Ecological Farmers
Association of Ontario

Towards farmer-led research: A guidebook

JULY 2018



Preface

WHAT IS IN THIS GUIDEBOOK?

This guidebook aims to provide insights for working collaboratively with farmers in research. We identified and synthesized the literature on farmer-led research and farmer participatory research activities from around the world, with a focus on the North American context. Further, we shared our experiences and lessons learned from the first three years of Ecological Farmers Association of Ontario's Farmer-led Research Program. This resource is meant to be used as a practical tool for researchers and practitioners looking to develop, implement, and evaluate farmer-led research programs.

WHAT IS FARMER-LED RESEARCH AND WHY DOES IT MATTER?

Farmer-led research, which is also sometimes called farmer participatory research, is an approach that empowers farmers to collect data for their own farms while collaborating with scientists. In general, farmers and scientists work together – from the design of the project all the way to data analysis – to meet the diverse needs of different farmers. Farmer-led research often leads to action and innovation, builds local capacity, and supports livelihoods including productivity, nutrition, and household income.

WHERE IS FARMER-LED RESEARCH HAPPENING?

Although mainly found in the Global South, several organizations and programs that support farmer-led research are found in the Global North. Some examples include the Practical Farmers of Iowa (PFI; United States), the Innovative Farmers (United Kingdom), the Sustainable Agriculture Research and Education (SARE; United States), Bauta Family Initiative on Canadian Seed Security, and the Ecological Farmers Association of Ontario (EFAO; Canada). As an example, this guide focuses primarily on EFAO's Farmer-led Research Program.

EFAO's Program puts the focus on being farmer-driven, from the creation of research questions and project design to data collection and dissemination of results. A cycle of the FLR Program begins with project design and planning in late fall and winter. The trials typically run during the growing season (May - October). Project findings are presented at the organization's annual workshop at the end of the year and online in the EFAO's Research Library.

Lessons learned from the first three years of EFAO's Farmer-led Research Program include:

- **Program support**, including scientific support and support for the farmer-researchers to connect with each other, is critical to farmer engagement with research.
- Farmers are inherently curious but research is new to most of them. Farmer-led research programs, therefore, take time to build such that **multi-year grants are essential** to building capacity and farmer involvement.
- A mechanism for **adaptive management** is needed to meet the dynamic needs of farmer-researchers (e.g. workshopping and implementing a Utilization-Focused Evaluation Progress).
- Focus on **farmer-led**! This includes farmer-led research priorities, project selection, project design and execution, and dissemination of results.
- A **model/mentor program** is an invaluable resource for advice and support.

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About Ecological Farmers Association of Ontario

Ecological Farmers Association of Ontario (EFAO) is an educational non-profit organization committed to farmer-to-farmer knowledge sharing around ecological and organic farming. Established in 1979, EFAO is focused on farmer-to-farmer training and support to help each other make a better living growing real food while improving our soils, crops, livestock, and the environment.

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BACKGROUND

The development of this guidebook was led by Ecological Farmers Association of Ontario (EFAO) in collaboration with University of Guelph. Our purpose is to provide pragmatic recommendations for working collaboratively with farmers in research. To do this, we reviewed both peer-reviewed and grey literature on the topic of Farmer-led Research (FLR). A combination of search terms was used including farmer participatory research, community-based participatory research, and farmer-led research. Note that this guidebook does not claim to provide a comprehensive or systematic review of the whole literature on FLR programs. Instead, this resource aims to map out the literature on FLR to shed light on the processes and outcomes of FLR itself.

We present the results by first defining what exactly is farmer-led research and why it is important. Then, we end with examples of FLR in North America and the United Kingdom, and experiences from EFAO's farmer-led research program. This resource is meant to be used as a practical tool for researchers and practitioners looking to develop, implement, and evaluate farmer-led research programs.

WHAT IS FARMER-LED RESEARCH?

Farmer-led research (FLR), sometimes called farmer participatory research, is an approach that empowers farmers to collect data for their own farms while collaborating with scientists. In general, farmers and scientists work together from the design of the project all the way to data analysis to meet the diverse needs of different farmers. Having farmers at the forefront of a research collaboration – the farmer setting the research question, designing the research, and interpreting the data – is a less common approach to research and development. Since farmers are also land managers, this approach has huge untapped potential as an efficient mechanism for innovation in agriculture.

WHAT ARE THE BENEFITS OF FARMER-LED RESEARCH?

There are three main benefits of farmer-led research. FLR leads to **action and innovation**, it builds **local capacity,** and it leads to **positive livelihood impacts** regarding things like productivity, nutrition, and household income.

FLR leads to on-the-ground action and innovation by supporting peer-to-peer learning and knowledge transfer among farmers. Programs around the world show that FLR leads to the emergence of locally appropriate technical innovations; having farmers at the centre of research changes the focus of the research to one that is more valuable to the farmer and, by extension, more sustainable and innovative. Indeed, farmers have been central to the development of modern agriculture and continue "to play a vital role in the development of key practices and systems such as minimum tillage" (MacMillan, 2018).

Even more, FLR builds local capacity. Knowledge transfer is built into the practice, as farmers collaborate with each other and academics, leading to a mutually beneficial practice that bolsters local capacity to innovate. FLR "can have profound, self-reinforcing and long-lasting impacts - that conventional impact evaluation does not pick up" (Waters-Bayer, 2015 et al., 6).

A third benefit of FLR pertains to impacts on livelihood, which can be broad and substantial. Across the world, farmer participatory research is playing a key role in supporting sustainable development. For example, community-based participatory research supported: i) management of invasive pests in the Ecuadorian Andes (Dangles et al., 2010); ii) soil conservation in Southeast Asian Cassava systems (Dalton, Lilja, Johnson, & Howeler, 2011); and iii) soil fertility and water management technologies in Southern Africa (Rusike, Twomlow, Freeman, & Heinrich, 2006). Community benefits from FLR in the Global South relate to yields, nutrition, and household income. FLR supported greater food and nutrition security by way of greater and more dependable food yields when compared to other practices (Waters-Bayer, 2015 et al., 6). In ecological farming, FLR also has led to higher household incomes than non-FLR methods, increased diversity of crops, greater resiliency, and decreased use of chemicals (Waters-Bayer et al., 6).

