



Crop Varieties for Canada's Organic Farmers

Part 1 | March 2023

Imagine you're browsing through a seed catalogue that gives you the whole story behind each variety. You can choose, for example, between (1) a variety developed in Europe for conventional production with the seed grown in China or (2) a variety developed and grown in Canada for organic production. If you're a Canadian organic farmer, you would likely be interested in the second choice. And if that variety was actually developed on organic farms by farmers... sound too good to be true?

Fortunately, crop varieties developed for Canada's organic farmers are now on the market, starting with two oat cultivars, AAC Oravena and AAC Kongsore. Also, a group of organic farmers, along with plant breeders, developed a bell pepper, Renegade Red. Many more crop varieties for organic farmers are in the pipeline - selections that show potential but are in the process of being fine-tuned. These exciting achievements reflect the work Canadian seed breeders, organic growers, and seed activists have focused on since 2009 with support from the Organic Science Cluster (OSC).



Renegade Red bell pepper from Kitchen Table Seed House (Photo Credit: Kitchen Table Seed House)



Carrot Evaluation: Dr. Micaela Colley from Organic Seed Alliance evaluating organic carrot populations at the UBC Farm during 2019 harvest (Photo Credit - Alex Lyon)

To Help Meet the Seed Needs of Canada's Organic Farmers, the OSC-Funded Work has:

- Bred varieties specifically suited to Canadian organic production
- Used Participatory Plant Breeding (PPB) in which organic producers evaluate accessions (genetic lines) on their own farms to help find potentially new varieties
- Conducted trials to identify the varieties that perform well on Canadian organic farms.
- Taught farmers how to save seed and develop varieties for their own use or to sell to other farmers
- Developed a network of seed growers to share knowledge with each other about seed saving, variety trials, and plant breeding.



Developing Varieties for Canadian Organic Farmers

Varieties for Organic Production

Modern crop breeding has focused on developing high-yielding varieties. After all, farmers generally want high yields. For large-scale commercial production, other desirable characteristics may include uniformity (re: size, shape, and colour), ease of mechanical harvesting, and durability of the crop during harvest, transportation, and storage.

Organic growers place more importance on other crop traits, such as disease resistance, performance in a low-input environment, and (indirectly) the ability to form symbiotic relationships with soil microorganisms. “Conventional seeds often perform poorly in organic agricultural systems in terms of leaf area and root mass development, root branching, nutrient use efficiency, and, in the case of legumes, nodulation.”¹ Small-scale growers, particularly market gardeners, also appreciate a diversity of colours and shapes, along with great flavour.

Ideal Characteristics for Organic Cultivars:

- Thrive in low-nutrient environments
- Form symbiotic relationships with other organisms, particularly soil life
- Compete well with weeds (e.g., establishing quickly and being tall enough to shade weeds and/or having foliage that quickly covers the ground)
- Are resistant to many diseases
- Do not attract pests and/or are resilient to pest damage (e.g., tougher leaves, spines, or release of volatile organic compounds that confuse or deter pests)
- When grown in an organic setting, they produce similar or higher quality and yields compared to conventional varieties.

Varieties for Canada



The Canadian seed industry is focused on cereals, oilseeds and pulses. Most Canadian grain growers, particularly prairie farmers, can find seed adapted to their region. For vegetable producers, however, the situation is quite different. Virtually all bulk vegetable seed sold in Canada has been grown outside of the country, much of it outside the continent, and isn't necessarily the best choice when facing short growing seasons and other challenges common in Canada.

Varieties for the Future

Many of the new Canadian organic/ecological vegetable seed companies focus on open-pollinated, not hybrid, seeds with a focus on heirlooms. Generations of seedsavers have preserved heirloom varieties because they have traits that were desired by gardeners and farmers. However, these traits are not necessarily valued by today's plant breeders. For example, gardeners often appreciate the flavour of heirloom tomatoes and their ability to produce a crop over an extended period of time. In contrast, commercial tomatoes have been selected for uniform size, shape, and maturity time, as well as a long shelf life and the ability to withstand commercial harvesting and transportation. With cereals, tall varieties were appreciated in the past when straw was a valuable resource on farms that had both crops and livestock. Also, taller varieties provide greater weed control. Many modern cereals are generally shorter since they were bred to be grown with herbicides and straw is often considered a waste product.

In the drive for seed security, interest in open-pollinated varieties has grown and has led to a resurgence of interest in heirloom varieties of vegetables, grain, and other field crops. But are heirlooms always better?

A study comparing modern and older wheat cultivars found that the modern varieties performed better than the older varieties even in low-input farming systems. "These authors conclude that even with restricted N application, which may occur in organic growing, modern cultivars will give best yield and best grain quality." ² The modern varieties also had stronger straw and performed better in artisanal baking. The older varieties excelled in two ways – they had a higher concentration of micronutrients, such as Zn, and had greater consumer appeal.

While heirlooms often have many desirable characteristics, such as great flavour, ability to thrive in organic growing conditions, and high genetic diversity, they generally have lower yields and less disease resistance than modern varieties. ³

Seed breeders concerned about seed security have started a movement to create "heirlooms of the future." These new open-pollinated varieties have the positive traits of heirlooms. Some have been developed through participatory plant breeding, and/or collaborations among plant breeders, seedsavers, chefs, and organic growers.

The heirlooms of the future are also being developed in the context of climate change, which has amplified the need for genetic diversity. As temperatures change and extreme weather events become more frequent, growers need varieties that can perform under these stresses. Some plant breeders are looking to wild relatives of crops and old varieties for resilient traits and then crossing these with more modern varieties to develop hardy varieties with marketable characteristics.



