Community Shared Agriculture or box programs
- Fresh fruits and vegetables account for 38% of organic sales in Canada, followed by beverages at 18%, dairy at 11% and frozen foods at 2%; 'other groceries' account for 31% of sales
- Rate of growth is highest in raw meat (81%), followed by fresh vegetables (38%) dairy (30%), fresh fruit (28%), beverages (24%) and frozen foods (14%) (See Charts 4 and 5 below for more data)
- An estimated 80% of organic products sold in Canada are imported (Note: AC Nielsen data indicate that 47% of organic products were labeled as grown, packaged or processed in Canada)

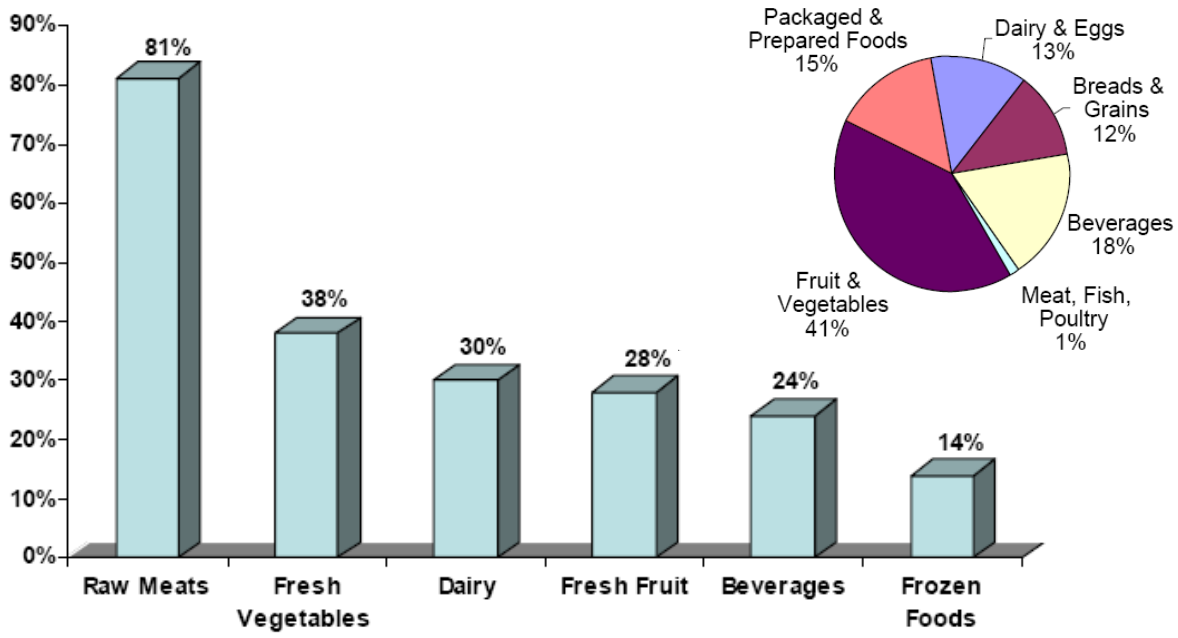
Table 1. Certified organic production by province, 2006 and 2001[6]												
Province	Farms reporting certified organic products		Hay or field crops		Fruit, vegetable or greenhouse products		Animals or animal products		Maple products		Other	
	2006	2001	2006	2001	2006	2001	2006	2001	2006	2001	2006	2001
NFLD	4	3	0	0	4	3	0	0	0	0	1	1
PEI	31	23	19	11	24	17	4	3	0	0	2	6
NS	61	23	16	6	50	20	12	10	3	0	14	5
NB	42	25	14	6	27	16	8	6	8	4	7	3
QC	765	372	303	105	208	125	161	53	279	119	42	35
ON	593	405	467	308	174	120	172	120	8	6	34	32
MB	196	90	170	74	21	7	44	17	0	0	3	8
SK	1,181	773	1,170	720	19	18	102	59	1	0	11	46
AB	230	197	193	142	31	21	84	60	0	0	13	30
BC	452	319	110	70	358	267	86	53	0	0	63	45
Can.	**3,555**	**2,230**	**2,462**	**1,442**	**916**	**614**	**673**	**381**	**299**	**129**	**190**	**211**

[6] Statistics Canada. 2008. Canadian Agriculture at a glance. see http://www.statcan.gc.ca/daily-quotidien/080328/t080328a-eng.htm

Chart 5 - Organic Foods Rates of Growth by Department

National Grocery Banners - % Increase in Retail Receipts 2006 vs 2005

Chart 4: Organic Food Sold in Canadian Supermarkets



Source: ACNielsen *MarketTrack* estimates. 52 weeks ending august 2006 vs 2005.Special to OACC

National Organic Sector Organizations

In recent years the organic sector has become highly organized to work together to establish national regulated standards and to support the production, market and science of organic. Key national organizations include:

- **Organic Federation of Canada (OFC)** is a national body with a mandate to represent the organic industry while working with provincial, territorial and federal governments on regulatory issues.
- **Organic Agriculture Centre of Canada (OACC)**, an operating division of the Nova Scotia Agricultural College, has a mandate to facilitate research and education for organic producers and consumers to build sustainable communities.
- **Organic Value Chain Roundtable** (OVCRT, hosted by AAFC) is an assembly of leaders from across Canada including producers, processors, distributors, retailers, exporters scientists and government and non-government professionals to establish key priorities and success factors for the branding and development of Canadian organic products for domestic consumption and export.
- **Canadian Organic Growers (COG)** is a charitable organization to lead local and national communities towards sustainable organic stewardship of land, food and fibre while respecting nature, upholding social justice and protecting natural resources.
- **Organic Trade Association** (Canada) (OTA) is a membership-based business association for the organic industry, promoting and protecting organic trade to benefit the environment, farmers, the public and the economy.
- **Other bodies:** in addition to the national organizations listed above, most provinces now have organic sector councils developed to represent the provincial level interests at both the provincial and federal (through the Organic Federation of Canada) levels. Most provinces also have active producer organizations bringing the grassroots of organic production to a coordinated and representative body for sharing information about organic agriculture.

B.2 Sector vision

Organic is well positioned to become a bright light in Canada's agricultural sector, with an estimated market growth rate of 20% per year both locally and internationally. Nevertheless, an estimated 80% of organic sales in Canada are based on imports. The implementation of the new nationally regulated standard as of June 30 2009 will strengthen the integrity of the organic market, present a consistent Canadian organic label for easy identification by consumers, and provide access to international markets. The branding of Canadian organic product will stimulate an increased demand for domestic supply of both raw and processed goods. These markets will be lost (and are being lost) if Canadian farmers cannot fill the void. The premium value of organic goods provides a significant boost to farm income, and is identified as a premium product drawing customers to stores.

The collective vision of the organic sector needs (for the next 5-10 years), in line with the discussions of the OVCRT are, in summary, to:

1. Establish a recognizable **Canadian organic brand** that is consistent with consumer values in order to support domestic and international marketing

2. Increase **capacity to produce** organic raw goods
3. Increase **capacity to add value** to Canadian organic products through vertical integration within value chains
4. Increase **profitability of farmers** of all scales to support the rural economy
5. Characterize and **enhance the consumer driven value** provided through an organic production system (e.g. environmental, animal welfare, health, etc.)

