

CANOVI Carrot Plant Breeding Program 2024 Summary Report

Background

After running several years of carrot variety trials, CANOVI received feedback from growers that they were interested in engaging with carrot material in a new way. To address this desire among growers, CANOVI piloted a participatory carrot breeding program in 2024 that focused on developing new open-pollinated carrot varieties that are adapted to their organic and ecological farming conditions.




Protocol overview



Growers were sent orange and/or multicoloured carrot seeds to grow in the spring, then do selections on mature roots at the end of the season. Growers could send carrot selections back to UBC to be pooled together with farmer selections across the country for communal seed production, keep carrots on-farm for their own independent seed production, or both. At UBC, received orange carrots were to be entirely pooled, while multi-coloured carrots were to be split into east versus west coast populations. The full protocol is available [here](#).

Cohort

This carrot program engaged 10 growers, ranging from vegetable farmers, university growers, and/or seed producers. Geographically, growers were spread out across Canada with two participants from BC, two from Alberta, one from Saskatchewan, one from Ontario, three from Quebec, and one from Nova Scotia.

Breeding goals and advanced breeding lines offered

Breeding Goal	Breeding Line	Breeder/Seed Source	Breeding Info	Photo
New, improved CANOVI orange line using the original selection criteria of tasty, deep orange, good storage, Nantes-shape that grows well overall for reliable root and seed production	CANOVI Orange	CANOVI	A sweet, deep orange, open-pollinated Nantes variety to provide an OP alternative for hybrids like 'Bolero' (F1).	
	CIOA Orange Flavour Select	Carrot Improvement for Organic Agriculture (CIOA)	A Nantes type orange population developed for superior flavor by combining several sources known for good flavor and texture.	
	F7119B	Phil Simon/USDA Carrot Breeding Program at University of Wisconsin	Advanced breeding line selected for Nantes shape, good uniformity, and nice flavor.	

Breeding/ selection goals are chosen by the growers: most selected against poor vigour traits (disease, canopy cover, pests) and positively for marketable traits (clear colour expression, flavour, texture)	Fantasia	Organic Seed Alliance	A highly diverse population exhibiting a wide range of color combinations. Selected for root smoothness, bolt resistance, and good flavor. This is a great breeding population to select for local adaptation and unique colors.	
	Sunset	Organic Seed Alliance	A subset from a Purple-orange-purple population that was segregated for its light purple/raspberry color, with mixed orange and yellow cores. The population has also been selected for Nantes shape and its flavor that is sweeter than other novel carrots.	

Where are the roots now?

Of the 10 growers, seven were successfully able to harvest, select, and store roots this year. Below is a summary of where their roots ended up:

- One grower in QC is stewarding an on-farm multicoloured population
- One grower in ON is stewarding an on-farm orange carrot population
- One grower in AB is stewarding on-farm orange and multicoloured root populations
- Three growers on the east coast (ON, QC, NS) sent multicoloured roots back to UBC for communal seed production, which will become the east coast multi-coloured population
- Three growers (SK, BC, NS) sent orange roots back to UBC for communal seed production, which will become a participatory-developed CANOVI Orange population
- One grower on the west coast (SK) sent multicoloured roots back to UBC for seed production, which will become that unique grower’s population

Of the three growers who were unable to get mature roots, one experienced germination-related crop failure, while the other two did not dedicate enough time to the carrots.

Agronomic performance and feedback across advanced lines

Table 1 summarizes the average ratings growers gave each advanced carrot line. CIOA Orange Flavour Select was the top rated orange carrot line, while Fantasia was the top rated multicoloured line. Table 2 summarizes qualitative feedback growers gave for each advanced carrot line. Across carrot lines, growers reported pest pressures like rust fly, and disease pressures like aster yellows and *Alternaria* leaf blight.

Table 1. Average grower ratings (n=4) across agronomic traits for different advanced carrot lines.

Population	Vigor	Germination	Flavor	Disease Resistance	Insect Resistance	Marketability	Canopy Closure	Uniformity	Yield	Overall
CANOVI Orange	3.3	3.3	3.2	3.6	4.4	3.5	3.3	3.4	3.5	2.8
CIOA Orange Flavour Select	3.3	3.0	4.5	3.8	4.8	4.5	3.3	4.0	3.0	4.0
F7119B	2.0	1.5	4.0	3.8	4.0	3.8	1.8	3.5	3.0	3.3
Fantasia	3.8	3.3	3.7	3.0	4.6	3.9	3.8	3.6	3.5	4.2
OSA Sunset	3.8	3.5	3.0	2.8	4.0	3.0	3.5	3.0	2.8	3.2

Table 2. Summary table of qualitative feedback reported from growers on different advanced lines.

Variety	Flavour	Shape	Marketability	Other
CANOVI Orange	Growers mentioned that the population was juicy and crunchy with a mix of sweet, mildly sweet, and at the worst, bland carrots (little to none turpentine/bad tasting carrots).	A clear Nantes shape was in a minority of the population.	The Nantes roots that had more uniform width/fill along the entire root allow for evenness in cooking which is great for chefs; really good raw carrot and probably also tastes great cooked; deep orange colour is beautiful	Still not stable in its sweetness and Nantes shape, but moving in a positive direction; Really good juiciness and crunchiness
CIOA Orange Select	Growers mentioned that the population was juicy and crunchy with a mix of sweet, mildly sweet, and at the worst, bland carrots (little to none turpentine/bad tasting carrots). This population had a larger proportion of sweet carrots than CANOVI.	A clear Nantes shape was seen in noticeably more roots in this population compared to the CANOVI population.		Had a noticeably larger proportion of Nantes shaped roots and sweet roots compared to CANOVI
F7119B				Had a lower germination compared to the other orange varieties
Fantasia	Not an overtly sweet variety like the orange carrots; has more a mixed perfumey, mildly sweet, and dry crunch; removed many turpentine/"bad" tasting roots	Unknown if there's a difference in vigour and/or maturation rate between different carrot colours but this lead to major differences in root sizes which could also be influencing shape; shapes were mix of Danvers, Nantes, and Imperator shape	Variability in shape, colour, and flavour makes these carrots work better for artisan markets; as these carrots are not overly sweet, these carrots might work better cooked and/or for folks who like more floral tasting carrots; chefs noted the differences in shapes and sizes could lead to non-uniform cooking times	Yellow carrots in this mix were often filtered out because of greenness and seemingly did not taste good; roots with bi/tri-colour expression was sometimes "muddy" making the carrot seem "diseased" or just ugly
OSA Sunset				Folks really liked the deep purple and reds among the roots

Next steps

- **Collect feedback from 2024 growers about improvements for next year, and whether growers would like to participate again in 2025** — we would be specifically interested in whether (or not) we should change or add new lines to the breeding population, and ways we could adjust the protocol to be more interesting and flexible for growers
- **Send out more seed next year** — several growers suggested that more seeds should be distributed to increase the chances of selecting exceptional breeding roots, rather than settling for just good to great ones.
- **Produce carrot seed at UBC based on roots received, and send seed back out to interested growers** — see “Where are the roots now?” breeding details