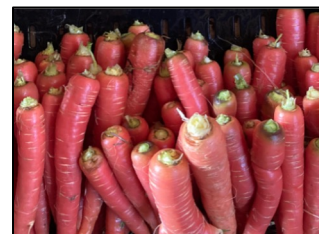


Trial Report: Red Nantes Carrots 2022

Goal: This trial's original goal was to test the CANOVI red Nantes carrot population alongside commercial hybrid (F1) and open-pollinated (OP) cultivars to gauge its readiness for commercialization. However, the CANOVI red population had almost no germination – due to a thrips issue in our greenhouse seed production – so our adjusted goal became to compare commercial red carrot cultivars, with emphasis on identifying OP cultivars that compete well with hybrids.



Background: The CANOVI Red Nantes carrot breeding project began in the summer of 2019, when CANOVI red carrot trials revealed a need for a **bolt-resistant, good tasting, smooth, blunt-tipped red carrot** for reliable root and seed production in Canada. Bauta Initiative BC partner FarmFolk CityFolk led this project, sourcing parents from trial fields of the Carrot Improvement for Organic Agriculture (CIOA) project and carrying out two rounds of selection since then. CANOVI on-farm and hub site carrot trials have been conducted in 2018-2020, and in 2022.

Varieties: In addition to CANOVI Red, participants trialed five commercially available carrot varieties: two F1 and three OP. Red Sun F1, Rubypak F1, Carnelian, and R6220 are “true” red varieties in that their red colour comes from lycopene, a carotenoid pigment. Dragon is an orange carrot with purple (anthocyanin) exterior, so it may fill a market niche for non-orange carrots for some growers, but it is not directly comparable to the other red carrot varieties.

Participants: 30, of whom 10 collected supplementary data.

Variety	OP / F1	Days to Maturity	Breeder	Seed Source
CANOVI Red	OP		CANOVI	CANOVI / UBC
Dragon	OP	70	John Navazio	Johnny's Selected Seeds
Red Sun F1	F1	70	Bejo Seeds	Johnny's Selected Seeds
Rubypak F1	F1	72	Bejo Seeds	Johnny's Selected Seeds
Carnelian	OP		Organic Seed Alliance	Organic Seed Alliance
R6220	OP		Organic Seed Alliance	Organic Seed Alliance

Planting: Participants planted 12 linear feet per variety at approximately 1” spacing after thinning, using single or multiple rows per bed. Seeds were sown in June or early July for harvest in September-October. Participants used their usual organic methods for soil fertility and weed management.

Evaluation: Participants evaluated varieties using the desktop or mobile [SeedLinked](#) app. Germination, early vigour, canopy cover, uniformity, yield, marketability, appearance, bolt resistance, and flavour were rated on a scale of 1 (low) to 5 (high). A rubric was provided that defined the rating scale for each trait. A subset of participants collected quantitative yield data and submitted comments on marketability and relative maturity.

Results and analysis: Interactive plots were available on the SeedLinked website immediately after trial closure. In addition, CANOVI researchers performed statistical analysis and presented results in a webinar and in this trial report.



Please view the 2022 CANOVI Carrot Trial Protocol for full instructions and the evaluation rubric.

- **When we divided participants by East-West region, we found more regional differences in trait ratings than by dividing participants by hardness zones.**
 - East = 13 participants in NS, QC and ON
 - West = 17 participants in BC and AB

	Appearance	Bolt Resistance **	Canopy Cover	Flavor	Germination *	Marketability ^	Uniformity	Vigor	Yield
East	3.3	4.8	2.9	3.1	2.9	2.9	3.2	3.2	2.8
West	3.6	4.1	3.2	3.1	3.3	3.2	3.3	3.3	3.2

- **Germination*** and **marketability^** were rated higher on **Western farms** than Eastern farms.
- **Bolt resistance**** was significantly better for **Eastern participants**, likely due to their lower average latitude.
- There were **no cases of genotype x environment interaction (GxE)** in which one variety did significantly worse or better in one region than the other.