B.2.1 Challenges

In 2008, OACC commissioned an independent analysis of global trends[7] relating to organic accompanied by an overview of opportunities, threats, strengths and weaknesses.[8] The following challenges were identified:

- As international supply of organic product increases, there will be increasing pressure for Canada to differentiate its organic products from other sources
- Little or no data exists to characterize Canadian organic production and differentiate it from international counterparts
- Despite following a standard, organic is an integrated and diverse production system which is complex to characterize
- As demand for organic has grown, the organic processing and retail sectors have become increasingly consolidated, with most leading conventional processors and retailers adopting organic lines. Concurrently, large commercial production enterprises continue to enter the market to fill the demand (particularly in fruits, vegetables, dairy), and are more likely to easily meet the shipping and handling requirements of the processors or retailers, as compared with smaller producers.
- In Canada, most production outside of grain and dairy is relatively small, and smaller scale processing facilities do not exist or are not readily available. Commercial scale organic production is also not highly concentrated, which impacts the ability of processors to invest in regional facilities that are within economical distances for transporting raw fruits and vegetables.
- Many new entrants to organic agriculture have tremendous enthusiasm, but have limited capital, ability to acquire capital, or training in production (including mechanical skills, or machine operation), food handling and marketing. These new entrants typically target local markets for sale of fresh vegetables, fruit and meat.
- Organic grains have largely become commodities as their relatively high supply results in international trading largely on the basis of price. Some local millers and grain processors will target local or Canadian sources of grain as much as is possible, however, producers are also attracted to selling to international buyers offering higher prices. This has resulted in considerable price fluctuation in the organic grains market. Eastern European countries are rapidly entering organic cereal production which will increase downward pressure on organic prices.
- Variability in climate and pest pressure combined with economic forces places organic farming at relatively high risk (like any farm). This is a challenge for organic

[7] Strategic Vision Consulting Ltd. 2009. An organic sector macroenvironmental scan. Produced for the Organic Agriculture Centre of Canada.
[8] Strategic Vision Consulting Ltd. 2009. Canadian organic research group SWOT analysis. Produced for the Organic Agriculture Centre of Canada.

production, but can place organic farmers at an advantage over non-organic production systems which often have higher input costs.
- In a recent national OACC survey of organic farmers, the need to educate consumers on the benefits of organic production systems was identified as a high priority by organic producers.

B.2.2 Strengths

In 2008, OACC commissioned an independent analysis of global trends[9] relating to organic accompanied by an overview of opportunities, threats, strengths and weaknesses.[10] The following strengths were identified for the organic sector:

- Canada will adopt a new regulated standard on June 30, 2009, with substantial equivalency with international counterparts
- The organic sector is organized, with national and provincial bodies in place to effect change
- A national organic logo will be released making organic products more identifiable
- Canada has been exporting products (mainly grains) for more than 20 years, building a reputation as a reliable supplier of high quality raw goods
- The current consumer interest in 'local' supply will increase Canadian demand for Canadian organic products
- Demand for local organic produce exceeds supply, as more institutions are showing interest in integrating organic foods in their menu. Institutional kitchens are designed for consistency in food cooking characteristics and supply which is not always achievable with small scale production.
- The organic dairy sector is well-established in the most populated regions of Canada, particularly ON, QC, and BC. Other provinces are quickly moving towards organic dairy production but at a smaller scale as dictated by demand. Organic is being viewed as one way of expanding domestic milk consumption by offering additional value to the consumer (through the production system and animal welfare).
- Many new entrants to organic agriculture have tremendous enthusiasm. These new entrants typically target local markets for sale of fresh vegetables, fruit and meat.
- Variability in climate and pest pressure combined with economic forces places organic farming at relatively high risk (like any farm). This is a challenge for organic production, but can place organic farmers with more yield stability at an advantage over non-organic production systems which often have higher input costs.
- The demographics of organic producers appear to be much broader than in conventional agriculture. Women appear to have a much more prominent role in owning, operating and managing farms. New entrants to fruit and vegetable production, often from immigrant communities, range in age from 20 to over 50 (as professionals take on organic production as a second career). Such studies help validate new provincial (Que.) and federal programs to provide payments to organic farmers for environmental services and improved farm management.

[9] Strategic Vision Consulting Ltd. 2009. An organic sector macroenvironmental scan. Produced for the Organic Agriculture Centre of Canada.
[10] Strategic Vision Consulting Ltd. 2009. Canadian organic research group SWOT analysis. Produced for the Organic Agriculture Centre of Canada.

- Organic is a sound option for reduction in risks associated with contamination of soil, water and air by synthetic pesticides, fertilizers (or production thereof), and manure application from intensive livestock operations (as applicable) or resistance to pesticides and antimicrobials. However, these benefits need to be quantified.
- Organic farms tend to be more diversified and of smaller scale than conventional farms. This is a strength in that the farms are more adaptable and resilient to stresses (pest, environment, economic). It is also a limitation in that it reduces the farm's capability for entering larger markets.

B.2.3 Organic Science Cluster Contribution

The needs of the organic sector cross multiple sectors of agriculture. OSC will target challenges and opportunities related to: soil fertility, grain cropping systems, vegetable cropping systems, greenhouse production, dairy production, high value fruits, food processing and consumer-driven environmental value of organic. More specifically, the cluster will enhance innovation and competitiveness by:

- Supporting development of advanced organic production practices such as low-till, without herbicides, which increases efficiency thereby maximizing profits and reducing environmental risk.
- Supporting development of modern cereal cultivars, specifically for organic production systems which increase yield and yield stability under organic management
- Developing a soil testing system that will allow improved soil fertility management to maintain optimum quality and yield
- Evaluating novel and integrated greenhouse production systems with high energy efficiency and innovative growing mediums, thereby increasing competitiveness with international imports and capturing emerging markets at the nexus of local and organic demand
- Supporting high-value commercial fruit production by adopting integrated approaches to addressing pest and fertility limitations resulting in higher yields of marketable fruit
- Characterizing the well-being of dairy herds in relation to management practices with impacts on milk quality allowing increases in efficiency, increases of consumer consumption, and enhancing competitiveness with imported dairy products
- Characterizing the environmental benefits of Canadian organic production in relation to energy use and greenhouse gas emissions to support consumer driven value for Canadian organic products, and national sector (OVCRT) branding efforts, while supporting Canada's contribution to reduction of greenhouse gases, and increasing sustainability of production systems.
- Addressing key processing constraints, such as substitutes for nitrates in meat and cleaning agents to facilitate easier integration of organic processing into existing facilities

B.3 Background

B.3.1 Sector Consultations

The Organic sector developed a National Strategic Plan which was published in 2002[11] . Since then OACC has conducted and facilitated research in organic agriculture and published numerous scientific documents and extension reports on www.oacc.info. OACC has conducted or facilitated research in nine provinces in Canada in topics including nutrient management, weed management, soil ecology, dairy health, animal welfare, marketing, cropping systems, and horticultural systems.

OACC coordinated development of, and has guided the Expert Committee on Organic Agriculture since its beginning in 2004. This committee has broad national representation across sectors and up the entire value chain. The role of the committee was to identify priority areas for science in organic agriculture, and they published a list of science priorities for distribution across Canada.[12]

The Organic Value Chain Round Table was formed in 2005 as part of the AAFC Roundtable Initiative. This body pulls together stakeholders throughout the value chain to identify key barriers and strategic market development initiatives. OVCRT began this process by integrating its plans with the National Strategic Plan as a starting point. As a result, OVCRT has four working groups: i) Regulatory, ii) Marketing, iii) Research (incorporating the Expert Committee on Organic Agriculture), and iv) Increased Capacity. See section C.3.2 for more information.

Since July 2007, OACC has taken a lead in coordinating a comprehensive review of research needs, followed by a prioritization process.

a) A macro trend analysis was commissioned by OACC to evaluate the social, technical, economic, environmental and political trends affecting organic agriculture.
b) The trend analysis identified opportunities that could be captured by organic, and also identified threats to organic. The strengths and weaknesses in the organic sector's ability to address these opportunities and threats were identified.
c) A survey of farmer research needs was conducted across Canada in eight provinces, with over 600 respondents.[13]
d) A prioritization process was undertaken to rate the potential for success and impact of selected research areas.
e) A review of Canada's scientific capacity was conducted, including an inventory of scientists with work relating to organic and their areas of expertise.
f) OFC has conducted a survey on regulatory impediments to the marketing of organic products.

[11] National Strategic Plan. See the OACC website at: http://www.oacc.info/reportfinal.pdf
[12] See the OACC website at: http://www.oacc.info/ResearchDatabase/res_priorities08.asp
[13] For provincial and national reports on research needs see the OACC website at: www.oacc.info/ResearchDatabase/res_strategies.asp

The Organic Federation of Canada was established in 2006 with representation from farmer and other industry groups across the country. It has become the umbrella organization for representing the organic sector at a national level. As the national industry body, OFC is the most appropriate applicant for OSC, while partnering with OACC with its nation-wide scientific linkages. OFC also conducted a survey on regulatory impediments to the marketing of organic products.

The prospects for a Science Cluster application were discussed at the most recent OVCRT meeting in January 2009 and the endeavor is supported by OVCRT. OFC was recognized as the most appropriate organization to be the applicant. A framework for an Organic Science Cluster was prepared with input from OFC, OVCRT, the Expert Committee on Organic Agriculture and OACC (see Chart 1 at the end of this document).