Examples of farmer-led research programs

Examples of organizations helping to foster FLR include Practical Farmers of Iowa (PFI) in the United States, Innovative Farmers in the United Kingdom, and the Bauta Family Initiative on Canadian Seed Security in Canada. There is also a funding program in the United States called Sustainable Agriculture Research and Education (SARE) that provides funding for farmers to conduct research on their own farms. These four organizations will be discussed in detail in this section to provide a few examples of current FLR programs. Furthermore, agricultural non-profit organizations like EFAO and PFI also focus on farmer-to-farmer knowledge generation and sharing. Through this approach, member-farmers are connected to the environment and each other.

PRACTICAL FARMERS OF IOWA – UNITED STATES

www.practicalfarmers.org

BACKGROUND

Practical Farmers of Iowa (PFI) is a farmer-led non-profit organization founded in 1985 in Iowa, United States. Its FLR program, known as the Cooperators' Program, began in 1987. PFI provides full support for member-farmers to conduct research trials on their farms. PFI helps farmers design, analyze, and publish their research results. PFI helps collect data and provides funding to cover research trial costs and stipends for the farmers' time.

In addition to this support, PFI also runs webinars on various topics, called "Farminars", and runs an annual conference, the Cooperators' Meeting. At the Cooperators' Meeting, farmers participating in research trials can learn, connect with other farmers, and start planning for the following year's trials. Farmers sometimes have the opportunity to work with partnering university researchers, but it is not required for every trial. PFI's Board of Directors is required to have farmers acting as 10 of the 12 board members ("Practical Farmers of Iowa," 2018).

FUNDING STRUCTURE

To fund the Cooperators' Program, PFI uses mainly government grants and grants from foundations. The staff at PFI apply for state and federal grants that are applicable to the farmer-led research program. Additionally, PFI is sometimes approached by foundations that would like to fund specific environmental/ecological projects and this money can be used to fund farmer-led research projects that fit the funding criteria. Members of PFI also pay membership fees. Every farmer that completes a research trial as part of the Cooperators' Program is paid $550USD in compensation (S. Gailans, personal communication, March 23, 2018).

IMPACTS TO DATE

To date, more than 220 farmers have conducted 1300 research trials in cooperation with PFI ("Practical Farmers of Iowa," 2018).

Since PFI and the Cooperator's Program are very well established, members and staff have been involved in many research studies in Iowa related to local food initiatives, farmer education, and environmental impacts of farming (Carolan, 2006; Gamon, Harrold, & Creswell, 1994; Hinrichs, 2003; Petrzelka, Korsching, & Malia, 1996; Pretty & Ward, 2001).

In terms of the greater environmental impact of farmers involved with PFI, one study found that "members of Practical Farmers of Iowa perform better than non-members in the same region; but those organized into groups within PFI outperform individual members even more; yields are roughly the same, but group members use 52% less nitrogen and 65% fewer pesticides" (Pretty & Ward, 2001). An evaluation that looked at the impact of PFI-run field days suggested that "by embedding knowledge in place, through making such knowledge intimate and tactile, PFI field days were able to foster locally embedded relationships of knowledge and trust" (Carolan, 2006). It is important to note that these studies were conducted with all PFI members, not necessarily just members involved with the Cooperators' Program. According to PFI's 2017 member survey (soon to be published in their 2017 annual report), 73% of PFI members reported that they use cover crops on their farms (S. Gailans, personal communication, March 23, 2018).

INNOVATIVE FARMERS – UNITED KINGDOM

www.innovativefarmers.org

BACKGROUND

Innovative Farmers is a non-profit organization founded in 2015 in the United Kingdom. The organization's goal is to build capacity for farmers to conduct research on their farms. The motivation for the organization stems from the idea that the "best ideas in farming come from farmers" (Soil Association, 2015).

Innovative Farmers is the restructured and improved model of a pilot project that started in 2012. It is operated in collaboration with the following organizations: Linking Environment and Farming (LEAF), Innovation for Agriculture, the Organic Research Centre, and the Soil Association (Soil Association, 2015).

The basis of Innovative Farmers is the concept of "farmer field labs". Farmer field labs are defined "as farmer-led meetings, open to all (both organic and non-organic), where producers examine innovative approaches, share existing best practice, learn how to run effective producer-led trials, and identify real gaps where academic research would make a crucial difference" (Reed, Ingram, Mills, & MacMillan, 2016). For the FLR process of Innovative Farmers, farmers work together to come up with a research idea that they are interested in pursuing and are connected to a researcher who helps design the research trials and analyzes the findings. Although the ideas are farmer-led, the research itself is not conducted solely by the farmers. The Innovative Farmers Steering Committee is made up of professors from universities, agricultural companies, and representatives from other farming organizations (Soil Association, 2015).

FUNDING STRUCTURE

Innovative Farmers is part of the Duchy Future Farming Programme which is funded by the Prince of Wales's Charitable Foundation. There are no membership fees to join the organization, but farmers must pay to run a trial unless there is a sponsor willing to fund the project. Farmers must pay for planning or organizational support for the research project from Innovative Farmers unless their research project fits into one of the sponsor's areas of interest, in which case the cost of running the research is free (Soil Association, 2015). Farmers can pursue any topic of farm research they are interested in; however, this system potentially limits the research topics that farmers are financially able to pursue.

IMPACTS TO DATE

An evaluation of the previous pilot project that led to Innovative Farmers was presented at the International Farming System Association Conference in 2016. The evaluation looked at the types of learning that occurred at the field labs and concluded that single loop learning (improved knowledge retention of concepts) was occurring but double loop learning (understanding the underlying principles) was most prominent (Reed, Ingram, Mills, & MacMillan, 2016). Including the pilot phase of the project that started in 2012, over 1000 farmers have participated in field labs on a range of topics (MacMillan, 2018). An evaluation is being conducted on the new program, Innovative Farmers, by the Countryside and Community Research Institute which will run until 2019 (Countryside and Community Research Institute, 2018).

SUSTAINABLE AGRICULTURE RESEARCH AND EDUCATION (SARE) PROGRAM – UNITED STATES

www.sare.org

BACKGROUND

The Sustainable Agriculture Research and Education (SARE) program is a government-run program in the United States. It began in 1985 and was authorized through the Food Security Act. Its purpose is to help support "sustainable agriculture research." Initially, it focused mainly on university researchers, but it began to offer research grants to farmers and ranchers in 1992 (Kroma & Flora, 2001).