Harvests from 2020 radicchio trials at Grounded Acres Farm (Photo Credit - Hannah Lewis)

The Heirlooms of the Future Include:

- New varieties created by using heirloom varieties (or even wild crop relatives) as parent stock, and
- ‘Improved’ heirlooms created by growing heirlooms and saving seed from the plants that have disease resistance, higher yields, and other valuable agronomic traits along with the desirable ‘old-fashioned’ traits.

Finding the Best Seed for your Farm

When selecting varieties, it is important to find cultivars that perform well on your farm and meet your needs. Factors to consider include:

- **Climate.** Will this variety mature in your frost-free window? Do you have enough or too much moisture or heat? If you tend to have fall storms, will this mature before they hit?
- **Pest resistance.** Is the variety resistant to the pests that are common in your area? Field crop growers can refer to annual provincial variety guides. Consider also the growth period; perhaps seeding can be timed to avoid an overlap between peak pest pressure and the most vulnerable phase of crop growth.
- **Nutrient requirements.** Does the variety need high levels of soluble nutrients? Note that varieties that form extensive relationships with mycorrhizal fungi may be the best choice for low-nutrient conditions and droughty soils.
- **Soil and moisture.** Will it grow well in your soil conditions and moisture levels? For example, shorter, thicker carrots do better in rocky or heavy clay soil than long, slender carrots.
- **Your farming methods and machinery.** Do you have the ability (tools, equipment and labour) to plant and harvest this variety? Or, for example, do you need a variety that has larger seeds, is shorter, or has more uniform ripening? Will it grow well under organic management?
- **Needs of your market.** What characteristics do your buyers/customers want? Large-scale growers may need to sign contracts before they plant and so the buyers’ needs should be clearly specified. Market gardeners, however, can experiment with small quantities of new varieties each year.

Once you identify the characteristics you want, you can conduct trials to identify which varieties perform best. You can also plant several varieties to ‘hedge your bets’ and increase the chance one or more varieties will prosper. If you still can’t find exactly what you need, consider partnering with a seed company to help develop a variety.

On-Farm Variety Trials

Conducting variety trials takes a bit of planning and recordkeeping, but might not add much extra work. If you're already growing several varieties of a crop and keeping those well labelled, you're already doing much of the work involved in a variety trial.

Tips for variety trials:

- Keep it simple. Rather than conducting variety trials for several crops in one year, focus on just one or two crops. Also, focus on a manageable number of varieties per crop.
- Identify your goals. What crop traits matter? Identify the characteristics that are most important before you start the trial so you know what to look for, such as rate of emergence, resistance to disease, flavour, yield, uniformity of shape, etc. Be specific. For example, what matters most, the number of squash per plant or total weight of squash produced? Also, be open to recording traits you didn't consider. For example, you might notice that the beans of certain varieties touched the ground and rotted whereas other varieties had beans higher on the stem.
- Use at least one benchmark or check variety. This is a standard cultivar, ideally one you have grown many times before.
- Try to replicate the trial by planting all the varieties (including the check) in more than one place on the farm. Or if you're doing the trial in one location, duplicate the trial. For example, rather than planting five 20-foot rows of five varieties, plant five 10-foot rows of each and then repeat (ideally changing the order).
- Label each variety clearly.
- Record data on the traits you identified as priorities. Consider using the SeedLinked App (seedlinked.com).
- To get the best results, replicate the trial over time - more than once in a season for succession crops and/or in different years.
- Analyze the results.



The Grower's Guide to
Conducting On-farm Variety Trials

You can find a comprehensive, 55-page free guide to conducting on-farm variety trials, including forms for recordkeeping, at the Organic Seed Alliance website:

https://seedalliance.org/wp-content/uploads/2018/02/Growers-guide-on-farm-variety-trials_FINAL_Digital.pdf

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Developing Your Own Landrace

Can't find what you want in a seed catalogue? Consider developing your own landrace - a genetically diverse mix adapted to your farm. The term landrace is often used to refer to historical seed sources, however farmers can create their own landraces by planting several varieties of a crop, allowing them to cross-pollinate, and selecting the seed of the plants with the most desirable traits.

Over generations, the resulting crop will likely be more adapted to the particular farm and reflect the attributes most valued by the seedsaver. Participatory plant breeding can be used to develop community or bioregional landraces. Several growers can plant a mix of varieties, select the 'best' seed according to the criteria the group has identified, and share their seed.

What is a Landrace?

A genetically diverse, dynamic population of a cultivated plant that is locally adapted.



Participatory Plant Breeding (PPB)

You can participate in the Organic Science Cluster's PPB work by contacting The Bauta Family Initiative on Canadian Seed Security (www.seedsecurity.ca). You can also create your own PPB program with fellow farmers to develop your own crop varieties.

To learn how to conduct PPB work, see:

Exploring Participatory Research Part I: Participatory Plant Breeding. 1-hr webinar. <https://youtu.be/5lFSWhfLMNg>

Exploring Participatory Research Part II: Trialing and Record Keeping 47-min. Webinar. <https://youtu.be/pDuyIvIOLqE>

Organizations:

Seeds of Diversity - <https://seeds.ca/>

The Bauta Family Initiative on Canadian Seed Security - <https://www.seedsecurity.ca/>

SeedChange - <https://weseedchange.org/>

References

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2 Løes, AK et al (2020) What should organic farmers grow: heritage or modern spring wheat cultivars? *Org. Agr.* 10(1):93-108. <https://doi.org/10.1007/s13165-020-00301-7>

3 Dwivedi, S et al (2019) Pursuing the Potential of Heirloom Cultivars to Improve Adaptation, Nutritional, and Culinary Features of Food Crops. *Agron.* 9(8):441. <https://doi.org/10.3390/agronomy9080441>

ABOUT THE ORGANIC SCIENCE CLUSTER



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SCIENCE CLUSTER

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