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MEASURING IMPACT OF ORGANIC AGRICULTURE RESEARCH: CANADA'S ORGANIC SCIENCE CLUSTER AS A CASE STUDY

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Abstract: Organic research is tailored to advancing the organic sector, by increasing yield and quality, reducing environmental and health impacts, and improving animal welfare. The practices from organic research can also be applied on non-organic operations. Recently, however, there have been critiques of organic research in particular: that results are not applicable for producers. Canada's Organic Science Cluster (OSC) has produced a substantial number of results that are intended to be of use to Canadian producers. A total of 386 new knowledge items were reported from 2009 to March 2019 in OSC. Going forward, assessment of impact of these results will be undertaken. Organic research can also have other types of impact. We present results about the number of highly qualified people (HQP) trained over the past ten years in OSC, as another measure of the impact of organic research.

Introduction: Organic agriculture research has recently been critiqued by Freyer and colleagues, identifying "myths" where the ideals of organic research do not line up with the actual research practices (Freyer et al., 2019). One of the "myths" identified is the applicability of results – that new knowledge and technologies developed are not being implemented by farmers. Significant efforts have been made by researchers and funding agencies into predicting and assessing uptake of agricultural research (e.g., Kuehne et al., 2017). Yet, the value of publicly funded research goes far beyond the economic impact generated by the uptake of the results (Salter and Martin, 2001).

The Organic Science Cluster (OSC) facilitates research that is specifically prioritized and supported by the Canadian organic sector. OSC is part of Agriculture and Agri-food Canada's AgriScience Cluster program and has been running since 2009. Both public and private funding demands that results be useful for producers. The intended impacts of OSC include improving the margins of producers, filling domestic gaps in consumer demand, increasing yields and quality of organic products, improving healthiness and food safety, addressing animal welfare, improving environmental outcomes, and informing policy. As with organic agriculture, the objectives of OSC are multi-faceted, and they align with organic

principles. Evaluating the impact of this research, as a case study, is an important contribution to the conversation on organic research.

Organic farms make up 1.4% of the world's farmland and 2.1% of Canada's farmland (Willer and Lernoud, 2019; Canada Organic Trade Association, 2018). With so much land cultivated conventionally, there is great potential for reduction of environmental impact when practices developed for organic are taken up more broadly. Alongside a review of the uptake of practices by organic stakeholders, consideration needs to be given to the impact for non-organic stakeholders.

The focus of the assessment of research impact remains on the use of new knowledge. However, evidence suggests that publicly funded basic research has numerous benefits, many of which are more substantial than the use of new knowledge (Salter and Martin, 2001). For this reason, it is important to evaluate other outcomes, in this case the contribution of HQP trained in organic agriculture, as they move forward in their careers.

Keeping track of HQP is another way to measure the impact of research programs. These students are educated in the techniques and principles of organic agriculture, and will likely to carry those influences with them into their careers. Skilled graduates lend their problem-solving abilities, innovative approaches, and education to their workplaces and communities.

The objective of this work is to summarize the results of OSC since the beginning of the program and evaluate how to assess OSC's impact.

Material and methods: There are 92 projects over 10 years of OSC, 27 of which are ongoing from 2018-2023. The projects span many disciplines and subjects within horticulture, field crops and livestock (Organic Agriculture Centre of Canada, 2019).

Performance metrics collected over ten years of organic research in OSC were collated. Results that could be taken up by producers were reported as new knowledge items. New knowledge included intellectual property (IP), new variety developed, products, processes, practices. As a metric representing the wider reach of the organic research, the number of HQP trained was also collected. In OSC, HQP were considered to be graduate students (M.Sc. or PhD). Undergraduate students and postdoctoral fellows can also be considered as HQP trained. However, this data was not collected consistently since the beginning of OSC, so it was not included.

Results: A total of 386 new knowledge items were reported from 2009 to March 2019 in OSC. There were 80 M.Sc. and PhD students trained within OSC's research projects, over the same time period.

Table 1. Results from 92 research projects over ten years of Canada's Organic Science Cluster program were reported in the form of new knowledge items and highly qualified people (HQP)

Type result	Number of new knowledge items and HQP reported 2009-2019
HQP	80

Intellectual property	8
Crop variety	3
Product	54
Process	53
Practice	101
Other knowledge	167

Discussion: OSC has generated many results that can be implemented by producers and others. With a database of new knowledge from ten years of organic research in Canada, it is now important to continue assessing the application of the work.

However, the impact of HQP training in organic science merits further exploration. Scientists working in organic agriculture are trained to think in terms of ecological systems as opposed to isolated disciplines. How this training influences career development and subsequent influence of organically trained HQP on agriculture needs to be better understood.

An improved understanding of OSC impact will guide future research prioritization, influence policy and future research contributions, and identify opportunities to improve the impact of the research. With a comprehensive list of results coming out of a defined organic research program, lessons learned from OSC can be applicable for researchers and policy makers globally.

Going forward, Canadian data will be placed in context of other models and findings from organic research occurring globally. We also propose to develop a simple tool for assessing uptake of the knowledge from OSC. The tool will be administered at presentations, conferences, and trade shows, as this is where researchers interface with producers.

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