

# Building Climate-Resilient Seed Systems in Canada

Celebrating the work of organic and  
ecological seed growers across the country

**SPRING 2024**

# Highlights

Seeds are the foundation of agriculture, and seed diversity is critical to the success of climate-resilient farming systems.

Preserving, improving, and developing seed diversity for organic, ecological, and climate-resilient farming systems offer promising solutions, not only in helping farmers reduce greenhouse gas emissions, but also in providing ecological benefits and building resilience to changing climatic conditions. To demonstrate the potential of this work being led by farmers, seed growers, and researchers across the country, SeedChange launched the "Growth Opportunities for Canadian-Grown Organic and Climate-Resilient Seed in Canada" project in partnership with Agriculture and Agri-food Canada.

- This project established demonstration gardens across Canada **to showcase, share knowledge about, and evaluate regional seed varieties of vegetables and field crops**. These sites connect the agricultural community and the public in order to foster awareness of regional seeds for climate-resilient farming systems, and ultimately support their increased spread, adoption, and commercialization.
- **24 demonstration sites were established at farms and research institutions across the country from 2021–2023**, showcasing and evaluating hundreds of different regional seed varieties. Demonstration sites highlighted two groups of crops: vegetables and field crops. Vegetable sites showcased regional open-pollinated (OP) varieties and field crop sites highlighted farmer-bred varieties, heritage/heirloom grains, and varieties of wheat and oats developed through participatory plant breeding (PPB) programs.
- Our team hosted **45 educational opportunities**, engaging over **1,100 participants across the country** about the value of regional seed. We also surveyed **146 farmers and seed growers** to assess the degree to which they have experienced changes in their seed saving skills and access to seed diversity through participating in this project and other related activities of the Bauta Family Initiative on Canadian Seed Security:
  - **83.7%** improved their abilities related to organizing and implementing variety trials.
  - **74.4%** improved their abilities related to plant selection, variety improvement and/or on-farm plant breeding
  - **66.4%** were saving a greater diversity of vegetable or field crop seed.
  - **60.2%** were purchasing more regional seed

- The diversity of varieties being adapted and developed by organic and ecological farmers, and the engagement of the farmers and researchers to learn about the work of this community are positive signs of growth and momentum in this sector. However, **there remains a significant opportunity for federal investment in this area** to not only help the growth of the organic, ecological, and climate-resilient farming sector grow, but to help Canada meet multiple public policy commitments while strengthening the resilience of Canadian agriculture as a whole.

Ultimately, as more farmers adopt climate-resilient farming practices, having access to a diversity of regional seed produced for those conditions will be critical to move Canadian agriculture towards a more sustainable and climate-resilient future.



## INTRODUCTION:

# Seed Diversity for Climate-Resilient Agriculture in Canada

The Bauta Family Initiative on Canadian Seed Security (the Bauta Initiative), a program of SeedChange, is dedicated to advancing resilient seed systems in Canada. In collaboration with farmers, seed growers, researchers, and farming organizations across the country, we work to increase the quality, quantity, and diversity of Canadian-grown seeds that are adapted to organic, ecological, regenerative, and climate-resilient farming practices.<sup>1</sup>

As climate change challenges mount and agricultural biodiversity diminishes, farmers in Canada are experiencing complex ecological and economic pressures. Canadian agriculture primarily relies on synthetic fertilizer, chemical inputs, and heavy amounts of fossil fuel use in order to be productive, but these practices are contributing to increased greenhouse gas emissions that are worsening the climate crisis.<sup>2</sup>

Furthermore, we have lost 75% of agricultural biodiversity over the last 100 years globally. In Canada, only 10% of the remaining crop varieties are commercially available and virtually all of the vegetable seed used in commercial farming is imported.<sup>3</sup>

This extreme loss in diversity significantly limits Canadian farmers' options to use appropriate varieties in the face of climate change.<sup>4</sup>

Climate-resilient farming systems are becoming increasingly recognized for their ability to reduce on-farm emissions, increase soil health, and enhance on-farm biodiversity.<sup>5</sup> However, these types of agricultural practices in Canada are not widely adopted and farmers face a multitude of barriers when transitioning into climate-resilient approaches.

