CANOVI ALÉBIO
Canadian Organic Vegetable Improvement
Amélioration des légumes biologiques au Canada

Corno di Toro Pepper Variety Trial Report 2018

BC Seed Trials and Canadian Organic Vegetable Improvement

UBC FARM
Centre for Sustainable Food Systems

THE BAUTA FAMILY INITIATIVE ON CANADIAN SEED SECURITY

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Background and Objectives

This report presents results from vegetable variety trials conducted by a farmer network developed jointly as part of the BC Seed Trials project and Canadian Organic Vegetable Improvement (CANOVI). The BC Seed Trials was a collaboration between the Bauta Family Initiative on Canadian Seed Security, the Centre for Sustainable Food Systems at UBC Farm, and FarmFolk CityFolk from 2016 - 2018. Through conducting vegetable variety trials on farms throughout British Columbia, this project identified varieties with strong regional performance for both fresh market and seed production.

In 2019, the BC Seed Trials became part of the Canadian Organic Vegetable Crop Improvement (CANOVI) Variety Trials Network, connecting trial networks across Canada to continue on-farm variety trials in support of participatory plant breeding for organic agriculture. More information, including trial reports for other crops and years, including bell peppers, can be found at www.seedsecurity.ca/canovi.

Corno di Toro Variety Trials

Trials of sweet peppers started in 2018 as a pilot collaboration between the BC Seed Trials and the newly formed North American Variety Trialing Network led by Prof. Julie Dawson at the University of Wisconsin-Madison, which aims to build collaborations between farmers, chefs, plant breeders, and seed companies across North America to facilitate breeding of varieties for diverse growers and consumer needs.

Peppers can be a challenge for BC growers particularly on the coast, Gulf Islands, and Lower Mainland because this crop is adapted to hotter climates and matures slowly in cooler, northern, and maritime climates. However, sweet peppers are a high-value crop for fresh market growers, and BC Seed Trials' farmer participants were interested in trials to identify early-maturing varieties with excellent flavour and plant structure conducive to hoophouse growing.

Corno di Toro peppers (also known as frying, roasting, or shepherd peppers) are a sweet, elongated type originating in Italy where they are named after the shape of a bull's horn. While not as familiar to consumers as bell peppers, they are a favourite with chefs as many varieties are sweeter and more flavourful than bell peppers and their shape makes them easy to prepare and roast. Importantly for BC growers, they tend to be earlier maturing than bell peppers. Therefore, trialing corno peppers provided an opportunity for growers to educate their customers and increase consumer interest in a pepper market class that is well suited to this region.

Materials and Methods

Trial Design

We used a Mother-Baby trial design[1], which pairs larger, researcher-managed hub trials with a group of farmer-managed trials on participating farms. The UBC Farm in Vancouver, which is certified organic, served as a hub site, with each variety planted in three replications in the field on these farms. Sites on other farms (on-farm sites) consisted of a single planting of all varieties, and two plantings of the check varieties, discussed below. In addition to the UBC Farm, pepper trials were grown on 3 on-farm sites in 2018, all of which were certified organic.

Trial Locations

This report includes results from the hub site location at UBC Farm in Vancouver, British Columbia, as well as three on-farm sites on Vancouver Island, Salt Spring Island, and the Okanagan. The hub site at UBC Farm is in Hardiness Zone 8a[2].

Planting Specifications

Plot size	*12 seedlings/plot including check varieties*
Row spacing	*18" apart in row, with 2 rows per bed and 7" between row. Spacing guidelines were adjusted as needed by farmers planting on-farm trials.*
Seeding method	*Seeded in greenhouse and transplanted*

Farmers were given planting guidelines and allowed to vary the precise bed spacing based on their growing system.

Planting and Harvest Dates

Location	*Seeding*	*Transplant*	*First Harvest*
UBC Farm	*March 19, 2018*	*June 1, 2018*	*August 20, 2018*
Other on-farm sites	*April 4-9, 2018*	*June 2018*	*August 2018*

Varieties and Seed Sources

Pepper varieties in this trial consisted of six varieties in the North American Variety Trialing Network. In order to trial varieties that have been selected in local Pacific Northwest and BC climates, the BC Seed Trials included three additional varieties produced by local seed companies, including 'Joelene,' from the BC Eco Seed Co-op, 'Elephant Ears,' from Uprising Seeds, and 'Golden Treasure' from Salt Spring Seeds. 'Carmen' was the check variety, a commonly used variety that can be compared with less-known varieties.