A Steering Committee with representatives from the working groups of OVCRT, extension specialists, farmers, processors, OFC, AAFC and OACC (balanced by region) provides broad industry input and recommendations regarding the science projects and activities.

On behalf of OFC and the organic sector, OACC is in a key position to facilitate and administer the new Canadian Organic Science Cluster. This Agri-Science Cluster is part of the Agriculture and Agri-Food Canada program 'Growing Forward: Growing Canadian Agri-Innovations Program', and the potential inclusion of Organic Agriculture as a Cluster in this program is important to the economic, environmental, and social health of Canadians. This Cluster will provide impetus and direction crucial for the growth of organic agriculture in the short term and in the long term. This is a singular opportunity. OSC Science will be broad based, encompassing every Canadian province and a diverse range of scientists and topics. This four year program will exponentially increase the applied science available to support farmers growing healthy, local, organic food that sustains our Canadian soils and people. Conventional farmers and other conventional practitioners will also benefit from OSC science as they choose to employ selected methods to improve their systems.

B.3.2 Value chain identification

The organic value chain may be as simple as producers and consumers relating through direct marketing of raw goods, particularly fruits and vegetables. More frequently, the organic value chain is more complex involving producers, buyers, processors, distributors, retailers, and consumers, any part of which may exist internationally.

Organic value chain development is being led through the work of the Organic Value Chain Roundtable (OVCRT). The OVCRT has four working groups addressing Regulatory issues, Market Development, Increasing Canadian Capacity and Research and Innovation. Under the Increasing Canadian Capacity working group, two benchmarking studies were initiated; one on beef which is in progress, and one on tomatoes[14] which is now complete.

"*The primary focus of supply chains is thus on cost and efficiencies in supply, while value chains focus more on value creation, innovation, product development, and marketing. Value*

[14] Serecon Management Consulting Inc. 2008. Benchmarking study for organic tomatoes. Prepared for the Organic Value Chain Roundtable.

chains underscore the importance of linkages to gain value and advantages to compete in global markets…. Value chain approaches have been used to streamline processes that generate the goods and services that customers value and to guide product improvement and innovation."[15]

"Identifying dynamic linkages between productive activities, value chain analysis transcends traditional economic and industry sectors by showing where value is added in a production process."[16]

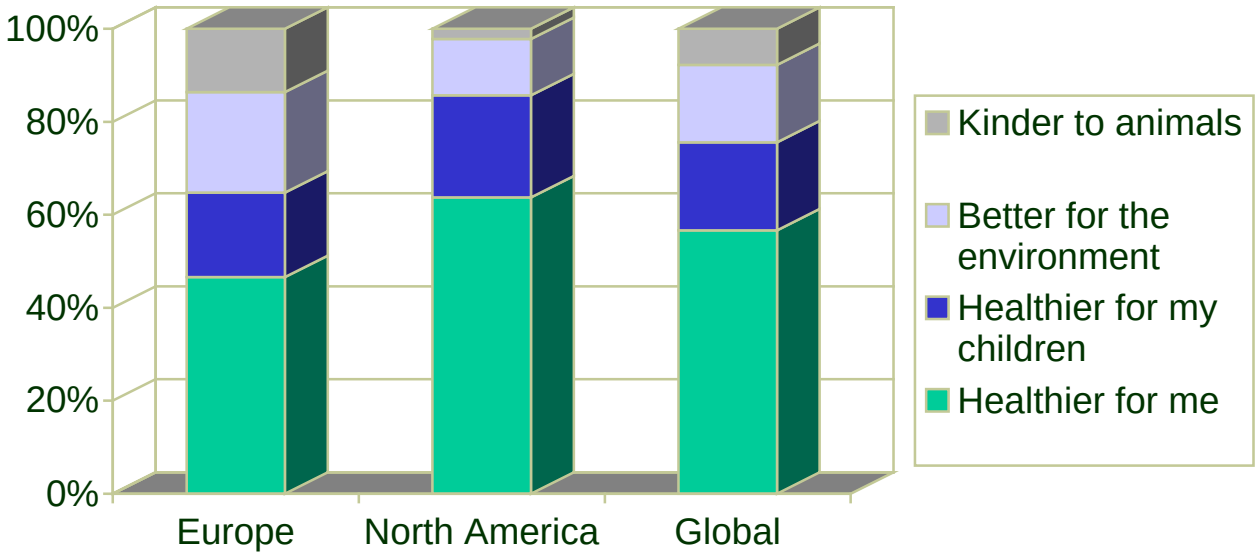


Figure 1. Reasons for purchasing organic. AC Nielson, 2006

The organic value chain is driven by the power of consumers making their purchasing choices more from product value than from price. While consumer demand provides the energy to drive the growth of the organic market, production of raw goods by farmers is the foundation of organic agriculture. The business commitment of the farmer to excellence and to adhering to the standards of a premium production system, sustains this sector in Canada.

Value is added in the traditional sense in organic marketing, in that raw goods are processed and combined to create products with higher value in terms of quality, taste, convenience, etc. However, organic is differentiated from the rest of the market by the perceived benefits of the organic production and processing systems which restrict use of expensive synthetics, resulting in an increased focus on ecological management. Consumers are becoming increasingly conscious of health, food security, food quality, environmental, ethical and animal welfare issues relating to agriculture. Most consumers purchase organic because they believe it is healthier for their family and the environment, and provides special consideration

[15] Martin Webber, J.E. Austin Associates, Inc. Using value chain approaches in agribusiness and agriculture in Sub-Saharan Africa. Prepared for the World Bank.
http://siteresources.worldbank.org/EXTBNPP/Resources/TF054197VCGuideJuly28FinalDraft.pdf
[16] Adapted from Kaplinsky and Morris, "A Handbook for Value Chain Research", IDRC, 2000, p. 46-47.

for the welfare of livestock (Figure 1). This social consciousness is largely consistent with the principles of organic agriculture, and in this sense, the organic production system 'adds value', increasing the consumer's willingness to pay more.

To meet organic standards, farmers must shift their emphasis to maintaining a system that promotes the health of the soil, plants and livestock, making them more resilient to stress. Herein lie additional costs in time, management and record keeping for the farmer. A substantial segment of the consumer population has demonstrated ongoing and growing support for these 'values' through their willingness to pay premium prices for both raw and processed goods. The true value-adding in organic lies in the standardized production system which differentiates organic products from non-organic; processing and convenience packaging primarily serve to expand market access. Essentially, the organic consumer believes organic farmers are providing a service that betters human health, the environment and animal welfare beyond that which conventional agriculture provides, and they are willing to pay for it. As a result, farmers focus on capturing this premium market, while improving market access through product differentiation and minimizing economic risks associated with high-input production.

Canadian organic supply falls largely into the categories of a) exceeding domestic demand (e.g. wheat production) or b) insufficient supply of raw product to support mid- or large scale processing. As a result, Canada's largest contribution to the organic economy is export sales of raw cereals. Meanwhile, an estimated 80% of organic food consumed in Canada is imported due to shortages in supply (e.g. fruits and vegetables) or processing capacity (e.g. convenience foods). Having said that, examples of successful value chains in Canada do exist in the livestock sector and in the sales of fruits and vegetables, where direct marketing is most common. Organic dairy production is the one of the few parts of the organic sector where growth in supply is matching growth in demand. The organic dairy market poses opportunities for increasing the domestic consumption of all dairy products in a sector where there is limited room for growth. The organic dairy market poses a unique opportunity to market the inherent value of organic production through well-established Canadian processors, and to become a model for animal health and welfare for all livestock.

Initiatives in value chain development include:

- Organic tomato study coordinated by OVCRT
- Development and marketing of Honeycrisp apple in the Maritimes
- Development of PEI branded organic fruit jams and specialty products for a targeted Japanese market
- Convenience marketing of meats and meat products to farmers markets and restaurants by offering fresh product (i.e. don't have to thaw) in target locations in ON and AB
- Development of environmentally friendly lines of cereal products from Canadian grains
- Marketing of fresh produce through community supported agriculture (CSA) or box programs
- Organic dairy product development beyond fluid milk including yoghurt, cheese, etc.

