Year 2 (2025): CANOVI Carrot Plant Breeding Program Summary Report

Background

Carrots bred for Canadian organic systems must show strong germination and early vigor, mature in-time for shorter growing seasons, and deliver high yields, uniformity, and flavour. There are few organically-bred carrots that can meet these needs, and even fewer that are open-pollinated.

After receiving feedback from farmers who wanted to address this gap in a more engaging way, in 2024, CANOVI began working with farmers across Canada on a participatory breeding program focused on developing improved open-pollinated carrot varieties that are adapted to their organic and ecological farming conditions.

(Left) Carrot seed harvest at the UBC greenhouse. (Right) On-farm multi-coloured carrot selection in Ontario.

Protocol overview

This year, growers signed up for orange, red, and/or multicoloured carrot populations to grow in the summer, then do selections on mature roots at the end of the season. All populations and available seed were produced from the previous year's root selections.

Growers could send carrot selections back to the University of British Columbia (UBC) to be pooled together with other farmer selections for communal seed production, keep carrots on-farm for their own independent seed production, or both. At UBC, orange and red carrots were entirely pooled, while multi-coloured carrots were to be split into east and west coast populations. The full protocol is available here.

Cohort

In 2025, the carrot cohort included 13 growers, varying from vegetable farmers, university growers, and/or seed producers. Geographically, growers were spread out across Canada with three participants from British Columbia, one in Manitoba, two from Alberta, one from Saskatchewan, three from Ontario, two from Quebec, and one from Nova Scotia. This year, only one grower had a total crop failure, while one other had major crop losses from poor germination caused by an abnormally (but increasingly common) hot and dry spring.

Carrot program successes

In the two years of working with the farmers in this program, we have made some positive gains in our goal of improving organic open-pollinated carrot varieties:

- **Seed availability:** Two growers who participated in this work last year have since adopted and commercialized the parent variety, Fantasia (developed by Organic Seed Alliance through the Carrot Improvement for Organic Agriculture Project in the USA). Fantasia is available for purchase at La société des plantes (Quebec) and BC Eco Seed Coop (BC).
- **Technical skill development:** From the 2024 cohort, three out of five growers who saved roots on-farm were able to produce seed from them in 2025. Two growers were unable to produce seed because of infrastructure issues and storage issues, respectively. These two growers will be trying to produce seed on-farm again in 2026.
- **Breeding gains in orange carrots:** We received overwhelming feedback from growers this year that the orange carrots have made great breeding improvements in their vigour, uniformity, and shape, with comparable performance to Bolero. This could be due to harder selection on roots, as well as multi-location selection allowing for more diverse selection pressures.

Breeding line history and progress

Breeding Goals	Breeding Line	Breeding info	Current status
New, improved orange line using the selection criteria of sweet taste, deep orange, good stored, Nantes-shape, and grows well overall for reliable root and seed production **For Prairie growers:** Strong tops for mechanical harvest, and uniformity for larger-scale wholesale markets have arisen as priority traits	Communal Orange	First crossed in 2025 at UBC from parents: CANOVI Orange, CIOA Orange Flavour Select, and F7119B (the latter two from Dr. Phil Simon at the USDA). Selections for the first cross came from roots grown and selected on-farm by farmers across Canada. In 2025, farmers did another year on-farm selections from first generation seed. We hope for this to become a strong OP alternative for hybrids like “Bolero”.	F1 roots from farmers across the country are in storage and will soon be prepped for F2 seed production during Winter/Spring 2026 at UBC. Seed produced will be grown on-farm for further selection by farmers across Canada in Summer/Fall 2026.
	CANOVI Orange	First crossed in 2019 at UBC between roots from multiple orange breeding lines including F5367, U7393B, Dor8267, and Rumba. Root selections, breeding, and seed production is centralized at UBC.	This line is now F5, with F6 seed set to be produced in Winter/ Spring 2026 at UBC. Growing and selection will continue at UBC in Summer/Fall 2026.