[1] Sieglinde Snapp, "Quantifying Farmer Evaluation of Technologies: The Mother and Baby Trial Design," in *Quantitative Analysis of Data from Participatory Methods in Plant Breeding*, ed. Mauricio R. Bellon and Jane Reeves (Mexico: CIMMYT, 2002), 9–17, https://cgspace.cgiar.org/handle/10568/76948.
[2] "Plant Hardiness Zones in Canada," accessed December 19, 2019, http://sis.agr.gc.ca/cansis/nsdb/climate/hardiness/index.html.

Variety Code	*Variety Name*	*Colour*	*Type*	*Source*
PC-01	*Joelene*	*Red*	*OP*	*UBC Farm/BC Eco Seed Co-op*
PC-02	*Carmen*	*Red*	*F1*	*Johnny's Selected Seeds*
PC-03	*Escamillo*	*Yellow*	*F1*	*Johnny's Selected Seeds*
PC-04	*Bridge to Paris*	*Red*	*OP*	*Uprising Seeds*
PC-05	*Elephant Ears*	*Red*	*OP*	*Uprising Seeds*
PC-06	*Golden Treasure*	*Yellow*	*OP*	*Salt Spring Seeds*
PC-07	*Lively Yellow*	*Yellow*	*OP*	*High Mowing*
PC-08	*Karma*	*Red*	*OP*	*Wild Garden Seeds*
PC-09	*Early Perfect Italian*	*Red*	*OP*	*Wild Garden Seeds*

Table 1. Varieties and seed sources. OP indicates open-pollenated varieties while F1 indicates hybrid varieties.

Evaluation

We adapted evaluation criteria from protocols developed by the North American Variety Trial Network in collaboration with plant breeders and farmers. Evaluations at on-farm sites were more minimal and emphasized farmers' notes and scores, while evaluations at the UBC Farm were more extensive. They included:

- Lodging (Number of plants)
- Insect damage (Notes)
- Disease (Score and Notes)
- Sugar content (Measured in brix, taken from a combined sample of 10 fruits per plot at peak harvest)
- Photos (Taken of 10 representative peppers)
- Flavour score (1 – 5 scale)
- Marketable count at 6 harvests
- Total count at 6 harvests
- Marketable weight at 6 harvests
- Primary reasons for unmarketability

Plants were harvested once a week, beginning when plots had approximately of 5 ripe fruit each. Fruit count, weight, and marketability data was collected for the first six harvests. Brix and flavour data were collected at one harvest when all plots were at peak maturity.

Hub Site Results

Yield

Yield measures recorded from this trial included a count of total and marketable fruit, marketable yield by weight, and marketable yield by weight as a percentage of total weight. All yield results presented in Table 1 represent the total season harvest from all three plots (10 plants) for a given variety, averaged over six harvests.

In terms of both total fruit number and marketable fruit number, 'Early Perfect' and "Bridge to Paris,' 'Karma,' and 'Joelene' were all highly productive, although we did not detect significant differences at the $p < 0.05$ level between any varieties for marketable fruit number or marketable yield by weight. However, 'Early Perfect' and 'Karma' had significantly higher percent marketable yield by weight than other varieties, and 'Elephant Ears' and 'Lively Yellow' and significantly lower percent marketable yield by weight (Table 2).

Looking productivity through the season, varieties peaked in the third week of harvest, though 'Elephant Ears' and 'Golden Treasure' were more productive later in the season (Figure 1).

Variety	Average Fruit per Harvest		Average Marketable Fruit per Harvest		Average Marketable Weight per Harvest (g)		Percent Marketable by Weight	
Early Perfect	37.33	ab	32.0	a	1139	a	0.97	b
Karma	32.34	b	27.7	a	764	a	0.96	b
Jolene	31.56	ab	27.06	a	771	a	0.82	ab
Carmen	30.92	ab	26.50	a	956	a	0.96	ab
Bridge to Paris	35.45	ab	30.39	a	796	a	0.89	ab
Escamillo	24.76	b	21.22	a	938	a	0.90	ab
Lively Yellow	25.54	b	21.89	a	820	a	0.69	a
Elephant Ears	25.47	a	21.83	a	817	a	0.71	a
Golden Treasure	24.69	b	21.17	a	1216	a	0.98	ab

Table 2. *Yield Measures for Nine Corno di Toro Pepper Varieties Grown at UBC Farm in 2018. Results represent the average from three 10-plant plots per variety over 6 harvests.*