SARE provides funding for farmers to conduct on-farm research, but it does not provide much support in terms of research design, execution, and analysis. Farmers are required to submit progress and final reports to SARE for their projects if they receive funding (United States Department of Agriculture, 2012).

FUNDING STRUCTURE

SARE is funded by the United States government. The funding is managed in four geographical regions including Western, North Central, Northeast and Southern US. To receive funding, farmers must submit a proposal to their respective SARE region. The funding is distributed based on the alignment of the research proposals with SARE's goals.

IMPACTS TO DATE

From 1992- 2009 the North Central Region of SARE awarded 700 farmer research grants (Yaeger, 2009); from 1994-2012, the Southern Region of SARE awarded 294 farmer-rancher grants, totaling more than $2.4 million (Sustainable Agriculture Research and Education, 2012).

THE BAUTA FAMILY INITIATIVE ON CANADIAN SEED SECURITY

seedsecurity.ca

BACKGROUND

The Bauta Family Initiative on Canadian Seed Security (BFICSS) is a program delivered by USC Canada working to build resilient seed systems in Canada since 2013. The project is delivered in partnership with national and regional food and farming partners across the country, with the support of The W. Garfield Weston Foundation. Through developing a series of regional, national, and international networks of farmers, seed producers, researchers, civil society, government, and the private sector, the BFICSS focuses on improving the quantity, quality, and diversity of seed in Canada.

FUNDING STRUCTURE

USC Canada receives core funding for the BFICSS from a 7-year grant from the W. Garfield Weston Foundation. These funds are delivered across a network of organizations to implement the project: FarmFolk CityFolk in B.C., Organic Alberta in the Prairies, EFAO and Seeds of Diversity Canada in Ontario, USC Canada in Quebec, and the Atlantic Canadian Organic Regional Network in Atlantic Canada. Primary funding for the BFICSS research programs is provided by Agriculture and Agri-Food Canada through the Organic Science Cluster, and delivered in partnership with the University of Manitoba and the University of British Columbia. Additional revenue for all organizations are generated through admission fees from training events.

IMPACTS TO DATE

- Expanded Seeds of Diversity Canada's public seed collection from 1471 unique seed varieties in 2013 to 5169 in 2017.
- Supported over 100+ vegetable farmers and seed producers to adapt and improve 400+ varieties of vegetable seeds on their farms from 2013-2018.
- Worked with over 80 farmers to develop 160 new lines of wheat and oats and 100 new lines of potatoes.

Ecological Farmers Association of Ontario

BACKGROUND

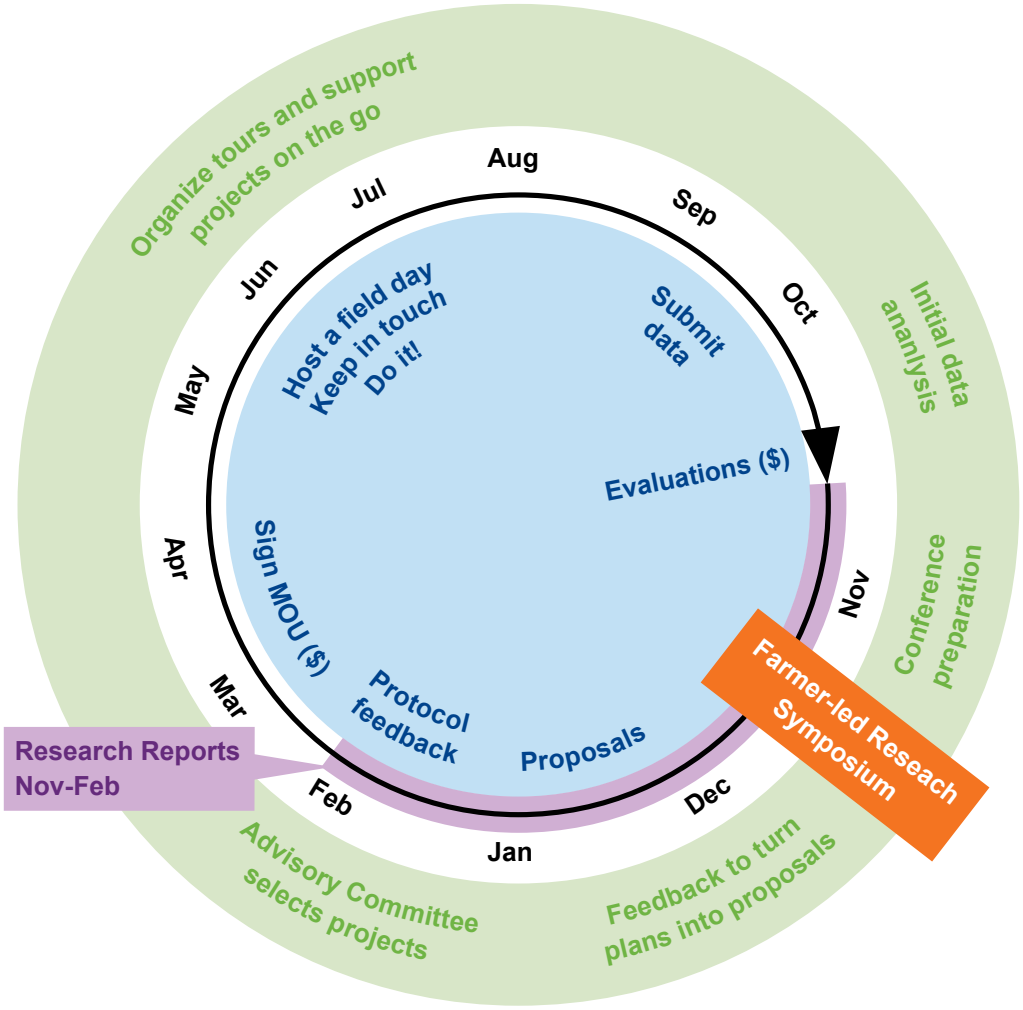
Ecological Farmers Association of Ontario (EFAO) has been committed to ecological and organic farming since 1979. EFAO is run by farmers, for farmers, to support each other to make a better living growing food while improving soils, crops, livestock, and the environment. EFAO's mission is to support and promote a vibrant community of ecological farmers through education, training, and knowledge sharing.

The program started in 2016. The program supports member-farmers in Ontario to develop and conduct research projects that generate evidence-based information about their farming practices. EFAO's Program is modelled off of PFI's Cooperators' Program (above), where farmers design and propose research trials, receive diverse training, conduct the trial, and are helped in disseminating their results.