Major traits for improvement are bolt resistance and reliable root and seed yield; other important traits are flavour, disease resistance, and long and blunt tip shape	CANOVI Red	Parents, R5647 and R5646, were first crossed in 2021 at UBC from red carrots from the USDA. Red carrots have proven challenging to grow and produce seed from, with two years of seed production failure in 2022 and 2023. To address these issues, farmers in BC have been growing back-up populations of CANOVI Red and sharing root selections with UBC for seed production. Growers in BC continue to support development of CANOVI Red given strong regional interest.	This line is now F2, with F3 seed set to be produced in Winter/ Spring 2026 at UBC. Breeding will continue at UBC. Seed produced will be grown on-farm for further rounds of selection by BC farmers in Summer/Fall 2026. Kwantlen Polytechnic University produced F2 seed on-farm in 2024 and will be growing them out in 2026 for on-farm and UBC root selection and seed production.
Overall aiming for diverse, productive, and locally adapted populations; negative selection for poor vigour traits (disease, canopy cover, pests) and positive selection for marketable traits (bold and/or unique colour expression, mixed core and skin colour, good flavour, crunchy and juice texture)	East coast multi-coloured	First crossed in 2025 at UBC from parents, Fantasia and OSA Sunset (both received from Organic Seed Alliance in USA). Selections for the first cross came from roots grown and selected on-farm by farmers in Eastern Canada (Ontario and east). In 2025, east coast farmers did another year on-farm selections from the first generation of seed.	F1 roots from farmers across the country are in storage and will soon be prepped for F2 seed production during Winter/Spring 2026 at UBC. Seed produced will be grown on-farm for further rounds of selection by east coast farmers in Summer/Fall 2026.
	Craig's multi-coloured	First crossed in 2025 at UBC from parents, Fantasia and OSA Sunset (received from Organic Seed Alliance in USA). In 2024, all west coast growers (Manitoba and west) experienced crop failures with their carrots, except one farmer (Craig) based in Saskatchewan. Given Craig's enthusiasm for the project, this line turned into a breeding population tailored towards Craig's priorities and the Prairies region. In 2025, Prairie farmers grew and selected roots on-farm from seed from Craig's initial selections.	F1 roots from Prairie farmers are in storage and are set for F2 seed production during Winter/Spring 2026 at UBC. Seed produced will be grown on-farm for further rounds of selection by Prairie farmers in Summer/Fall 2026.

Qualitative feedback reported from growers on different breeding lines

Line	Flavour	Shape	Marketability	Other
CANOVI Red	Not very sweet when eaten raw, most people rather consume this carrot type cooked	Uniform cylindrical with blunt tips, but high size variability	Colour is beautiful Strong market interest for red carrots in BC	Still needs improvement for root and seed yield, select harder for roots with strong stems and productive flowers

Communal Orange	Juicy and crunchy with a mix of sweet, mildly sweet, and at the worst, bland carrots (little to none turpentine/bad tasting carrots)	Anecdotal farmer observations mention seeing the perfect Nantes shape in ~40% of the population, with the ~60% still being straight but with a rounded/ pointed tip	For market gardeners, roots are already great as-is. For farmers selling commercial wholesale, further improvements need to be made for root uniformity so they meet Canada No. 1 grade shape/size requirements.	On-track to be competitive with Bolero F1! Growers in the Prairies would like to select harder for stronger tops as it can improve varieties for mechanized harvest and clay soils that Prairie growers face when growing carrots for large wholesale markets
CANOVI Orange				
East coast multi-coloured	Not overtly sweet like the orange carrots; has more a mixed perfumey and sweet; still has some piney tasting roots Craig found that blunt tipped roots have better flavour than pointy ones	A mix of Danvers, Nantes, and Imperator shape, with east coast growers selecting any shape and Prairie growers selecting for more Nantes-like roots	Variability in shape, colour, and flavour makes these carrots work better for artisan markets; variation in shape can potentially lead to non-uniform prep and cooking times	Population still expressing “muddy” colouration in bi and tri-coloured roots which needs to be selected against
Craig’s multi-coloured				Select harder for flavour, blunt tips, disease resistance, and multicolour and bold (not muddy) colouration

Next steps

- **Conduct another year of on-farm carrot growing and breeding, supporting growers with any support they need.**
- **Encourage growers to select harder for strong tops, flavour, and colour and shape uniformity in 2026** — these traits came out as the ones that still need improvement, but have made great gains in the last years from participatory selection. These traits are crucial for variety marketability, especially as production scales up.
- **In 2027, CANOVI plans on having centralized, replicated variety trials to compare breeding lines to commercial F1 checks in preparation for variety commercialization** — we aim to have a trial site in each major growing region of the program, including BC, the Prairies, and Eastern Canada. We also plan for trials to collect more yield data, like weight and quantity of marketable and unmarketable carrots.
- **Conduct market research and outreach on the commercialization potential of advanced lines that may be ready for market** — While several small-scale seed producers have expressed interest in commercializing certain lines, many may be unable to produce seed at the scale needed for large-scale market growers. CANOVI plans to explore commercialization pathways that address the needs of both seed producers and seed buyers at different scales.