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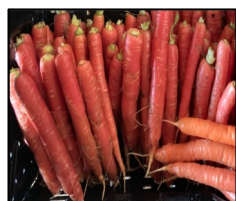
Mean Ratings by Variety

	Appearance *	Bolt Resistance	Canopy Cover ***	Flavor	Germination ***	Marketability ^	Uniformity *	Vigor ***	Yield ***
Dragon	3.8	4.6	3.9	3.4	4.0	3.5	3.4	4.3	3.8
Rubypak	3.5	4.5	3.2	3.1	3.2	3.1	3.1	3.4	3.3
Red Sun	3.8	4.7	3.3	3.1	3.8	3.1	3.5	3.4	3.2
Carnelian	3.4	4.2	2.9	3.2	2.9	3.0	3.3	2.9	2.7
R6220	2.9	4.0	2.0	2.9	1.7	2.5	3.0	2.1	2.0

Means and significant variation by variety in 2-way fixed effects ANOVA with East/West as environmental variable
Green = High rating; Yellow = Mid-range rating; Red = Low rating

- The **productivity traits** of germination***, canopy cover***, vigour***, and yield*** varied strongly among varieties. **Variety rank varies among these traits**, but the table above is sorted by yield.
- For the **quality traits** of appearance* and marketability^, R6220 was rated significantly lower than one or two commercial varieties. However, no significant differences existed between commercial varieties Dragon, Red Sun F1, Rubypak F1, or Carnelian.
- No significant differences in uniformity or flavour were found among varieties.

Quantitative Yield



Red Sun F1

Variety	Percent Marketable Yield	Marketable Yield (Lbs)	Total Yield (Lbs)
Dragon	70%	7.4	10.3
Red Sun	61%	4.3	6.4
Rubypak	64%	3.9	6.0
Carnelian	60%	3.9	5.7
R6220	70%	2.7	4.3
CANOVI Red	86%	2.2	2.7
Mean with CANOVI Red	69%	4.1	5.9
Mean without CANOVI Red	65%	4.4	6.5



Carnelian

Yield from 12 linear feet, as measured by 10 CANOVI trial participants

- Percent marketable yield was **between 60-70%** for all varieties, excluding CANOVI Red.
- Note that **OP Carnelian showed yield quite similar to hybrids Red Sun F1 and Rubypak F1**.

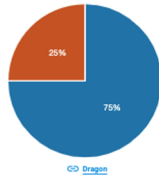
	P (<F)	Strength of evidence
^	<0.10	Weak
*	<0.05	Moderate
**	<0.01	Strong
***	<0.001	Very strong

Images: Delisa Lewis, BC

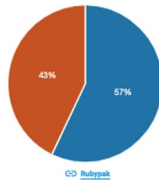
Varieties by Overall Preference



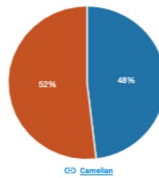
Dragon



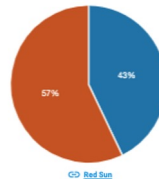
Rubypak F1



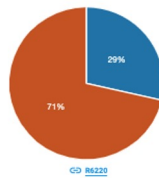
Carnelian



Red Sun F1



R6220



Blue = Would grow again
Red = Would not grow again
 Varieties are ordered by percent of participants who would grow the variety again

Results by Variety

- **Dragon** was highly vigorous and productive in both regions, but flavour did vary among farms. On Eastern farms, Dragon was rated highest for all traits except bolt resistance and appearance. On Western farms, Dragon was rated highest for all traits except bolt resistance, germination and uniformity.
- **Dragon, Red Sun F1, and Rubypak F1** performed quite similarly. In the West, Red Sun F1 did not differ significantly than Dragon or Rubypak F1 for any trait. In the East, Red Sun F1 showed lower vigour than Dragon, but no other trait ratings were significantly different between the three varieties.
- Among the 'true' red carrot varieties, **Red Sun F1, Rubypak F1, and Carnelian** were rated very similarly. They were not rated as significantly different from one another for any traits.
- Participants noted slightly **darker red colour** in Rubypak F1 than Red Sun F1, but some mentioned **rough appearance** for Rubypak F1. Red Sun F1 has occasional orange off-types but some participant comments praised the **light red colour**.
- **Carnelian**, an OP variety bred for organic conditions through the CIOA project, showed **similar productivity** to hybrid red carrot varieties and could be a good OP red carrot option. A few Northern growers mentioned **issues with bolting**, but several also commented on Carnelian's **pleasant flavour**. Carnelian will be newly available in 2023 through High Mowing Organic Seeds.
- **R6220**, still under development in the CIOA project, was rated **significantly lower for productivity traits** than Dragon and Red Sun F1 in both regions. However, several participants commented that it had unique and delicious flavour.

This research is part of [Organic Science Cluster 3](#), led by the [Organic Federation of Canada](#) in collaboration with the [Organic Agriculture Centre of Canada at Dalhousie University](#), supported by Agriculture and Agri-Food Canada's [Canadian Agricultural Partnership- AgriScience Program](#), [The Bauta Family Initiative on Canadian Seed Security](#), and the [Centre for Sustainable Food Systems at the UBC Farm](#).

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Variety images: Solveig Hanson.