EFAO's Program focus is farmer-led, from the creation of research questions, to project design, to in-season adaptation, and results dissemination. In this way, EFAO's FLR Program serves as a conduit, helping with training and technical aspects at each step of the way. As a program within the EFAO, member-farmers are motivated to improve the ecological impacts from their farms, and this self-led research within an organization with larger member support enables farmer-researchers to share their results with the membership and beyond.

A cycle of the FLR Program begins with project design and planning in late fall and winter. The trials typically run during the summer, and the results are analyzed the following fall. The findings of these projects are presented at the organization's annual workshop at the end of the year and are also posted online in EFAO's Research Library (efao.ca/research-library).

ANNUAL CYCLE OF FARMER-LED RESEARCH



Farmers!

$500 given to farmers in two installments. Research expense receipts are submitted as incurred.

EFAO Staff

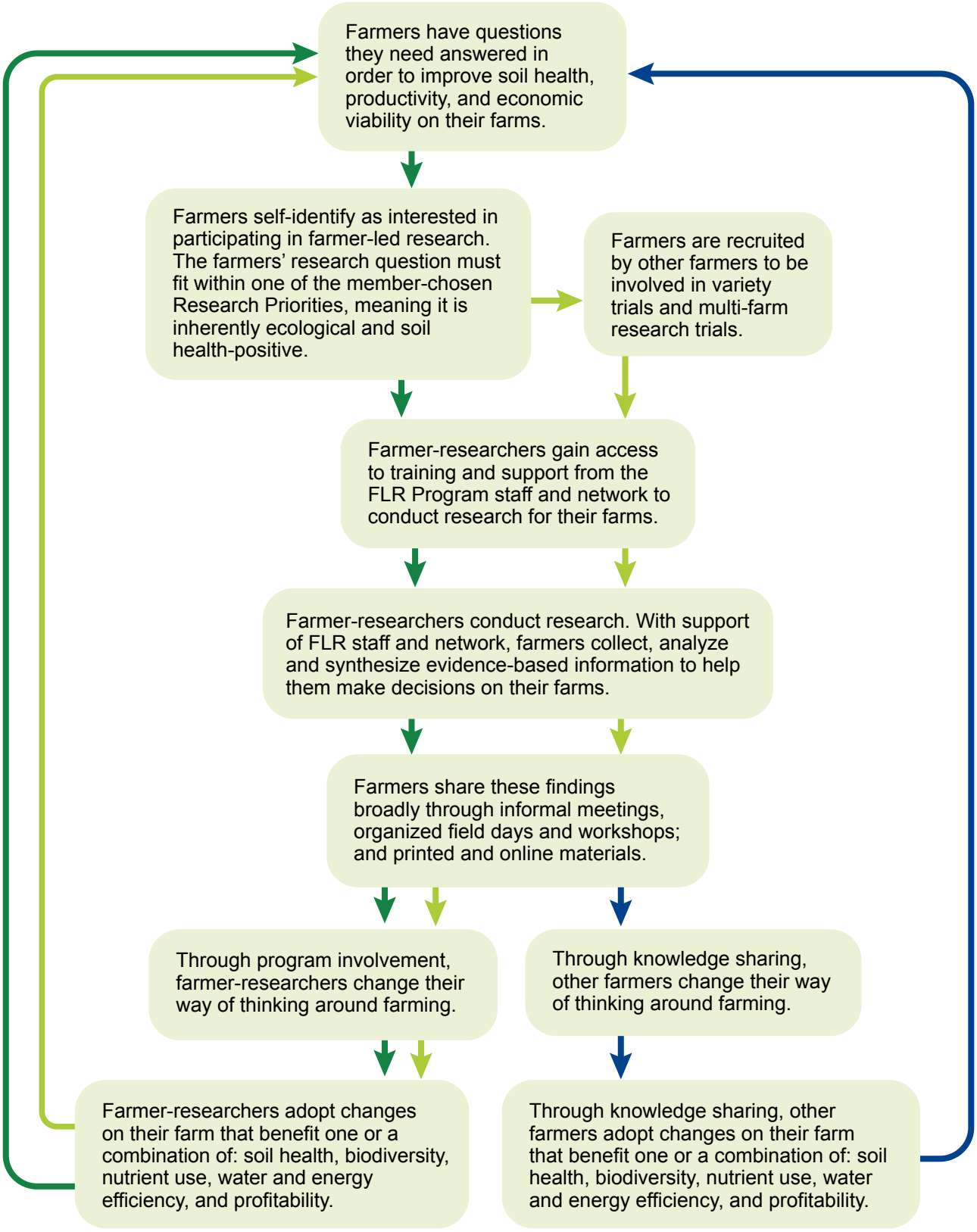
Ongoing staff activities:

- Farmer training
- Quarterly e-news
- Experimental support

Figure 1. An annual cycle of EFAO's FLR begins in the fall. In November, the previous season's research reports are presented at the Farmer-led Research Symposium.

IMPACTS TO DATE

The first cycle of the program was implemented in 2016 with 11 member-farmers and 14 trials. In 2017, there were 13 member-farmers and 14 trials; and in 2018 there are more than 20 member-farmers conducting at least as many trials. All projects fit within at least one of the member-chosen Research Priorities, which include alternative livestock feed, cover crops, disease and pest control, livestock breed selection, nutritional quality of ecologically-raised foods, pasture regeneration, pollinator services, seed production and breeding, soil health, and weed control. Specific trials include testing the reproducibility of different soil health indicators on ecological farms, cover crops for vegetable and small grain production, breed comparison and probiotics for pasture-raised chicken, organic pest management, interplanting in vegetable production, companion planting in orchards, mulches for organic garlic production, local seed production, locally adapted vegetable varieties, and pasture management (see Outcomes). EFAO's FLR Program is a relatively young program within an experienced association, and it has made substantial accomplishments in its first two years and plans to expand its reach.



EFAO's Theory of Change is supported by a *scaling-out* approach, whereby innovation in farming originates from, and is shared between and among farmers, communities, and other stakeholder groups. This kit is to inform other groups that want to institute FLR programs and projects. Stakeholders include the farmers doing the research (farmer-researchers) as well as funders and farmers not involved directly in the research but standing to benefit from more ecological methods of farming.