Saskatchewan is home to the largest number of producers and hectares of organic production, which is mainly cereals, oilseeds, and pulse crops. Considerable market research had been conducted at the University of Saskatchewan[17] from 2002 to 2007 including supply chain analyses of wheat, oats, flax and lentils. Approximately 80% of organic wheat production on the prairies is exported, most often as raw product. An analysis of the supply chain for wheat shows an increase in value (2005) from $8/bu at the farm gate to $26.4/bu after milling, to $56/bu through distribution and retail (i.e. value increases 7x, not including wheat bran)[18].

Several provinces, such as PEI[19], ON, and QC are making significant efforts to support organic value chain development. For example, a small PEI company has been formed to work directly with a Japanese buyer to develop specialized organic jams. In this case the organic branding is marketed with the Anne of Green Gables image of PEI, which the Japanese adore.

Research results posted on the OACC website (www.oacc.info/ResearchDatabase/res_welcome.asp) are intended to directly benefit Canadian farmers and processors. They can make more Canadian organic products available for the benefit of all Canadians along the entire value chain of organic systems. Practitioners will contribute in-kind resources such as land, livestock, equipment for research and some will contribute cash along with farm organizations, retailers, foundations and others.

B.3.3 Market analysis and science to validate opportunities

Considerable market research has been conducted both internationally and in Canada over the last 10 years as organic retail sales have increased; it includes the introduction of organic statistics in the 2006 national census of agriculture. Overall, these reports describe growing consumer demand for organic products, and an expanding domestic and international market with premium prices for producers. Key opportunities in the domestic retail market lie in processed and packaged goods, beverages and meats. Export strengths are primarily in grains where a surplus of production exists. The following documents illustrate this point.

- Retail sales of organic food products in Canada, in 2006[20]
- Grow Local Organic Strategy[21]
- Organic Macrotrend analysis[22]
- Organic SWOT analysis[23]

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[17]The Organic Marketing Study. Department of Agricultural Economics, University of Saskatchewan. http://organic.usask.ca/Marketing%20study.htm

[18]Ferguson et al. 2005. Organic wheat supply chain profile. Department of Agricultural Economics, University of Saskatchewan. http://organic.usask.ca/reports/Marketing%20Study%20Papers/wheat%20profile%2022%20mar%2005.pdf

[19] PEI Agriculture. 2007. Organic industry development program 2007-2011. sSee: http://www.gov.pe.ca/af/agweb/index.php3?number=1015980

[20] A. Macey. 2007. Retail sales of organic food products in Canada, in 2006. Prepared for the OACC. See: http://www.organicagcentre.ca/Docs/RetailSalesOrganic_Canada2006.pdf

[21] R. Christianson and M. Morgan, Rhythm Communications. 2007. Grow Local Organic: Organic Food Strategy for Ontario: Value-added processing. Prepared for the World Wildlife Fund. See: http://www.organicagcentre.ca/Docs/GrowLocalOrganic_wwf_Oct-07.pdf

[22] Strategic Vision Consulting Ltd. 2009. An organic sector macroenvironmental scan. Produced for the Organic Agriculture Centre of Canada.

- ACORN Organic Market Research and Action Plan[24]
- The Canadian Market for Organic Food and Beverages[25]
- Vista on the agri-food industry and the farm community: Niche market or expanding industry? Organic fruit and vegetable production in Canada.[26]
- Ontario Goes Organic: How to Access Canada's Billion Dollar Market for Organic Food[27]

B.3.4 External expertise for management and facilitation

OACC will be contracted to manage the OSC program for OFC. OACC is working with two science leaders on each project (Projects A through I), one from AAFC and one from a university or other organization, external to AAFC. OACC and OFC are also advised by a working group from AAFC regarding potential participating AAFC scientists and how they can be effectively linked to OSC.

The Steering Committee convened at the recommendation of OVCRT has provided on-going advice since January, 2009 as science priorities were refined and science leaders were solicited to develop proposals to address these priorities. The Steering Committee consists of

Members	Observers
Chantal Jacobs, SAF, SK	Tomas Nimo, OVCRT, ON
Donna Youngdahl, CWB, OVCRT, MB	Nicole Boudreau, OFC, QC
François Bélanger, Jardins Nature, QC	Dalia Kudirka, AAFC, ON
Andrew Hammermeister, OACC, NS	Mike Leclerc, AAFC, ON
Hugh Martin, OMAFRA, ON	
Frédérick Duhamel, Jardins de Tessa, QC	
Jason Freeman, Farmer Direct Co-op, OVCRT, SK	
Ted Zettel, OFC, OVCRT, ON	
Keith Everts, OVCRT, AB	
Derek, Lynch, OACC, OVCRT, NS	
Peter Hicklenton, AAFC, OVCRT, NS	
Allison, Grant, OVCRT, NS	
Ralph Martin, OACC, OVCRT, NS	

[23] Strategic Vision Consulting Ltd. 2009. Canadian organic research group SWOT analysis. Produced for the Organic Agriculture Centre of Canada.
[24] ProAgri Consulting and Morton Horticultural Associates. 2003. Organic market reseach and action plan. Prepared for ACORN. See: http://www.acornorganic.org/pdf/MarketingFinalReport.pdf
[25] R. Kortech-Olesen. 2004. The Canadian market for organic food and beverages. Prepared for the International Trade Centre UNCTAD/WTO. See: http://www.intracen.org/organics/documents/canadian-market.pdf
[26] W. Parsons, Statistics Canada. 2005. Vista on the agri-food industry and the farm community: Niche market or expanding industry? Organic fruit and vegetable production in Canada. Catalogue no. 21-004-XIE. See http://www.statcan.gc.ca/pub/21-004-x/21-004-x2005002-eng.pdf
[27] MacRae et al. 2006. Ontario Goes Organic : How to access Canada's growing billion dollar market for organic food. World Wildlife Fund and Organic Agriculture Centre of Canada. See: http://www.organicagcentre.ca/ResearchDatabase/res_oos_intro.asp

B.4 Opportunity

With about 1.5% of the food retail marketplace, the Canadian organic food sector, is the only significant growth area of the Canadian agri-food system. For the past decade, annual growth rates have been estimated at 15-25%[28,29], bringing its market presence from a few tenths of a percent to its current level of penetration. Such growth rates explain, in part, the significant merger and acquisition activity experienced by the sector in the last five years, as mainstream food companies have created alliances with, or taken control of, organic food enterprises[30] . An analysis of the potential to expand the organic market in Ontario revealed that, with the right infrastructure in place, organic retail sales could grow to over 5% of the Ontario food retail market within 15 years, with organic production covering 10% of cropped acres[31] . Comparable growth would be anticipated in other regions of the country as well, especially other provinces with established organic strategic plans (PEI, Manitoba, Quebec, Saskatchewan, BC).

But growth is currently impeded by a lack of supply, especially a lack of Canadian supply. It's currently estimated that only 15-40% of the organic food consumed here is produced and processed domestically, meaning that Canadian farmers and processors are missing out on the economic opportunities presented by this demand-side phenomenon[32] .

It is well established in the literature that organic production is a significant financial opportunity for farmers[33] . The reduced input costs and the market premiums usually combine, despite frequently higher labour costs, to make organic farmers more profitable than they were as conventional producers. But the transition-to-organic barriers are significant, including information and transition planning gaps, deficiencies surrounding knowledge mobilization and commercialization uptake, lack of access to trusted advisors, supply chain immaturity, capitalization challenges for small-medium enterprises, limited market intelligence in certain commodities and regions, and dysfunctional market signals (e.g., prices that don't accurately reflect supply conditions and price externalities that favour unsustainable over sustainable practices)[34,35].

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[28] Holmes, M. and Macey A. 2007. Canada's Organic Market. Accessed 17 June 2009. http://www.cog.ca/documents/CdnOrganicMkt2007.pdf

[29] Macey,A. 2007.Retail Sales of Certified Organic Food Products, in Canada, in 2006. Prepared for the Organic Agriculture Centre of Canada. Accessed 17 June 2009. http://www.organicagcentre.ca/Docs/RetailSalesOrganic_Canada2006.pdf

[30] Howard, Philip H. and Patricia Allen. 2008. Consumer Willingness to Pay for Domestic 'Fair Trade:' Evidence from the United States. *Renewable Agriculture and Food Systems* 23(3), 235-242. Copyright 2008, Cambridge University Press.