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<sup>1</sup> The Bauta Initiative primarily works with certified organic farmers, as well as farmers who use “ecological”, “regenerative”, or “sustainable” practices, without seeking organic certification. All farmers we work with are adopting agricultural practices that reduce the use of fossil-fuel based inputs, exclude the use of agrochemicals, preserve and enhance biodiversity, build soil health, and increase regional food sovereignty. These practices can also fall under a definition of “climate-resilient farming,” and this term will be used (in addition to organic, ecological, and regenerative) in this report to refer to the farming systems we work with.

<sup>2</sup> Government of Canada, 2023; Malaj, Freistadt, & Morrissey, 2020; Beingessner & Fletcher, 2019; Alahmad et al., 2023; Laforge, Corkal, & Cosbey, 2021

<sup>3</sup> Levert, 2014

<sup>4</sup> Fu, 2006; Gilbert, 2014

<sup>5</sup> Tuck et al., 2014; Gomiero, Pimentel, & Paoletti, 2011; Lori et al., 2017; Smith et al., 2019; Chiriaco, Castaldi, & Valentini, 2022

One of the most significant and overlooked barriers to their adoption is *seed*. In order for farmers to successfully practice climate-resilient agriculture, they need a diversity of seeds adapted to those conditions. Seeds developed for these types of farming systems need to be able to thrive without the use of synthetic fertilizers, have good pathogen resistance to limit the use of agrochemicals, strong vigour and good leaf canopy to outcompete weeds, and demonstrate strong nutrient use efficiency to perform well in a diversity of fertility regimes and climates.<sup>6</sup>

The majority of farmers in Canada are either reliant on seed developed for high-input farming systems, and/or seed from international seed companies that do not breed varieties adapted for Canadian climates or climate-resilient farming systems.<sup>7</sup> A growing body of evidence is demonstrating that *regionally-produced varieties developed under organic and ecological farming systems* can help farmers develop soil fertility and health, build natural resilience to pests and diseases, adapt to climate variability, and in some cases, provide greater nutritional value and flavour.<sup>8</sup>

However, limited resources are available — both from the private and public sector — for plant breeding programs to develop varieties suitable for climate-resilient agriculture.<sup>9</sup> This lack of investment severely inhibits the growth of this sector, and limits the diversity of varieties available that can thrive in those conditions. Modern seed varieties are also increasingly being released with restrictive intellectual property rights (IPRs) (e.g. plant breeders' rights, plant variety protections, utility patents, variety use agreements) that prevent or limit farmers' ability to save seed.<sup>10</sup> Seed saving is vital not only so that farmers have secure access to their most important input, but also because the practice enables on-farm climate resilience through variety adaptation to specific environments and farming practices.

Despite these limitations, a small but unwavering group of organic and ecological farmers, seed producers, researchers, and farming organizations are contributing significant labour and taking on considerable economic risk to fill this gap. Through on-farm plant breeding, regional seed adaptation and production, and participatory variety trials, this community is strengthening regional seed systems in Canada, and in turn, the climate resilience of Canadian agriculture.

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<sup>6</sup> Entz et al., 2018; Murphy et al., 2005; Lammerts van Bueren et al., 2011

<sup>7</sup> Levert, 2014; Bronson, 2015; Howard, 2015; Thoreau, 2021; Lammerts van Bueren et al, 2011

<sup>8</sup> Murphy et al., 2005; Murphy et al., 2007; Shelton & Tracy, 2016; Entz et al., 2018

<sup>9</sup> Hanson, 2007; COTA, 2020

<sup>10</sup> Howard, 2015; Endres, Guarino, and Nathani, 2023; Jenney, 2015

Over the past decade, the Bauta Initiative has offered support to this community through opportunities to participate in on-farm research and knowledge exchange programs that further develop their seed production and plant breeding skills. A particular focus of our research initiatives has been the implementation of participatory plant breeding (PPB) and participatory variety selection (PVS) programs. These methodologies prioritize farmer leadership in evaluating, selecting, and developing varieties, and assert that these activities should happen on farms to replicate the conditions in which the seeds will ultimately be grown.<sup>11</sup> PPB and PVS – established research methodologies internationally – are underdeveloped in North America, but are emerging as empowering approaches for farmers to assert more control over their seed sovereignty.<sup>12</sup>

The Bauta Initiative now works with over 200 organic and ecological farmers across Canada who are producing regional seed of field crops and vegetables that perform well in Canada’s diverse growing regions.