PROGRAM STRUCTURE

PEOPLE

Board of Directors, all EFAO members, volunteer

Executive Director, reports to the Board, staff

Director of Research, reports to the Executive Director, staff

Eastern Ontario Research Assistant, reports to the Director of Research, staff

Advisory Panel, EFAO members, volunteer
This program is supported by an advisory panel, which includes at least 2/3 EFAO member-farmers as well as university and non-profit partners.

FUNDING STRUCTURE

As a non-profit organization, EFAO's FLR programming is dependent on short-term financial support from government funding programs and private foundations. To launch the program in 2016, EFAO received a Seed Grant from the Ontario Trillium Foundation for $75,000. The organization continues to grow the program through 2019 with a Grow Grant from the Ontario Trillium Foundation ($281,680) and a Seeding Food Innovations Grant from George Weston Limited and Loblaw Companies Limited ($83,030).

PROPOSAL SUBMISSION

Farmers are asked to describe their potential project in an online submission form that includes straightforward questions about their motivation, treatment(s) of interest, business-as-usual (i.e. control), measurements of interest, space available, potential challenges, other considerations, and the Research Priority that best fits their project. This information is used by the Advisory Panel in initial project evaluations and discussions. The bulk of projects are chosen early in the calendar year but funding is available year-round, as appropriate.

PROJECT SELECTION

Research projects must fit within at least one of the member-chosen Research Priorities, which include:

- Alternative livestock feed
- Cover crops
- Disease and pest control
- Livestock breed selection
- Nutritional quality of ecologically-raised foods
- Pasture regeneration
- Pollinator services
- Seed production and breeding
- Soil health
- Weed control

Project controls are "business-as-usual" for each specific farm and, therefore, can include conventional practices, but the treatment regimes must be ecological (i.e. no synthetic pesticides, herbicides; minimize or no-till).

As an overarching criterion, design for the research trials must be rigorous (i.e. randomized and replicated). In 2018, however, the Advisory Panel agreed to also fund a much smaller number of demonstration sites (i.e. un-replicated sites, as proof-of-concept), which are mostly considered for trials involving insects (i.e. pollinator strips, beneficial insects for pest management). Research trials involving insects often require designs that are beyond the current capacity of EFAO's Program, including replicate paired farms with large minimum distances between pairs.

The Advisory Panel meets early in the calendar year (January/February) to select the majority of research projects that will receive funding for the year. Since projects are proposed year-round, proposal selection is also done on an ad-hoc basis throughout the year.

Proposed projects are discussed and voted on as a group. In 2018, each panel member was the Primary Panelist for 1-3 projects, to which they paid detailed attention when reviewing proposals prior to the meeting and were responsible for beginning the group discussion. When necessary, proposals are returned to applicants with special conditions for approval.

TRAINING PROGRAMS

A diversity of training is provided by the EFAO, including how to formulate a research question, how to design a research protocol, training in statistics and data interpretation, and how to communicate and "tell your story" to others. EFAO organizes field tours of research sites, which are open to the public (efao.ca/upcoming-events). Training comes in different forms, including in-person workshops, meetings, video and teleconference meetings, and webinars.

PROTOCOL DEVELOPMENT

Project design begins with project selection in January and research plans and protocols are finalized by May, at which point the farmer-researcher agrees to a Memorandum of Understanding and receives 1/2 their farmer-stipend. Research trials aim for a minimum of 4 replicates and receive $500 per year. Variety trials use a "mother-baby" approach, with one mother site that includes all varieties (and a check), at least 3 replicates and receives $500 per year; and at least 2 baby - or satellite - sites that include some varieties (and a check), 3 replicates and receive $250 per year. Experts are consulted at this stage, including scientists and academics associated with universities and other agricultural non-profits in Canada and the US.

Figure 2. Greta Kryger (right), a farmer-researcher on the Southern Ontario Pepper Breeding Project, describes fruit selection to a participant at a field day hosted by Rebecca Ivanoff in 2017 another farmer-researcher participating in the breeding project.

IN-SEASON SUPPORT

In-season farm visits, video conferences, and teleconferences are conducted to check up on the progress of each project, address any concerns, and ensure that projects are running according to the protocol outlined by the farmer. Farmer-researchers receive a "Farmer-Researcher with EFAO" laneway sign, which advertises the program, instills pride in their research work, and acknowledges funders. In multi-farm research trials, farmers are encouraged to connect and communicate with each other during the season.

EFAO field tours give farmers the opportunity to show other farmers first-hand what they are researching on their farm. These events are open to the public and press.

Each growing season culminates with the FLR Symposium & Workshop, which precedes the annual Ecological Farmers of Ontario Conference (http://conference.efao.ca). To faciliate cross-network knowledge sharing, EFAO also invites a farmer-researcher from Practical Farmers of Iowa to join the Symposium and share their experiences with farmer-led research.

Finally, the FLR Symposium & Workshop offers a space for farmer-researchers to provide feedback to help the Program adapt and improve to better meet their needs and program outcomes. For example, feedback from the 2017 Symposium & Workshop called for an emphasis on multi-farm and multi-year trials, as a way to add built-in support for farmers and rigour to their data.

DATA ANALYSIS AND INTERPRETATION (RESEARCH REPORTS)

At the end of the trial season, farmers are supported in the consolidation and analysis of their research data. The FLR Program helps ensure that proper interpretation of results (i.e. statistical relevance and practical significance) is consistent, and helps farmers write and publish reports.

RESULT DISSEMINATION

Research posters are developed as a clear and concise presentation of each project's research methods and findings. They are designed using a common template. Farmer-researchers present their posters at the FLR Symposium & Workshop.

The research protocols and reports are accessible to the public through EFAO's online Research Library (https://efao.ca/research-library/). Also, EFAO has a bi-monthly print newsletter and a blog (https://efao.ca/blog/), where they publish research findings. They are in the process of creating short educational promotional videos.

NETWORK OF FARMER RESEARCHERS

Over the last 3 years, an energetic, committed and diverse network of EFAO farmer-researchers has emerged. This network was created through the in-person knowledge sharing at workshops, field days, and multi-farm research trials. This type of focused farmer-to-farmer network has shown a variety of benefits, including motivation and inspiration for fellow farmer-researchers, camaraderie, and technical support.