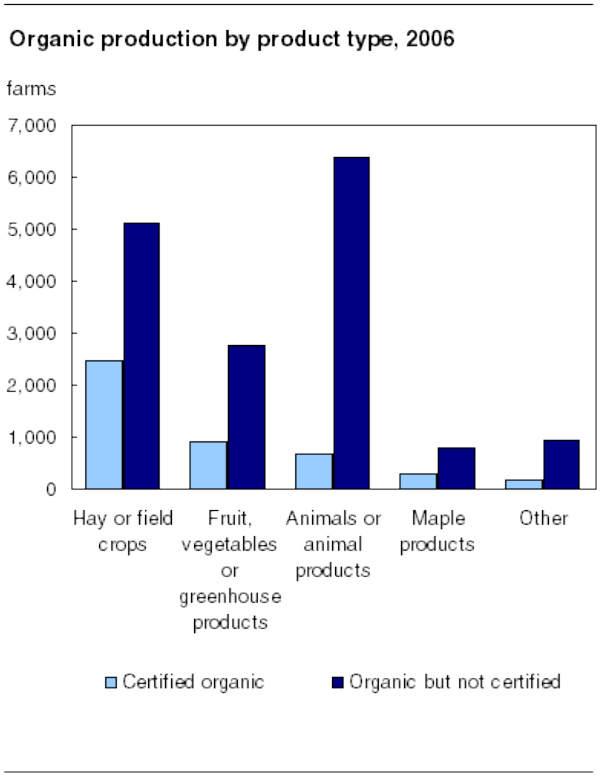
[31] MacRae et al. in press.

[32] MacRae et al. in press.

[33] MacRae et al. 2007. Economic and social impacts of organic production systems. Canadian Journal of Plant Science 87 (5): 1037-1044.

[34] MacRae et al. in press.

[35] Christianson and Morgan, 2007



The “shovel ready” information gaps are particularly significant because the organic sector has not benefited from the same levels of research and knowledge mobilization that have been common in many conventional commodity sectors. Addressing these types of information and mobilization gaps, the focus of this proposal will accelerate the transition process. For example, as new knowledge is mobilized to help craft farm and product specific transition plans, the costs and uncertainties surrounding the transition process will be reduced, diminishing one of the most significant financial and psychological hurdles for conventional producers interested in going organic.

The 2006 census showed that more than twice as many farmers are in “organic” production but are not certified compared to those in certified organic production (see figure below). Until June 30, 2009, these “uncertified organic” producers could claim they were in organic production when marketing their product (except in Quebec). With the new product regulation, these producers can no longer make such a claim without being certified. The rationale provided for not becoming certified typically involves: a) cost of certification, b) record keeping burden, and/or c) the farmer has a well-established clientele for direct marketing and certification does not provide enough of an advantage to warrant the extra record keeping. However, this poses a significant opportunity, since the actual number of farms using organic practices would be approximately three times that reported for certified organic production. The impact of organic science and innovation on production management is estimated to be at least three times higher than estimated by organic statistics (with even broader relevance to most of the agricultural industry) and a 50% increase in production capacity could happen quickly if the market/production/regulatory environment is appropriate.

B.5 Benefit to Canada

B.5.1 Issues of High Priority for the Canadian Organic Sector

In 2008-2009, OACC engaged in a science prioritization process to identify the top science priorities for the organic sector. Questions prepared for nine different research categories were ranked for their impact against nine criteria in addition to the likelihood of project success and time required for completion (See document OSC.3.5.Prioritization_Summary.final.pdf).

The results of this analysis are provided in Appendix 1. In the General category, the top six strategic science areas that were ranked to have the most impact were:

1. Develop integrated production systems that reduce pest pressure from weeds, insects, disease and parasites.
2. Reduce the risk of transitioning to organic production through the development of new management systems or production aids.
3. Develop integrated production systems that increase yield and yield stability.
4. Identify key characteristics of the organic production system that are of value to the consumer.
5. Develop and/or identify livestock breeds and/or crop varieties that are adapted to organic management.
6. Identify practices that reduce energy requirements on the farm.

More specific strategic research areas were identified in the categories of soils, plants, livestock, ecological, sustainability, policy, market and health and food. The priorities in these areas largely focused on integrated management of nutrition and pests for soil, crops, and livestock. This is consistent with the research needs identified by most farmers across Canada[36]. Overall, integrated approaches to production management were identified as a higher priority than identifying 'magic bullets' for enhancing fertility and controlling pests.

The Market Development Working Group of the OVCRT has identified a goal of creating an identifiable Canadian Organic Sector Brand to increase sector competitiveness. Some of the gaps identified in developing a brand for Canadian Organic included:

- Volume of product and capacity
- Lack of small scale processing facilities
- Consumer education about organic as a production system
- Lack of scientific information on environmental benefits related to Canadian production
- GMO contamination
- Lack of organic marketing infrastructure throughout the value chain
- Lack of stable funding for research.

[36] For provincial and national reports on research needs see the OACC website at: www.oacc.info/ResearchDatabase/res_strategies.asp

The Increasing Capacity Working Group of the OVCRT commissioned a benchmark study for organic tomatoes. Among the recommended strategic objectives coming out of the report (that are relevant to this proposal) were:

- Strategic Objective #1: to develop within the industry the capacity to research and develop new products, processing technologies, packaging formats, and extended year round supply capabilities.
- Strategic Objective #4: Development of a science-based environmental impact indicator as a means to market organic tomatoes.

While these strategic objectives were targeted toward tomatoes, they are believed to be relevant to most other products as well. This working group also identified key factors limiting capacity growth. Those relevant to this proposal included:

- Financial risk of transitioning production and processing operations to organic management practices
- Lack of experience and knowledge of organic management practices on the farm and at the processing facility
- Access to shelves hindered by:
    - …
    - Competition from imported products
    - Lack of product availability
- Growth in processing capacity hindered by:
    - …
    - Availability of ingredients
    - Cost of ingredients
    - Competition from imported products.

The focus of projects in this cluster will be on addressing barriers to production capacity in conjunction with characterizing the benefits of organic production systems.

B.5.2 Economic Benefits for the Canadian Organic Sector and for Canada

OSC will benefit Canadian practitioners (farmers and processors) directly by improving accessibility to information resources and indirectly by supporting the work of extension agents and scientists. These farmers and processors will make more Canadian organic products available for the benefit of all Canadians along the entire value chain of organic systems. We can realistically expect over 75% of organic farmers in Canada to benefit directly or indirectly from the activities in this project including surveys, workshops, field days, conferences and newspaper articles.

Many conventional farmers are and will be aware of OACC science and innovation through regular articles in mainstream farm newspapers and by the advice of conventional and organic extension workers across Canada that use the OACC website as a reference when assisting farmers to improve cost effectiveness or to meet environmental goals. It is expected that they will keep accessing www.oacc.info for information. Processors, distributors and retailers will benefit by having their Research Needs addressed and having access to OSC scientific results. All organic extension personnel and many conventional extension specialists will benefit from this project. The project activities will also provide up to date

content for OACC web courses which have about 20 registered students per course per year or 260 students per year. At least 40 scientists have been involved with OACC research and this number is growing as this program develops.

Increasing science capacity in organic agriculture will increase the numbers of farmers and acres dedicated to organic practices. Our experience is that farmers in the mainstream agricultural community adopt many of our research results when they see possibilities to save money and resources. Organic methods reduce general environmental impact as well as greenhouse gas emissions. To the extent OSC results are employed, all Canadian consumers and farmers will benefit.

Entrants to conventional farming are at an all-time low, creating concern about sustaining our food supply. Organic agriculture, in comparison, is growing with new entrants, many of whom are women and ethnic minorities, exploring non-traditional roles. Urban youth with limited to no access to traditional farm assets are also flocking to organic, as demonstrated by the success of programs such as FarmStart and Everdale Environmental Learning Centre. It is expected that OSC will create and support new farmers in Canada.

The environmental, health and social benefits of an increase in organic farming are significant, measurable and vital to the future of Canadians and key to the continued growth of the sector.[37,38] Organic agricultural systems are usually more profitable than conventional farming systems. This difference results from a combination of yield changes, input cost reductions, and price premiums.