This report outlines the findings of the “Growth Opportunities for Canadian-Grown Organic and Climate-Resilient Seed in Canada”, hereinafter referred to as the *Climate-Resilient Seed Demonstration Site Project*: one of our most significant interventions to date in support of this sector. Its findings, though preliminary, help validate our belief that the preservation, improvement, and creation of seed diversity are key to helping farmers mitigate the impacts of climate change and enhance biodiversity, while contributing to the long-term sustainability of Canada’s seed sector.



<sup>11</sup> Almekinder, Thiele, & Danial, 2007; Lammerts van Bueren et al., 2018

<sup>12</sup> Mendum & Glenna, 2009; Ceccarelli & Grando, 2019; Colley et al., 2021; Jensen, Storosko, & Dang, 2024



Watermelon growing at the Fertile Ground Farm in Ontario.  
Photo credit: Martina Schaefer.

**The varieties showcased in this report and those featured at the demonstration sites are only a small sample of the remarkable seed saving and plant breeding efforts of organic and ecological farmers in Canada.**

For gardeners, farmers, and researchers interested in seeing the full diversity of seed being grown in Canada, please visit [weseedchange.org/local-seeds](https://weseedchange.org/local-seeds).

# Lil Red N Black Cherry Tomato

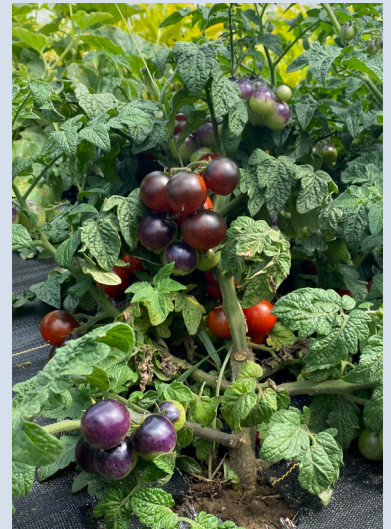
*Regionally-bred, regionally-produced*

Duane Falk and Vita Gaike at Mimosa Research Farm near Hillsburgh, Ontario wanted to create a beautifully coloured cherry tomato that was also delicious, productive, and easy to manage. By crossing Dwarf Red Cherry with Indigo Black tomato through multiple generations, Lil Red N Black was born.

Lil Red N Black grows vigorously regardless if they are grown as branching, field, container, or pruned tomatoes. They start bearing fruit early in the season up until the last frost, making them extremely productive. They produce a cherry-sized, near-black fruit that then shows red when fully ripe. They are also resistant to late blight and most other common tomato diseases.

Lil Red N Black impressed visitors at the Fertile Ground Farm demonstration site specifically with its flavour and colour. After seeing this new variety at a field day, Kim Delaney was so impressed with the variety that she chose it for distribution through her company, Hawthorn Farm Organic Seeds, making Lil Red N Black available to the public for cultivation. The commercial adoption of this variety shows how demonstration sites offer seed companies the opportunity to interact with advanced breeding lines and new varieties as well as local on-farm breeders, then invest in the commercialization of these varieties if they perform well.

Lil Red N Black growing in the field at Fertile Ground Farm in Ontario. *Photo credit: Angie Koch, Janine Stanic, and Nikola Barsoum.*



## **TRAITS OF INTEREST**

taste, colour, dwarf size, earliness, productivity

## **DEMONSTRATION SITE**

Fertile Ground Farm -  
St. Agatha, ON

## **SEED PROVIDER**

Duane Falk and Vita Gaike of Mimosa Research Farm - Hillsburgh, ON



**“The future of farming is farmers adapting their crops to their own microclimate, and their own circumstances and situations.”**

- Frank Bueckert, grain farmer at Woodland Organics



Dried Flood Fife.  
Photo credit: Ironwood Organics.



