Latest Research Results

organic SCIENCE CLUSTER 3

Participatory variety trialing and breeding for commercial organic vegetable growers and seed producers in Canada.

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Submitted by Hannah Wittman

Canadian organic vegetable producers primarily use seed varieties that have been bred for conventional, high-input systems, yet these varieties often lack traits important for organic production and markets.

Moreover, the vast majority of the vegetable seed planted in Canada is imported. This situation presents a strong need to develop domestic seed systems that improve the ability of Canadian organic vegetable growers to access varieties that suit their needs. A growing body of evidence shows that when varieties are developed, selected, and tested by the farmers who will be using them – through participatory plant breeding and on-farm variety trials – there is greater varietal adoption upon release.

The Canadian Organic Vegetable Improvement Project (CANOVI) was established to address the gap in Canadian organic vegetable variety development and build a collaborative network of farmers, seed producers, researchers, and industry stakeholders. The CANOVI project sought to:

1) Coordinate a national collaborative research network to evaluate existing commercial varieties for agronomic and quality traits,

2) Collect and analyze crop functional trait data to explain crop trait response to environmental stimuli, crop influence on agroecosystem function, and key traits for performance in organic systems, and

3) Implement an on-farm, participatory plant breeding program to create new breeding populations and finished varieties of carrots and peppers.

Participatory plant breeding (PPB) and participatory variety trials have been shown to be effective in selecting and developing varieties for organic and climate-resilient farming systems – systems that are currently underserved by

Dr. Solveig Hanson presenting in radicchio variety trial plots at a 2022 Radicchio Field Day and Taste Test at Poplar Bluff Organics, AB (Photo Credit - Tierra Stokes)

conventional breeding programs and seed offerings. The principles underpinning these methodologies are that;
i) farmers should take an active part in the variety selection and development process, and that;
ii) these processes should happen on farms to replicate the conditions in which the new varieties will be grown.

Accordingly, an on-farm variety trial network of small-to-mid-scale organic vegetable farmers was established in 2018. Sixty to 65 farmers from across Canada participated in the trialing network each year, conducting single-replication observational trials on: carrots (orange and red), peppers (bell and corno di toro), radicchio, and rutabaga. Replicated trials of each year's focus crops were conducted on hub sites at UBC Farm in Vancouver, BC, and at High Road Farm in Senneville, QC. Priority crops and traits were identified through an online survey in 2018 and adjusted annually based on feedback received through end-of-season surveys and farmer consultations. For all trials in 2019-2022, on-farm trial data were collected via SeedLinked, an online variety trial platform. Aggregated participant evaluation data were available on the SeedLinked platform as soon as trials were closed, and results were presented in webinars and various written formats.

Functional trait data was collected at on-farm trial sites and then paired with metadata (i.e., climatic and management information) to be interpreted through a coupled 'response and effect' framework, which assessed crop trait response to agri-environmental conditions and crop influence on agroecosystem function. Orange and red carrot breeding was centralized at UBC Farm with selection performed by several BC farmers and UBC researchers, in consultation with Organic Seed Alliance and University of Wisconsin-Madison plant breeders. Priority traits for both orange and red carrots were flavour, minimally tapered root shape, marketable yield, and storability. The red bell pepper breeding project was led by the SeedWorks breeding club in Southwestern Ontario, and members performed mass selection at four farms to develop an early-maturing red bell pepper.

Results and conclusions:

- Participatory, on-farm variety trials are effective in that they allow farmers to identify favourable varieties for their farm, develop observational skills, learn about available seed diversity, and participate in knowledge exchanges about variety improvement and plant breeding.

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

- Hybrid varieties generally performed favourably relative to open-pollinated counterparts, indicating that hybrids remain as reliable choices for most organic vegetable farmers. However, some open-pollinated and organically-bred varieties competed well with hybrids and, at times, exhibited exceptional traits – most notably flavour, texture, and appearance. Open-pollinated varieties can be excellent choices for Canadian organic growers, in terms of both crop productivity and seed security. However, growers should trial any variety of interest before relying on it for market production. CANOVI trial results are available at Bauta Initiative and BC FoodWeb websites.

Continued:

- The success of PPB projects hinges on farmers having a vested interest in variety development and being appropriately compensated throughout the process. The CANOVI red pepper breeding project succeeded for both of these reasons, in addition to the regional proximity and strong, established relationships of the breeding group.

- An early-maturing, blocky red bell pepper was released commercially as 'Renegade Red' pepper. 'Renegade Red' is pledged with the Open-Source Seed Initiative (OSSI) and now commercially available from Kitchen Table Seed House, Hawthorn Farm Organic Seeds, and Greta's Organic Gardens. This farmer-initiated project has been supported financially by the Ecological Farmers Association of Ontario and has benefited from variety trial infrastructure and knowledge transfer events facilitated through CANOVI.

- Three organically-bred carrot populations (an orange Nantes population, an orange/yellow Nantes population, and a red population) will be available for on-farm trials in 2023 due to the participatory breeding and trialling efforts facilitated through CANOVI.

Viewing Renegade Red pepper breeding plots during a 2019 field day at Kitchen Table Seed House, ON (Photo Credit - Aabir Dey)

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For more information visit the OSC3 Activity 11 webpage and/or DAL.CA/OACC/OSCIII & https://organicfederation.ca/organic-science-clusters/

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