Globally, plant yields in organic systems are, on average, 10% below conventional systems. However, crop yields in prairie organic systems have not produced the same results shown by studies in many other regions. Weed management appears to be a significant challenge and several factors may account for the results obtained to date:

a) still-emerging knowledge about how to manage weeds ecologically in a prairie environment
b) limitations on management options imposed by the requirements of science protocols (.eg. a farmers might finger weed several times depending on the weather but a research trial might only allow one or two passes in order to test other methods. Therefore, the best organic weed management practices have not always been employed in trials)
c) crop rotation design, with the associated challenge of incorporating perennial legumes in moisture-limited environments. Low soil phosphorous levels may also be an extensive problem contributing to reduced yields[39, 40,41].

[37] MacRae et al. 2007. Economic and social impacts of organic production systems. Canadian Journal of Plant Science 87 (5): 1037-1044.
[38] Lynch, in press.
[39] Entz et al. 2001. Crop yield and soil nutrient status on 14 organic farms in the eastern portion of the northern Great Plains. Canadian Journal of Plant Science. 81: 251-354.
[40] Martin et al. 2007. Phosphorus status on Canadian organic farms. Journal of the Science of Food and Agriculture. Volume 87:2737-2740.
[41] Buhler, R.S. 2005. Influence of Management Practices on Weed Communities in Organic Cereal Production Systems in Saskatchewan. Thesis. etd-12302005-142348.

Generally, however, yields in organic systems continue to rise as understanding of them grows and as more money is devoted to research. For example, 2006 results from the Rodale Research Centre long-term trials showed 40% greater corn yield in an innovative one-pass roll / plant organic no-till system compared to that in a conventional chisel-till system[42] .

For animal products, yields are, on average, 20% below conventional, with the same caveats regarding comparisons.

Gross margins of organic enterprises are at least as good as, if not better than, those under conventional regimes. In more extensive systems like those practiced in North America, input cost reductions are often sufficient to maintain margins. Four factors usually account for the positive end of these income results.

First, operating costs for organic farms may be up to one-third lower, particularly for energy, chemicals, and drugs. Variable input costs are 50 to 60% lower for cereals and grain legumes, 10 to 20% lower for potatoes and horticultural crops, and 20 to 25% lower for dairy cows. Second, where premium prices are available in organic markets, the likelihood of a superior net income situation is even greater. Third, many organic farmers achieve higher net income by making more direct links with consumers, which allows them to capture a greater percentage of the consumer dollar. Fourth, organic farms may be more resilient in the face of poor weather. For example, during 5 yr of droughty conditions in the Rodale Research Centre 22-yr cropping system trials, organic corn yields surpassed conventional ones by an average of 28 to 34% depending on the organic system. In years of 'regular' conditions, organic yields were comparable to those in conventional production[43] .

Labour productivity, measured against yields is generally lower on organic farms than in conventional systems, and traditional economic analysis views this as problematic. Labour requirements are generally reported to be higher in Europe and in more intensive production systems.[44,45] More extensive systems, however, often do not report additional labour

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[42] Hepperly, P. et al. 2007. Soil carbon management : economic, environmental and societal benefits / edited by J.M. Kimble[et al.]. Boca Raton, FL : CRC Press, c2007., p. 129-153.

[43] Pimentel et al. 2005. Environmental, Energetic, and Economic Comparisons of Organic and Conventional Farming Systems. July 2005, Vol. 55, No. 7, Pages 573-582. Posted online on December 18, 2008. Accessed: 17 June 2009. http://caliber.ucpress.net/doi/abs/10.1641/0006-3568(2005)055%5B0573:EEAECO%5D2.0.CO%3B2

[44] Jansen, K. 2000. Labour, livelihoods and the quality of life in organic agriculture in Europe. Biological agriculture & horticulture. ISSN 0144-8765. 2000, vol. 17, n°3, pp. 247-278.

[45] Green, M. and Maynard, R. 2006. The employment benefits of organic farming. Published in Atkinson, C; Ball, B; Davies, D H K; Rees, R; Russell, G; Stockdale, E A; Watson, C A; Walker, R and Younie, D, Eds. Aspects of Applied Biology 79, What will organic farming deliver? COR 2006, page pp. 51-55.

requirements.[46] Average increases in requirements are in the 10 to 20% range, but there is wide variability amongst cropping systems. Field crop and mixed operations report slightly higher requirements for organic production, and horticulture is substantially higher. In dairy production, however, requirements are comparable. Further processing and direct marketing may also be significant contributors to increased labour requirements. Labour demands on organic farms are, however, generally falling relative to the early 1990s[47] . These increased labour requirements sometimes require additional hirings.[48] (see below) and are sometimes absorbed within the farm family. Interestingly, returns to total labour may be higher on organic farms, and wages may also be higher (see below). There is also evidence that the quality of labour is more positive in organic farming because the work is more diversified and less repetitive.[49] Because of both the difficulty of making labour comparisons and the debates about the most useful labour measures, it is not clear that increased demands for labour are actually problematic.

Regional economic implications are more difficult to evaluate because of a lack of organic multiplier data. Analyses of widespread conversion to organic production suggest net benefits relative to conventional production scenarios in regional economic vibrancy, but there are tradeoffs[50] . Christianson and Morgan[51] estimated regional economic multipliers, based on the literature, at 2-3:1, with economic ratios for processors investing in new organic products at 14 times each dollar of capital investment.

Regarding environmental benefits, a review of empirical studies carried out by Lynch[52] suggests beneficial organic farming system attributes relative to conventional systems regarding cropping, floral, and habitat diversity; nutrient intensity; soil management; and energy and pesticide use. More research is needed to validate these results, for the benefit of producers, consumers and policy makers as they decide the relative importance and contribution of organic farming systems to the Canadian food marketplace and agri-food sector.

As OACC disseminates more OSC research results linking health and healthy food to soil, crops and animals, more information will be available for consumers as well. Consumers gain confidence in Canadian organic food as the scientific underpinning develops and they are asking for this information. With the OSC results available in French and English, on the

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[46] Wynen, E. (2003), Organic Agriculture in Australia - Levies and Expenditures, report No. 03/002. RIRDC, Canberra. Accessed 17 June 2009. (http://www.rirdc.gov.au/reports/org/02-45.pdf).
[47] Stockdale, E.A. et al. 2001. Agronomic and environmental implications of organic farming systems. Advances in Agronomy. Vol. 70, pp. 261-262. 2001.
[48] Green, M. and Maynard, R. 2006. The employment benefits of organic farming. Published in Atkinson, C; Ball, B; Davies, D H K; Rees, R; Russell, G; Stockdale, E A; Watson, C A; Walker, R and Younie, D, Eds. Aspects of Applied Biology 79, What will organic farming deliver? COR 2006, page pp. 51-55.
[49] Jansen, K. 2000. Labour, livelihoods and the quality of life in organic agriculture in Europe. Biological agriculture & horticulture. ISSN 0144-8765. 2000, vol. 17, n°3, pp. 247-278.
[50] MacRae, R. et al. 2004. How Governments in Other Jurisdictions Successfully Support the Development of Organic Food and Farming. Report funded by the Canadian Agriculture and Rural Develop (CARD) Program of Agriculture and Agrifood Canada. Organic Agriculture Centre of Canada, Truro, NS.
[51] Christianson, R. and Morgan M.L. (2007) Grow Local Organic: Organic Food Strategy for Ontario: Value-added Processing. Report to WWF Canada. Rhythm Communications, Campbellford, ON
[52] Lynch, in press.

OACC website (www.oacc.info), the current annual hits of four million are expected to double, within four years.

The key to improving aggregate Canadian productivity and capacity (and capturing a greater percent of the economic value of organic sales) is increasing supply, and concomitantly the number of suppliers of organic primary and processed goods. On the production side, there are three relatively discrete farming situations that need to be enhanced:

1. Existing organic farmers who can expand production
2. Conventional farmers wishing to convert to organic production
3. New entrants to farming who start as organic producers

On the processing side, two supply expansion scenarios are seen as most viable in the short to medium term:

1. An increase in co-packing by conventional processors
2. A modest increase in dedicated organic small-medium enterprise start ups

Success in all these scenarios will be determined by a range of factors and supports of which knowledge mobilization and commercialization will be only a part. However, the work of this cluster is designed to support primarily farmer scenarios 1 and 2 and processing scenario 1.

The projects outlined in this proposal address many of the problems identified by existing organic producers, problems that have an economic and efficiency cost for their operation. However, much of this new information can be packaged in "transition planning" frameworks that will also assist conventional growers undertaking a transition to organic. The increases in supply associated with that knowledge will increase volumes sufficiently to make co-packing (processor scenario 1) a more viable option.