## TRAITS OF INTEREST

climate-resilient,  
flood-resilient

## DEMONSTRATION SITE

Ironwood Organics -  
Athens, ON

## SEED PROVIDER

Chris Wooding at  
Ironwood Organics -  
Athens, ON

# Flood Fife Wheat

*Regionally-adapted, regionally-produced,  
heirloom*

Many seeds are only bred to grow in stable environmental conditions. As weather extremes have become more common across Canada, Chris Wooding at Ironwood Organics strives to adapt his wheat to be more climate-resilient.

In 2017, during a summer of repeated floods, Chris' populations of Red Fife (a heritage grain from 1844) and Winter Rose Red Fife, only managed to produce an 8% yield at 80lb per acre. Chris saved the seed that survived from this population and it formed the basis of what became his new flood-resistant winter wheat population, Flood Fife.

For the next couple years, Chris continued to plant seed from his Flood Fife in areas of his fields where flooding risk was high and saved seed from surviving plants. Last year, in spite of the flooding, his field of Flood Fife saw the highest yield grain at 2,300lbs per acre, grown organically and with no inputs. Wheat testing analysis showed that Flood Fife had comparable

qualities to other wheats on the market milled for baking, and had negligible presence of mycotoxins.

Flood Fife currently performs predictably and is more stable across environmental conditions than other varieties Chris grows. Chris wants to trial growing Flood Fife in dry conditions over time to see if its flood tolerance qualities persist. He also wants to share his seed and grow Flood Fife at other regional farms to test its performance in other wet field environments.

**Chris advocates for adapting seed through selection to extreme weather conditions as a key strategy to ensure future sustainable harvests, food sovereignty, and climate-resilient agriculture.**

# Changes in Farmer Seed Saving Behaviour

In 2023, in collaboration with Good Roots Consulting, the Bauta Initiative administered a survey to program participants to learn about the experience of farmers engaged in our program.

The majority of farmers who completed the survey engaged with the demonstration sites either by contributing varieties or participating in a field day/workshop/virtual training event related to the work of the sites. Accordingly, we surveyed farmers on the degree to which the collective activities of the Bauta Initiative impacted their on-farm seed saving practices, skills related to implementing variety trials and on-farm plant breeding, and willingness to procure more regional seed.

Of the 146 farmers and seed growers who completed the survey, 55.5% are commercial vegetable growers, 34.9% grow seed for commercial sale, and 11.0% are field crop farmers. 73.5% of respondents farmed under 10 acres, and 26.5% had over 10 acres in active production. Of these growers, 63.7% grow seed for their own use.



Researchers and students harvesting Kernza® at Bishop's University in Quebec. Photo credit: Bishop's Educational Farm.

Below is a summary of the degree to which they have **experienced changes in their seed saving skills and their access to seed diversity** through participating in our program.

Results are presented according to the number of people who responded to each particular question. Some respondents chose not to answer every question or indicated “not applicable” for questions that did not relate to the specific way that they had engaged in the program.

#### VARIETY TRIAL ABILITIES:

**83.7%** improved their abilities related to organizing and implementing variety trials. (n = 135)

#### PLANT BREEDING SKILLS:

**74.4%** improved their abilities related to plant selection, variety improvement and/or on-farm plant breeding. (n = 125)

#### SAVING DIVERSE SEED:

**66.4%** were saving a greater diversity of vegetable or field crop seed. (n = 113)

#### SEED QUALITY:

**75.9%** were saving better quality seed. (n = 116)

#### ACCESSING DIVERSE SEED:

**71.2%** were able to access a greater diversity of regionally adapted, ecologically-grown seed. (n = 125)

#### PURCHASING MORE REGIONAL SEED:

**60.2%** were purchasing more regionally adapted, ecologically-grown seed. (n = 123)

#### INTEREST IN PRODUCING SEED UNDER CONTRACT:

**59.2%** had a greater interest in producing seed under contract. (n = 113)

#### SELLING SEED:

**41.0%** had started to sell seed commercially. (n = 78)

**These survey results indicate that demonstration sites facilitated important connections between farmers and others across the agricultural industry.**

Farmers mentioned how the program facilitated network building with industry collaborators at both regional and national levels, which provided valuable support for their agricultural work, even beyond seed. Farmers also emphasized how this program has helped them connect with a community of individuals with similar interests, allowing them to lean on each other for social connection, learning, and agronomic support. Below are a sample of quotes from survey respondents related to how connections made within the community have influenced their attitudes and behaviours related to seed:

“[The Bauta Initiative helped with] connecting to other farms and **bringing some scientific rigour to what is otherwise very independent work.**”

« L'initiative Bauta a joué un rôle central dans la solidification des liens entre les différents acteurs du milieu. J'ai le réel sentiment de faire partie d'un réseau de semenciers au Québec. » **“The Bauta initiative played a central role in solidifying the links between the different actors in the sector.** I have the real feeling of being part of a network of seed companies in Quebec.”

“The Bauta Initiative has helped link us with other local plant breeders and **these connections have resulted in us offering new seed varieties in our catalogue.**”

“Our engagement in the Initiative has helped enmesh us into a social fabric of farmers and breeders with shared interests. **We are able to make face-to-face connections and share ideas and knowledge more freely.**”

« Nous avons réseauté avec d'autres fermiers ou semenciers. Nous avons développé un intérêt à la production de semences, ou du moins d'être auto-suffisant en semences pour nos productions maraîchères. » “We networked with other farmers or seed companies. We have developed an interest in seed production, or at least **being self-sufficient in seed for our market gardening.**”

“Before I joined I was always interested in ecologically grown veg and fruits coming from Sri Lanka. I felt like I was alone learning what I could. **Now I feel connected and have a group that I can rely on for information and support.**”

“I doubt I would have my own small seed company now (PEI Seed Alliance) without the knowledge gained through Bauta. I wouldn't have had the hands-on experience gained through the farmer seed network, plus the help to access good seed from our Maritime Seed Bank & Seeds of Diversity. Steph Hughes, our Maritime [Coordinator] is always there to help & guide us. Bauta has trained & supported all of our seed interests & initiatives, plus **made us proud to be part of a vitally important seed community** that is fighting to feed Canadians now and in the future as we adapt to climate change.”

## CONCLUSION:

# Building Climate-Resilient Seed Systems in Canada

Seeds are the foundation of agriculture, and seed diversity is critical to the success of climate-resilient farming systems.

Climate change poses a significant threat to Canada's agricultural sector, signalling the need for adopting agricultural practices that will mitigate emerging environmental challenges. Organic, ecological, and regenerative organic farming systems offer promising solutions, not only in reducing greenhouse gas emissions but also in providing ecological benefits that are essential in fostering climate-resilient agriculture.

Farmers understand the enormity and complexity of these challenges. As farmers adopt more climate-resilient farming practices, they need a wide diversity of regional seeds that are well-adapted to those conditions. By showcasing and evaluating these kinds of varieties, the demonstration sites we manage help fill a critical gap for this community of growers. These sites provide opportunities to gather valuable multi-site agronomic data about varietal performance and create a dynamic space for knowledge sharing about climate-resilient seed systems.

As evidenced by the diversity of varieties showcased in this report and by the impacts these sites have had on the farming community, there is tremendous potential in building Canada's domestic organic and ecological seed system. The sites have already contributed to greater awareness of the importance of regional seed systems and new commercialization opportunities for regional seed.

The varieties showcased in this report and those featured at the demonstration sites are only a small sample of the remarkable seed saving and plant breeding efforts of organic and ecological farmers. For gardeners, farmers, and researchers interested in seeing the full diversity of seed being grown in Canada, please visit [weseedchange.org/local-seeds](https://weseedchange.org/local-seeds).

Demonstration sites have also helped catalyze PPB and PVS collaborations between researchers, agricultural organizations, and farmers. Some major outcomes of this work include:

- Due to the success of the organic carrot breeding work and the national-scale variety trials facilitated by CANOVI, our vegetable breeding and trialling collaboration with UBC is entering its second phase with an expanded crop focus for another four years.
- In Ontario, interest in our participatory research methodology initiated a collaboration with researchers from AAFC interested in developing new dry bean varieties for organic farming systems.
- In Quebec, the Bauta Initiative is in the process of continuing a PPB potato breeding program with Consortium de recherche sur la pomme de terre du Québec (CRPTQ) and Bishop's University, exploring collaborations with McGill University on incorporating organic trials into their pulse breeding program, and working with the Centre de recherche sur les grains (CEROM) to explore the potential of PPB for buckwheat and sunflowers.
- In the Prairies, the materials developed through the PPB wheat and oat program are being incorporated into other research projects on organic agronomy. Many farmers are eager to continue the selection work, start new plant breeding projects on different crops, or work with different researchers to explore moving more materials through the variety registration system.