Lessons Learned

Lessons learned from the first three years of EFAO's Farmer-led Research Program include:

- **Program support**, including scientific support and support for the farmer-researchers to connect with each other, is critical to farmer engagement with research.
- Farmers are inherently curious but research is new to most of them. Farmer-led research programs, therefore, take time to build such that **multi-year grants are essential** to building capacity and farmer involvement.
- A mechanism for **adaptive management** is needed to meet the dynamic needs of farmer-researchers (e.g. workshopping and implementing a Utilization-Focused Evaluation Progress).
- Focus on farmer-led! This includes **farmer-led** research priorities, project selection, project design and execution, and dissemination of results.
- A **model/mentor program** is an invaluable resource for advice and support.

As an example, the following section details three main points that came out of a workshop exercise. Led by trained facilitator Dr. Ricardo Ramirez, farmer-researchers were asked to list up to three things they "want to keep", "want to discontinue", "want to consider adding". The outcome of this simple, anonymous group exercise provided concrete feedback for Program staff for how to improve in a "farmer-led" framework.

MULTI-YEAR TRIALS

Farmers more than any other profession understand that each year is unique in its own way. Weather and many other unknowns (e.g. neighbour's practice) often provide unexpected challenges to the farmer and farmer-led research. For this reason, farmer-researchers called for more multi-year trials, because including multiple growing seasons increases the applicability of the data.

SUPPORT FROM PROGRAM STAFF

Farmer-researchers expressed their appreciation for FLR Program staff and emphasized the importance of a dedicated, timely and supportive staff to make their research a reality – from training, protocol design and statistical analysis to field visits, emails, and workshops. Having a committed program staff is integral to the success of future farmer-led research programs.

MULTI-FARM TRIALS

For similar reasons to wanting multi-year trials, farmer-researchers expressed their need for more multi-farm trials. Like multi-year trials, multiple farms researching the same question increases the applicability of data and scope of the findings, especially for a province as geographically diverse as Ontario. In addition, multi-farm trials hold farmers socially accountable, knowing that other farmers depend on them to finish their project to the best of their ability and deliver data on time. It also gives farmer researchers a support group to discuss their successes, challenges, innovations, and to empathize with throughout the season.

IMPLEMENTED FARMER-LED RESEARCH PROJECTS

ALTERNATIVE LIVESTOCK FEED

PROBIOTICS FOR PASTURE-RAISED CHICKEN
Justin Hilborn, 2017
Do poultry probiotics affect weight gain or health of pasture-raised chickens?

COVER CROPS, SOIL HEALTH, & WEED CONTROL

SPRING PLANTED WHITE CLOVER IN GARLIC
Heather Coffey, 2017
Does a spring planted white clover cover crop lead to better garlic yields than standard bare soil beds?

FALL PLANTED OATS IN GARLIC
Eric Barnhorst, 2017-2018
Does a fall planted cover crop lead to better garlic yields than standard bare soil beds?

QUICK TURNAROUND COVER CROPS BEFORE LATE SEASON BRASSICAS
Kevin Hamilton, Angie Koch, Ken Laing, Mike Reid and Ryan Thiessen, 2016

LIVING & DRY SPRING MULCHES IN GARLIC: CULTIVATION, WINTER WHEAT, HAY
Ken Laing, 2017
Is there a difference in labour and/or yield between garlic that is cultivated or mulched?

DISEASE AND PEST CONTROL

FOLIAR SPRAYS FOR CUT FLOWER PRODUCTION
Jessica Gale, 2017
Does nutrient spray improve length of Sweet Pea? (Appendix A)

EFFICACY OF FOLIAR SPRAY FOR ORGANIC VEGETABLES
Angie Koch, 2016
Do nutrient foliar sprays improve organic vegetable production?

EFFICACY OF FOLIAR SPRAYS FOR CUCURBITS
Angie Koch, 2017
Do nutrient foliar sprays improve plant health and production of summer squash and cucumbers?

LIVESTOCK BREED SELECTION

PASTURE-RAISED CHICKEN COMPARISON
Jason Hayes and Drake Larsen, 2016
Is the Nova Free Ranger meat chicken better on pasture than the industrial White Rock – Cornish Cross?

PASTURE REGENERATION & SOIL HEALTH

AMENDMENTS FOR PASTURE REGENERATION
Tony McQuail, 2017
Do micronutrient amendments improve pasture growth of rotationally grazed pastures?

SEED PRODUCTION AND BREEDING

SOUTHERN ONTARIO PEPPER BREEDING PROJECT
Rebecca Ivanhoff, Greta Kryger, Annie Richard, Kathy Rothermel, 2017
Goal: Early ripening, blocky red and yellow bell peppers with good flavour for organic field production. (Appendix B)

CABBAGE SEED PRODUCTION
Rebecca Ivanoff
and Nicola Inglefield, 2017
How do two methods of cabbage seed production compare with respect to seed quality, quantity, and marketable cabbage? (Appendix C)

SOIL HEALTH

BIOLOGICAL SOIL HEALTH TESTS: ARE THEY WORTH IT?,
Paul DeJong, Ken Laing and Tony McQuail, 2016
What is the practicality and usefulness of new soil tests?

WEED CONTROL

A "COMFREY" COMPANION FOR SASKATOON?
Pat Kozowyk, 2017
Does comfrey promote Saskatoon bush health and fruit production?

INTERPLANTING ONIONS AND BRASSICAS
Ryan Thiessen, 2017
Is onion growth affected by intercropped brassicas?

Conclusion

The benefits of Farmer-led Research are apparent. FLR leads to action and innovation, builds local capacity and leads to positive livelihood impacts in areas such as productivity, nutrition, and household income. This guidebook summarizes Ecological Farmers Association of Ontario (EFAO) process for developing a farmer-led research program. Program structure, lessons learned, and outcomes are explained. The lessons learned from EFAO's process so far are most valuable to organizations who might be interested in starting a FLR program. Find a mentor to help you build your FLR program, foster the inherent curiosity of farmers, make the process farmer-led from start to finish, and continuously obtain and act on feedback provided about your program.

APPENDIX A

Research Report: HORTICULTURE 2017
Foliar Sprays for Cut Flower Production

Ecological Farmers Association of Ontario

FARMER-RESEARCHER

Jessica Gale, Sweet Gale Gardens - West Region

WHY IT MATTERS

Ecological cut flower growers are more limited in the their options for managing pests and disease pressure. There is anecdotal and observational information around the use of organic foliar sprays, but quantitative data is lacking. **To generate robust data for herself and other growers, Jessica tested the efficacy of a nutrient foliar spray and an anti-fungal spray on two flower varieties.**

RESEARCH QUESTIONS

Does nutrient spray improve length of Sweet Pea? Does anti-fungal spray improve survivability of Lisianthus?