Based on extrapolations from an Ontario study,[53] an objective of this program is to support the increase of Canadian domestic production and processing capacity (number of hectares, farmers, processors etc.) by the following amounts:

a) For existing organic producers, 20% increases in capacity over four years to expand existing production, or add new production to existing operations, e.g. certifying a conventional beef herd in an existing organic cash cropping operation; adding vegetables to an existing dairy operation.

b) For conventional farmers converting, increases in converting acreages by 40% over four years (note that Census of Agriculture data suggests there is a significant pool of producers who are near organic) are possible. New knowledge generated from these projects will provide credible support to those who choose to take the next steps to organic certification.

[53] MacRae, R.C. Martin, M. Juhasz and J. Langer (2009). Ten percent organic within 15 years: Policy and program initiatives to advance organic food and farming in Ontario, Canada. *Renewable Agriculture and Food Systems*, **24** , pp 120-136 doi:10.1017/S1742170509002531

c) For processing, a 40% increase in co-packing infrastructure within six years (two years after project completion to accommodate lag times associated with supply chain development).

The increase of Canadian capacity will be measured by annual data purchased from Nielsen. OACC has been tracking these data since initiating a consortium of provincial and AAFC collaborators to pay for the initial coding of organic products.[54] OACC is engaged in assisting SPINS to set up their data collection service in small and medium sized stores in Canada. If successful, their data will also be used to complement Nielsen data.

OSC will provide impetus and direction crucial for the growth of organic agriculture in the short term and in the long term. The science will be broad based, encompassing every Canadian province and a diverse range of scientists and topics. This four year program will increase the research available for farmers to grow healthy, local, organic food that sustains our Canadian soils and people.

Canadians are providing only 15% of the organic food consumed in Canada and even less to the growing markets in the U.S., Europe and Asia. We lack a science strategy to support the production and processing of more organic products in Canada. Scientists, especially those only marginally involved in organic science, are often unaware of the most pressing needs and barriers to growth of the organic sector. Those who need access to results of science tend not to find them or sometimes do not understand them when they are written in language specific to scientific disciplines. The goal of the OSC Communication project is not only to translate between French and English but to also translate scientific language to practitioner language as the results become available. As the new National Organic Regulations and Standards are being finalized, there is an opportunity to brand and market healthy, Canadian, organic food. In order to do so, Canadian farmers and processors need OSC research support for specific problems and they need timely access to easily understood results.

B.6 Cluster overall Goals/Objectives

B.6.1 OSC Objectives

The goals of the Canadian Agri-Science Cluster Initiative are to:

- Enable key industry-led agricultural organizations to mobilize a critical mass of scientific and technical resources to support innovation strategies for enhanced profitability and competitiveness.
- Develop and implement comprehensive applied agricultural science and technology transfer plans addressing the priorities of the industry.
- Address the challenges of technology, organization and knowledge management while developing new agri-products, practices and processes that will increase agri-industry opportunities for profitability and competitiveness.
- Support industry leadership in developing and managing national applied science plans.

[54] Macey, A. 2007. Retail Sales of Certified Organic Food Products,in Canada, in 2006. Accessed 17 June 2009.

- Engage national industry, academic and government applied science resources in a coordinated response to industry-defined science requirements.

This Organic Science Cluster is in an excellent position to address these goals. It is:

- Industry led, addressing strategically identified industry priorities,
- National in scope, bringing together scientific activities and scientists from nine provinces to address multiple commodities in the organic sector,
- Creating a national collaboration of academic and government applied science resources, with both AAFC and non-AAFC scientists participating in most projects,
- The results will be of benefit to all of agriculture to increase efficiency, competitiveness and profitability, bringing Canadian organic to the forefront of domestic and targeted international markets.

The objectives of the Organic Science Cluster are to:

- Increase competitiveness of Canadian farmers in domestic and international markets
- Increase profitability of Canadian farmers by improving cost effectiveness and expanding their capacity to supply growing markets
- Implement and coordinate a science program across Canada addressing strategic science areas identified by industry, thus removing barriers for Canadian practitioners in the organic and conventional food systems.
- Establish Canada as a leader in the production of high quality and safe organic food by characterizing organic production systems and supporting development of the sector and market (international, national and local) with innovative, industry-directed science.
- Support the increase of Canadian production and processing capacity by 20%, over 4 years.
- Support development of sustainable production systems that reduce business and environmental risk by using ecologically sound management.
- Validate claims of environmental benefits from Canadian organic agriculture, encoded (as five of seven stated principles) with the new national Canadian organic standards, to enhance and strengthen consumer confidence in the Canada organic brand in both domestic and export markets.
- Support branding efforts of the organic sector nationally (i.e. Organic Value Chain Round Table market development working group) to link the ‘Canada organic’ brand with the attributes of (i) environment and stewardship (ii) superior products (iii) dedication to excellence, and (iv) knowledgeable, trustworthy people.
- Inform the Canadian organic regulatory process and Permitted Substances List (PSL) as it evolves such that amendments are based on science.
- Increase and support Canada’s science capacity in organic agriculture by working with scientists in university and government institutions, supporting organic project design and proposal writing, communication of results, and networking.

B.7 Description of Sub-projects

The Projects and Activities of OSC are the product of extensive consultation with the organic sector as described above, particularly in sections C.3.1 and C.5.1. The final determination of science activities resulted from review of the Cluster Steering Committee, priorities identified by contributing and collaborating industry partners, and consultations with the team of researchers that has been assembled. An overview of the Projects is provide below.

B.7.1 Project A: Biologically based fertility management

Organic agriculture prohibits the use of synthetically produced fertilizers, but encourages the use of suitable crop rotations, manures and composts, and approved amendments to sustain soil fertility and promote a biologically active soil. While nitrogen can be readily managed through the use of legumes in rotations, phosphorus is not so easy to manage. Rock phosphorus sources that are acceptable in organic production typically have very low availability for crops, and can be very expensive to apply. In many cases, an adequate supply of phosphorus exists in the soil but it is very difficult for plant roots to extract because it is relatively immobile and is bound to soil particles or organic matter. Some plants have developed associations with arbuscular mycorrhizal fungi (AMF), where the AMF is much smaller in diameter and can explore a larger soil volume than roots. This association can provide significant volumes of phosphorus as well as various micronutrients for crops. The relationship between AMF, crops, and crop management is poorly understood, despite the availability of a few sources of AMF inoculants. Management practices (e.g. tillage, fertilization, pesticide use, crop types and cultivar) all can influence AMF activity. As a result, some farmers have observed little response to fertilizer phosphorus, or, a lack of deficiency symptoms in the crop despite low phosphorus levels detected in soil tests. This research strives to model the relationship between AMF, crop and management practices. It will allow farmers (organic and conventional) to better manage their crops to take advantage of AMF associations, and will allow soil testing laboratories to make more accurate recommendations. As a result, this project will increase the profitability and competitiveness of Canadian farmers.

B.7.2 Project B: Integrated grain-based cropping systems

Grain production has long been the foundation of the organic sector in Canada. This production involves the largest proportion of organic farmers, and the largest land area in production. Much of the grain that is grown is exported to U.S., European and Japanese markets while some is used for Canadian milling and processing. While human consumption of grains is of primary importance, organic feed grain production is also essential for the growth of the organic livestock and dairy sectors. Shortages of grain supply and related high prices have limited opportunity for growth in the organic livestock sector (with the possible exception of dairy). The five top ranked needs of organic grain producers in a recent survey[55] were:

- soil fertility and crop rotations
- beneficial crop rotations for specific problems

[55] OACC.2009.Research needs assessment of Canadian organic cereals producers. See: http://oacc.info/Docs/SurveyReports/cereals3.pdf

- ecological interactions in rotations
- rotations for weed control
- soil quality.

Organic producers emphasized the need for integrated approaches to organic research that address problems associated with weed control and soil fertility. It emphasized a need to understand the ecology of crop production in order to optimize management for sustainability and profitability. The integrated approach requires tools including high quality grain cultivars suited to organic management and reduced tillage systems for weed management and soil building. Long term evaluation of rotations is a necessity due to the complexity of interactions in the soil and management practices. The science activities in this project will result in a better understanding of the ecological interactions under organic management, develop new cultivars of wheat and oats specifically suited for organic production, and bring a low-tillage technique for terminating cover crops a step closer to commercialization. This combination of knowledge development and innovation will lead organic grain producers to higher competitiveness and profitability in the international market.