These developments are positive signs in the climate-resilient farming sector, but significant gaps remain. Whether it is a small-scale vegetable seed company developing unique, regional varieties, or a diversified grain farm developing a new variety of wheat requiring evaluation in climate-resilient farming conditions, farmers and seed growers continue to bear the economic burden of regional seed development for this sector.

These activities contribute to the public good through the preservation and creation of significant agricultural biodiversity. To ensure this work can continue and scale up, farmers and seed growers require more public support.

Federal investment in organic and ecological variety development pales in comparison to the public resources available to conventional plant breeding. Over the past decade, approximately \$3M in public funding has been allocated to organic vegetable and field crop development (of which SeedChange has contributed \$500,000).<sup>42</sup> A recent study by the University of Saskatchewan indicated that approximately \$14.8M of annual public funding is invested into conventional wheat breeding alone.<sup>43</sup> Accordingly, there is an enormous opportunity for public research institutions and the federal government to build on the momentum of this community with strategic investments.<sup>44</sup>

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<sup>42</sup> Data compiled from all listed plant breeding projects supported through Organic Science Clusters 2013-2023. OACC, 2024

<sup>43</sup> Bolek-Callbeck & Gray, 2022

<sup>44</sup> Lyon, Friedmann, & Wittman, 2018; Kröbel et al., 2021

Although farmers are appreciative of the efforts of the Bauta Initiative, they also acknowledge the public interest component of this work and the limits of what can be accomplished through the scale of our organization:

“I’m a bit frustrated that the [Bauta Initiative] has to exist, and that it does exist as a separate entity [from the government]. Because it’s no substitute [or] an adequate replacement for public research in my view...I think they do an amazing job given [the] funding that they do have...But it really should be a government funded program. And that should be a part of the broad public interest research.”

The federal government is in the process of setting ambitious targets to reduce GHG emissions from agriculture. Investing in regional seed systems, as articulated in this report, will help farmers adopt and maintain the climate-resilient farming practices *required* to meet those targets. These investments also help Canada meet its international public policy commitments (e.g. International Treaty on Plant Genetic Resources for Food and Agriculture) through supporting the sustainable use and development of plant genetic resources through farmer-led seed conservation, production, and plant breeding.

Farmers and seed growers in the organic and ecological farming community have been leading seed adaptation and plant breeding work long before the interventions of the Bauta Initiative, and will continue to do so with or without support. But in order for this work to truly scale – to extend beyond the climate-resilient farming community – and generate the kind of ecological benefits Canadian agriculture needs, more investment is needed from the federal government.

Organic, ecological, and regenerative organic farmers in Canada are working to preserve, improve, and create new seed diversity to advance climate-resilient seed systems and contribute to the future resilience of our food systems.

For these growers to continue to do this important work, they need an enabling public policy landscape that supports their efforts. We hope that the successes of this partnership with AAFC demonstrate the potential of this sector, and signal the kind of research and public policy investments required to build robust, farmer-led, climate-resilient seed systems in Canada.



## Learn more!

For more information on ways to get involved in the Bauta Family Initiative on Canadian Seed Security, please visit [seedsecurity.ca](https://seedsecurity.ca).

If you would like to learn more about any of the crops and varieties featured at these demonstration sites, or how to get more involved in the seed community in Canada, please contact the Regional Coordinators of the Bauta Initiative:

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If you are a research organization interested in collaborating with the Bauta Initiative, we encourage you to review our list of participatory research and knowledge transfer services [here](#).

If you have any questions about this report, please contact **Aabir Dey** ([adey@weseedchange.org](mailto:adey@weseedchange.org)), Director of The Bauta Family Initiative on Canadian Seed Security at SeedChange.



The Bauta Family Initiative on Canadian Seed Security is a program of SeedChange.

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