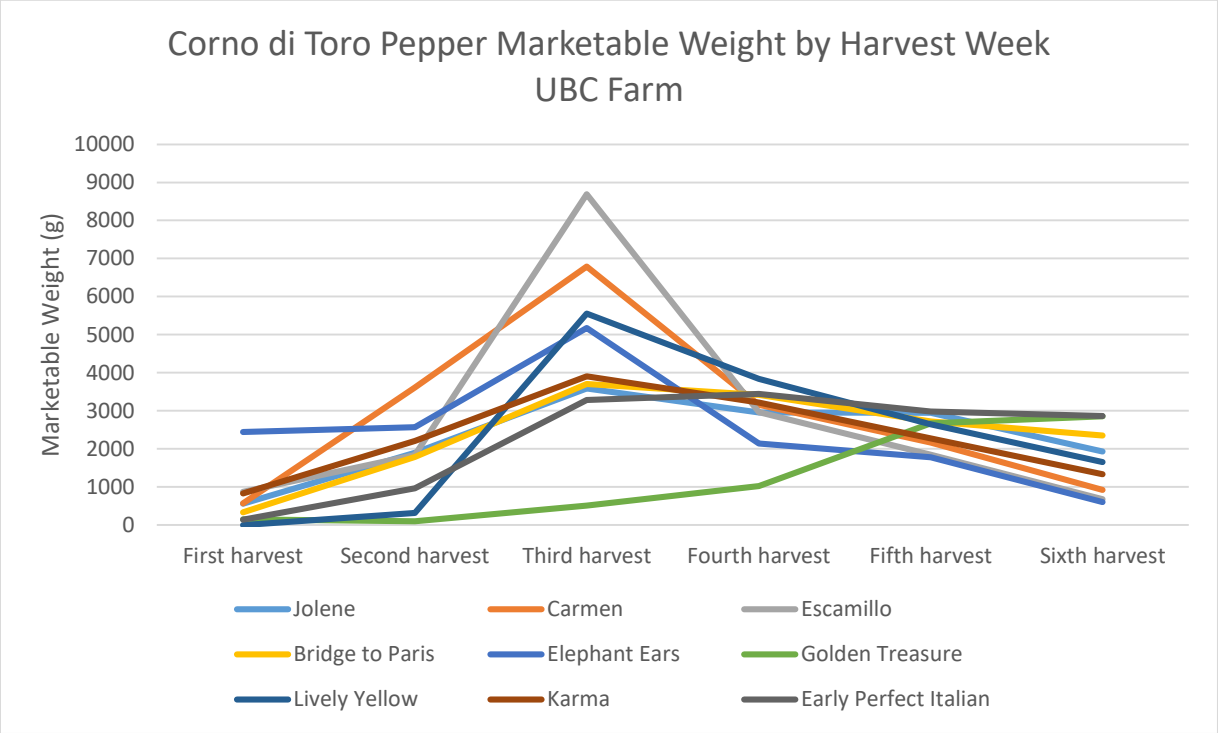

Figure 1. *Marketable weight for each harvest shown for each variety for six harvests starting in August and ending in October. Plants were harvested once per week.*

Issue Affecting Marketability

Upon harvest, we sorted fruit into marketable and unmarketable based on any type of damage or quality issues. Most common issues affecting marketability were sun scald, cracking, and wrinkling from over-ripeness. Varieties that were most negatively affected by these qualities included the 'Lively Yellow' and 'Elephant Ears.' Best performing varieties in terms of marketable fruit included 'Golden Treasure,' 'Early Perfect,' 'Karma,' and 'Carmen.'

Flavour and Sugar Content

A group of UBC Farm staff performed the flavour rating on a 1 to 9 scale, with 9 being the best and 1 being the worst flavour. Based on average tasting scores, 'Early Perfect Italian' was the favourite variety, followed by 'Escamillo' and 'Bridge to Paris,' although there was a high amount of variation in scores between tasters making it difficult to draw strong conclusions (Figure 2). 'Escamillo,' 'Karma, 'Bridge to Paris,' and 'Carmen' had the highest average sugar content (Brix), although differences in Brix were not statistically significant (Table 4).