METHODS

Sweet Pea

Spray: Seaweed liquid fertilizer, $75.89

Spray rate: 3 oz / 3 gal in spray pack.

Schedule: Weekly, 7 weeks, Jun 12-Jul 26

Measurements: On two dates, Jessica collected 3 stems at random per section, from the middle of each section to avoid drift. She measured the length of each stem as an indicator of marketability.

	Bed 1	Bed 2	Bed 3	Bed 4	
Block 1	1	5	9	13	Block 3
	2	6	10	14	
	3	7	11	15	
Block 2	4	8	12	16	Block 4

Figure 1 A) *Layout with 4 replicate blocks and* ***B)*** *photo of the Sweet Pea trial, with 12 stems/bed. Pink = Spray; Grey = no spray control.*

Lisianthus

Spray: Chamomile, $197.75

Spray rate: 32 oz / pack

Schedule: Weekly for 7 weeks from June 30 to August 14, with one week skipped.

Measurements: Six times between Jul 11-Oct 4, Jessica removed and counted stems affected by fungal disease.

	Bed 1	Bed 2	
Pair 1	6	7	
Pair 2	5	8	
Pair 3	4	9	100' bed
Pair 4	3	10	
Pair 5	2	11	
Pair 6	1	12	

Figure 2A) *Layout of the Lisianthus trial in 6 replicate pairs and 1200 stems/bed. Purple = Spray; Grey = no spray control.*

RESULTS

Sweet Pea

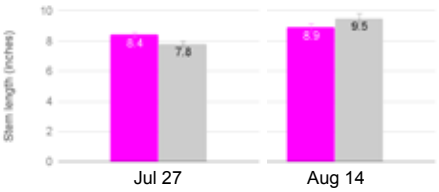


Figure 4. *Average stem length for Sweet Peas. Pink = Spray; Grey = no spray control.*

- July 27: **Sweet Pea stem length was longer in the spray sections** and we are confident this was due to the spray (P=0.02).
- August 14: Average stem length of the control plants was also longer but we do have evidence this was an effect of the spray (P=0.12).

Lisianthus

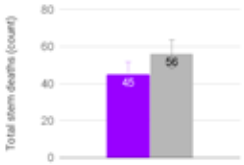


Figure 5. *Cumulative Lisianthus mortality from fungal disease. Purple = Spray; Grey = no spray control.*

- At each date separately (not shown), as well as cumulatively throughout the season (Fig 5), we were **unable to detect a spray effect on Lisianthus death from wilt** (P=0.63).
- Overall mortality from fungal disease was low (2-19 stems per section).

TAKE HOME MESSAGES

Sweet Pea

- The efficacy of the nutrient foliar spray varied and resulted in longer stems at peak growth in July, but not August.
- Different nutrient foliar sprays are made for specific developmental stages. Jessica's results suggests the liquid seaweed spray helped Sweet Peas during early stages of development (flowering).
- The boost in stem length in July from the spray was ~1.5 cm. Jessica isn't sure whether this difference is worth the cost of the spray. She wants to replicate the trial to see if this difference increases with better growing conditions (i.e. less wet!)

Sweet Pea stem measurement

Lisianthus

- Lisianthus disease pressure from fungal pathogens was unaffected by the spray.
- The wet, cooler season was a perfect storm for fungal disease.
- Jessica is interested to try the efficacy of anti-fungal sprays in a more normal year for fungal pathogens.

Fungal wilt in Lisianthus

FUNDING

Ontario Trillium Foundation / Fondation Trillium de l'Ontario

Weston Seeding Stronger

For additional details visit: **efao.ca/research-library**

November 2017

APPENDIX B

Research Report: HORTICULTURE 2017
Southern Ontario Pepper Breeding Project

Ecological Farmers Association of Ontario

FARMER-RESEARCHER BREEDERS (left to right)
Rebecca Ivanoff, Whole Circle Farm - Central Region
Greta Kryger, Greta's Organic Gardens - East Region
Annie Richard, Patchwork Gardens - East Region
Kathy Rothermel, Mouse Seeds at Windkeeper Community Farm - East Region

WHY IT MATTERS

Ecological farmers in southern Ontario do not have access to an early ripening bell pepper that is available in organic seed or bred for organic production systems. **To meet this need, Greta, Rebecca, Annie and Kathy are selecting red and yellow peppers while building a network of regional vegetable seed breeders!**

BREEDING OBJECTIVE

To produce early ripening, blocky red and yellow bell peppers with good flavour for organic field production in southern Ontario

METHODS

This participatory pepper-breeding project started in 2016 using seed obtained from Dr. Michael Mazourek's breeding program at Cornell University, which he derived from a cross made between commercial varieties *Ace* and *Aristotle*.

The four growers in Ontario are working together and using mass selection to select best peppers for the project's goal of creating an early, blocky red pepper with good flavor that is adapted to organic growing systems in southern Ontario.

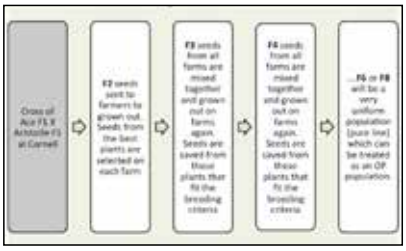


***Figure 1**. Selection method used to produce early ripening, flavourful, blocky red and yellow peppers.*

The 2017 growing season was the second year of growing out the cross Ace F1 x Aristotle F1 (F3 seed) at the four different locations in the province (Ottawa, Wolfe Island, Battersea, Acton). Selecting for earliness, blocky shaped fruit with low shoulders, and bright red colour with good yield potential and good flavour.

Red pepper seedlings in the greenhouse.

RESULTS

The 2017 growing season was very challenging, with a wet spring and wetter summer on all of four farms.

At some point in the season, all four growers contended with plants being overwatered and some had standing water in their fields; they also reported some lodging of plants.

One grower's plants were left in the greenhouse too long, and went into the ground when they were leggy and stressed before being pounded by a lot of rain.