B.7.3 Project C: Organic greenhouse production

As was discussed above, fruits and vegetables account for 41% of the organic consumption in Canada. It has been estimated that only 15% of organic products consumed in Canada have been produced in Canada. While cold winters provide Canadian agriculture a natural advantage in terms of pest control, it also greatly shortens the growing season affecting yield potential and crop selection. Season extension has been identified as an important need for increasing the competitiveness of Canadian horticultural farmers. Greenhouse production has its challenges, however, namely the cost of heating, development of growing mediums, soil fertility management, and control of pests and diseases. The science activities under the greenhouse project of the OSC are a direct result of needs expressed by industry partners, who have provided significant funding and in-kind contributions to support this research. This project will identify solutions to make organic greenhouse production in Canada more competitive and profitable including activities that: identify growth enhancers and supplements that reduce disease and pest incidence, improve quality and productivity, develop growing mediums and fertility amendments for organic production, develop innovative solutions to increasing energy efficiency, and develop lighting solutions that will allow continuous, year-round production of organic vegetables.

B.7.4 Project D: Integrated management of horticultural field crops

Vegetables have been identified as the primary entry point for consumers into the organic market. Organic vegetable production has largely been restricted to small scale production for farmers markets and restaurants, with some wholesale distribution and little production for large scale processing in Canada (with potatoes a possible exception). Again, integrated practices for building soil quality while managing weeds, insects and diseases is a high priority for these farmers. While tremendous market potential exists, these barriers are limiting the large scale commercial production and processing in Canada. The activities in this project will increase profitability and competitiveness by developing management solutions controlling for controlling weeds, insects and disease, and promoting soil fertility through integrated management systems.

B.7.5 Project E: Environmental stewardship and product branding

The consumer willingness to pay more for organic food relates directly back to the production system and its perceived outcomes. As a result, the branded image of organic is directly linked with perceived benefits that the organic production system offers for the health of humans, animals and the environment. The Canadian organic product must be prepared to compete in an expanding global marketplace. Canadian organic products must be identified as a leading production system consistent with the values of a progressive consumer base. To accomplish this, the impacts of the organic production system must be characterized to allow branding and image development. This project will emphasize the environmental stewardship associated with organic production, with particular attention on modeling farm scale energy and nutrient efficiency, and global warming potential, as affected by management, and the potential environmental impact of transitioning a sub-watershed to organic production.

B.7.6 Project F: High value fruit production

High-quality fresh fruits are among the pinnacle of organic consumption. Unfortunately, the small scale and seasonally constrained production in Canada has limited supply for meeting fresh market demand, international opportunities and commercial scale production for processing. Insect pests, diseases, soil fertility and short growing seasons have constrained production. Again, integrated approaches are needed. This project will include activities that explore novel technologies for season extension and pest control, and integrated crop management to optimize stand establishment and productivity. Target crops include apples, wild blueberry, black currant and possibly haskap, strawberry and raspberries.

B.7.7 Project G: Benchmarking the organic dairy production system

The dairy sector is one of the best established value chains in organic agriculture, often beginning with farmer cooperatives and ending with a product catering to the taste of consumers. The dairy sector is also a leading component of the organic livestock community, with an opportunity to demonstrate premium animal health and welfare conditions that are consistent with the philosophy of organic agriculture (e.g. outdoor access, restrictions on grain feeding, restrictions on anthelmentics, and promotion of high standards in housing). As a leading example of livestock husbandry, the dairy sector can become an identifiable benchmark for milk production systems in all of Canada. The continued evolution of Canadian milk production is necessary to maintain a competitive position with the import of international processed milk products, and pressure to allow imports of fluid milk. This project will increase the profitability and competitiveness of Canadian milk producers by establishing farming system benchmarks for organic and conventional farms in eastern Canada. Scientists will evaluate herd health and welfare and related management practices in addition to milk quality attributes such as fatty acids and CLAs (conjugated linoleic acid).

B.7.8 Project H: Organic food processing

Processing of organic products has been limited by insufficient volume and concern about meeting food safety requirements with current organic protocols and products, in large scale facilities. Both factors are a disincentive for organic facilities or even co-packing lines. Nevertheless, the pull of demand within Canada for Canadian organic products, especially in regions such as Toronto and Vancouver is compelling. The demand for organic meat is

especially pronounced but a formulation from natural ingredients and a protocol are needed to effectively replace or reduce nitrite/nitrate in organic cured meats from the standpoints of sensory quality and safety. By addressing these issues and removing aspects of the food safety barriers the required volume for Canadian organic food processing facilities is expected to meet growing demand.

B.7.9 Project I: Parasite control in sheep

When sheep are raised on pasture they typically become infected with gastro-intestinal nematodes (GIN). Internationally, the sheep industry faces an increasingly severe production-limiting problem with resistance of the major species of GIN to all classes of dewormers. Because of this, sheep production has almost ceased in some regions. Thus, producers on conventional farms must adopt alternative control methods if sheep production is to remain sustainable. Similarly, since the sheep industry has embraced organic production, alternative methods must be adopted in order to prevent severe disease problems due to gastrointestinal parasitism. In order to provide sound advice on alternative control methods, a through understanding of the epidemiology of GIN in Canada is required – unfortunately, no work has been carried out in this area in Canada for over 40 years. This project will improve understanding of factors that affect two major sources of gastrointestinal nematodes (GIN) responsible for parasitic infections in sheep: over-wintering of hypobiotic larvae in adult ewes and the subsequent periparturient egg rise (PPER) which then contaminates spring pasture resulting in infection of naïve lambs; and over-wintering of infective L3 larvae on pasture from contamination from the previous grazing season.

B.7.10Project J: Communication

Organic agriculture is a knowledge-intensive business. Until now, organic farmers and processors have been remarkably successful with relatively low scientific support. However, to meet the increasing demand for Canadian organic products, it will be necessary to grow the sector in unprecedented ways. The original organic pioneers need new recruits. Canadian farmers and processors have a tradition of adopting products and methods developed by scientific investigation. The key is for these practitioners to have timely access to clearly presented, credible information. Furthermore, this information should be available to extension agents and farm magazines to facilitate adoption of research results as quickly as they become available. The results will be systematically presented on the OACC website (www.oacc.info), in bulletins and newspaper articles and directly to participating industry partners. OACC will also assist practitioners to contact researchers as more specific information is required. Many practitioners have donated funds are keenly interested in the results. The feed back of practitioners is also expected to improve and refine the research as it progresses. Commercialization is expected to be the inevitable consequence.

Research conducted in the field is at risk of seasonal failure due to seasonal variation in weather patterns or outbreaks of pests and diseases. By repeating some trials at several sites and in multiple years the risk is mitigated. Furthermore, as is customary, the plot design includes replicates to mitigate the risk of failure in a few plots. The likelihood is very low that there will be failure to the extent that meaningful data analysis is not possible.

Organic farmers have consistently informed OACC researchers that field trials should be conducted on organically managed sites to provide them with reassurance that measures to counteract long term risk and variability of weather and pests are similar to the actual conditions and measures they encounter on organic farms. Organic research sites (e.g. Glenlea in Manitoba, Brookside pasture in Truro, NS) offer these real test conditions and will be crucial to the credibility of OSC research.

There is the potential risk that one or more scientists may not be able to complete their investigations due to illness or other unforeseen circumstances. The OSC network is extensive and it is expected that other colleagues will be able to pick up the part of a specific research activity that may be affected by the withdrawal of one or more scientists.

There is a very low risk that pending industry funds will not be secured for years 2, 3 and 4. However, this amount is less than 12% of all industry contributions. Over 88% of industry contributions were secured in the last 6 months. It is reasonable to expect that the remaining funds will be committed over the next year. It is also possible that some funds committed by letter may not materialize depending on business cycles of specific companies. To mitigate this potential deficit, OACC will continue to fund raise for the duration of the cluster. To date, several companies, not identified in the proposal, are considering a donation to OSC or related initiatives.

The proposed research is not expected to involve risks from the experiments to the environment. If anything, the experiments are expected to show how environmental risk can be minimized while still achieving profitable yields (stability, cost effectiveness, and supply capacity).