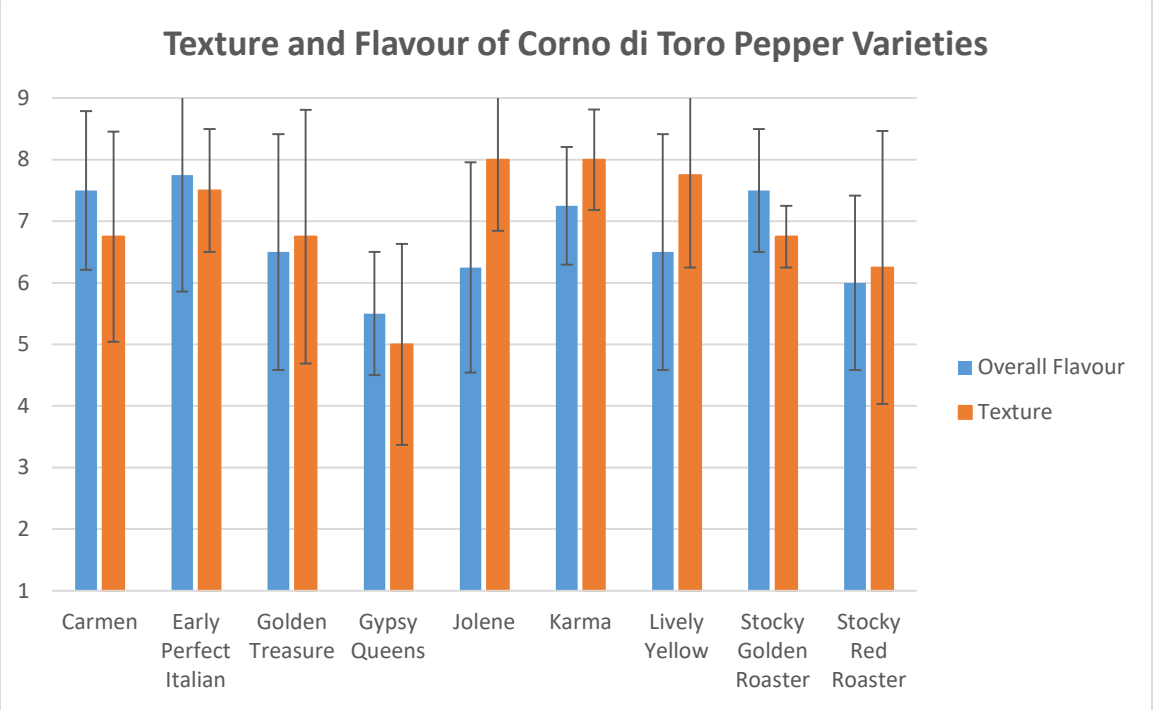

Figure 2. *Flavour and texture ratings from four tasters at UBC Farm. All traits were rated on a 1 to 9 scale with 1 being the worst and 9 the best for that trait. Error bars represent standard deviation.*

Variety	Brix value
Escamillo	9.30
Karma	9.17
Bridge to Paris	9.17
Carmen	9.13
Early Perfect	8.95
Lively Yellow	8.70
Jolene	8.43
Golden Treasure	8.30
Elephant Ears	8.20

Table 4. *Brix (soluble solids) values for 9 Corno di Toro pepper varieties grown at UBC Farm in 2018. Results are the average of samples taken from 10 peppers/plot, and the average of 3 plots per variety.*

Baby Site Results

Farmer-collected data were available for two of three baby sites for Corno di Toro peppers. Of these, both farmers said they would grow 'Carmen' and 'Escamillo' again, and one of them said they would grow 'Bridge to Paris' again. Both farmers responded "no" to all other varieties in the trial. These preferences were highly related to the farmers' comments on flavour: 'Carmen' was noted as having a simple, sweet flavour and 'Escamillo' a more tangy, sweet flavour and juicy texture. For productivity, 'Escamillo' and 'Bridge to Paris' received the most positive feedback, followed by 'Carmen.' One farmer added an addition variety 'Capriglio,' which they noted being early and very productive with the better flavour than the trial varieties, but prone to lodging. Additional comments on varieties are displayed in Table 5.

Variety	**Strongest Points**	**Major Flaws**
Joelene	-Nice shape -Healthy -Very good flavour	-Not vigorous or productive -Late -Plants Yellowing
Carmen	-Fastest ripening -Nice colour and shape -Productive	-Disease-prone -Not fully red
Escamillo	-Large fruit -Early ripening -Cool yellow colour -Attractive	-Slight disease susceptibility -Somewhat late
Bridge to Paris	-Uniformly productive -Largest plant frame -Lots of fruit (but didn't ripen in time)	-Slow to ripen -Too pointy, looks like a hot pepper
Elephant Ears	-Nice shape -Early ripening -Looks good	-Plants not self-supporting, falling under fruit weight -Fruit split -Needs to be bred to reduce cracking and improve crispness
Golden Treasure	-Disease-free plants	-Low germination -Slow growing -Small plant size -Failed to ripen

Table 5. *Farmer comments on Corno di Toro pepper varieties.*

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For additional copies of this and other research reports, visit www.seedsecurity.ca/canovi.
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