Stressed plant

Project Summary

Seeds Sown: **150+**

Dates	Greta	Rebecca	Annie	Kathy
Seeds sown	Mar 23	Mar 31	Mar 21	Mar 30
Flower opening	*Early July*	NA	*Jun 1*	Jun 6
First ripened fruit	Aug 20	*First week in Aug*	Sep 4*	Aug 20/25

**Annie's first peppers ripened on Sep 5, before check plantings. This was later then others because all plants were stripped and allowed to "restart" due to the stressful growing conditions. Annie will not include 2017 seed in the 2018 grow-out because she does not feel confident that her selections under such poor growing conditions reflected the genetic potential of plants.*

Field layout at Annie's plot (left) and Kathy's farm (right).

SELECTION PROGRESS

Early ripening, blocky red peppers!

Greta and Rebecca are also selecting for early ripening, blocky yellow peppers.

Despite the challenging wet season, progress was made for both red and yellow blocky pepper lines.

- There is still some variability in plant stature and fruit shape and size, but less than the previous year.
- Yellow peppers were observed in all plots, though less reported than previous year.
- All four growers made selections and harvested seed.
- Collectively they harvested **over 40g of seed from red pepper selections**. These seeds, excluding Annie's, will be combined and redistributed for another round of mass selection in 2018.
- Greta and Rebecca continued to select a yellow blocky pepper line out of the mass selected population.

Greta describes how to scout and flag early ripening red peppers at an EFAO field tour hosted by Rebecca, Whole Circle Farm.

FUNDING

Ontario Trillium Foundation / Fondation Trillium de l'Ontario

Weston Seeding Stronger

APPENDIX C

Research Report: HORTICULTURE 2017
Cabbage Seed Production

Ecological Farmers Association of Ontario

FARMER-RESEARCHERS (left to right)
Rebecca Ivanoff, Whole Circle Farm - Central Region
Nicola Inglefield, Whole Circle Farm - Central Region

WHY IT MATTERS

Seed saving is important tool for ecological growers who want to produce locally adapted seed, develop new or maintain older varieties, and/or reduce seed costs. Biennial seed production has added challenges, as it occupies valuable storage space for overwintering that would otherwise be taken by marketable crops. **To optimize trade-offs between vegetable storage for seed saving and market, Nicola and Rebecca compared two methods of cabbage seed production.**

RESEARCH QUESTIONS

How do two methods of cabbage seed production compare with respect to seed quality, seed quantity and marketable cabbage?

METHODS

Nicola and Rebecca compared two methods of cabbage seed production:

1. The **Pyramid method**, learned from Petra and Matthew at Fruition Seeds, where the head is trimmed like a pyramid such that leaves are usable but not sellable (*control)*, and
2. An **alternative Chop** method, learned from Beth and Nathan at Meadowlark Hearth Biodynamic Seeds, that removes the head in a way that it can be sold at winter and spring markets (*new method; treatment*).

Predictions: Greater quality from the Pyramid method due to the main stem of the flower not being cut off, but greater value from Chop method, both in terms of seed quantity and saleable cabbage.

In autumn 2016, Nicola and Rebecca selected 110 ideal *April Green* cabbage heads and stored them with roots in plastic bags in the rafters of a cooler (photo right).

In spring 2017, they assigned the 99 plants that survived to one of the two methods by choosing plants at random from the cooler.

They planted cabbages on May 12 (**Fig 1**). They marked Pyramid plants with flagging tape tied around the stalk. They used the Florida weave to maintain plants as they grew, and they did not rouge in 2017, as it would have affected the experiment.

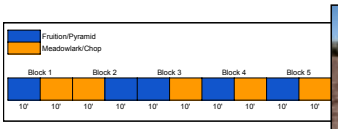


Figure 1. *Layout and photo of the trial with 5 replicate pairs comparing two methods.*

RESULTS

Cabbage Sold

- Chop method resulted in 38 heads of cabbage (~ 3lb each) **sold for $115 total**
- 12 were too small after peeling back the molded leaves or were too rotten

Seed Quantity

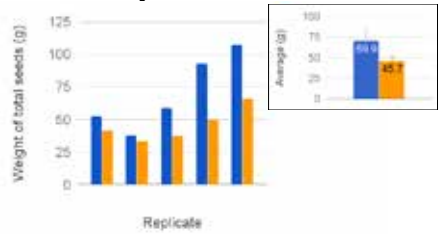


Figure 2*. Total seed weight of cabbage seeds by replicate and average (inset; P=0.06).* ***Blue*** *= Pyramid;* ***Orange*** *= Chop*

- Total seed weight was 13-87% greater using the Pyramid method, and we are confident this was due to the different methods (P=0.06).

Seed Quality

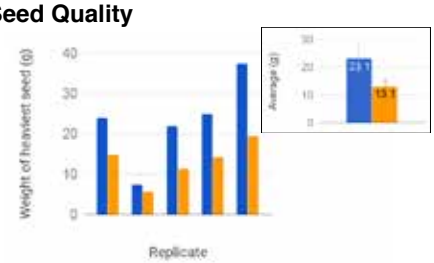


Figure 3. *Weight of heaviest seeds by replicate and average (inset; P=0.05).* ***Blue*** *= Pyramid;* ***Orange*** *= Chop*

- The weight of the heaviest (good quality) seeds was 29-92% heavier from the Pyramid method, and we are confident this was due to the different methods (P=0.05).
- At $20/28g, this means seed from Pyramid method would have sold for **$35.80 more**

TAKE HOME MESSAGE

- The Pyramid method produced better seed quantity and seed quality.
- Nicola and Rebecca think the lower performance of the Chop method is because removes a large number of nodes (and thus potential seeds; see *diagram right*).

- This is consistent with the fact that the ratio of heavy seed between methods was the same (data not shown; P=0.21), so the difference between methods is because the Pyramid method produces more seed.
- Rebecca thinks the "block effect" - increasing seed weight from replicates 1 to 5 - might be do to compaction near the road closer to replicate 1. It could also be because plants from the first replicates were winnowed a few weeks before the last blocks.
- These results emphasize the importance of randomizing and replicating! *Imagine the conclusions if they compared the methods side-by-side, with the Chop method farther from the road!?*
- The decision around what method to use in the future depends on growers' goals: **If high quality seed is the goal, the Pyramid method appears to be better; if net revenue is the goal, then the Chop method wins.**

Rebecca and Nicola harvested cabbage from the two methods using colour coded tarps.

Seed processing set-up

Cabbage seeds separated by plot

FUNDING

Ontario Trillium Foundation
Fondation Trillium de l'Ontario
WESTON SEEDING stronger communities

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