

Bell Pepper Variety Trial Report 2018



Background and Objectives

This report presents results from trials conducted in 2018 as part of Canadian Organic Vegetable Improvement (CANOVI), a collaboration between the Centre for Sustainable Food Systems at UBC Farm, the Bauta Family Initiative on Canadian Seed Security, and FarmFolk CityFolk. More information, including trial reports for other crops and years, can be found at seedsecurity.ca/canovi. For more information on vegetable trials conducted by this research team before 2018 as part of the BC Seed Trials, see www.bcseedtrials.ca/trials-results.

Bell Pepper Variety Trials

Trials of sweet peppers started in 2018 as a pilot collaboration between CANOVI and the newly-formed North American Variety Trialing Network led by Prof. Julie Dawson at the University of Wisconsin-Madison. The North American Variety Trial Network 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.

In Canada, this trial consisted of two market classes of peppers: bell and Corno di Toro (also known as shepherd or frying peppers). Early maturing, blocky sweet bell peppers were a priority by growers in Eastern Canada, some of whom are working on participatory plant breeding of bell peppers. In general, Eastern Canadian growers were the primary participants in the bell pepper trials, while BC growers were more interested in Corno di Toro peppers.

Materials and Methods

Trial Design

We used a Mother-Baby trial design¹, which pairs larger, researcher-managed “mother” trials (usually at research stations) with a group of farmer-managed “baby” trials on participating farms. Mother trials consisted of three plots of each variety, arranged in a Randomized Complete Block Design, while baby trials consisted of single plots of each variety with an additional second plot of a check variety, used to assess within-site variation. Baby farm sites consisted of a single plot of all varieties, and two plots of the check varieties. At mother sites we collected quantitative yield data and one-to-five ratings, while farmers who participated in baby sites were asked for descriptive comments and yes or no questions about the 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>.

Trial Locations

Unlike typical mother-baby trials where the mother site is a research station, for bell peppers both replicated trials were conducted on working organic farms. These included Everdale Farm in Hillsburgh, Ontario, and Kitchen Table Seed House on Wolf Island, Ontario.

Management practices and environmental conditions differed significantly between these two sites. Everdale Farm is in Plant Hardiness Zone 5b while Kitchen Table Seed House is in Zone 6a to 6b2. More notably Everdale site experienced a late cold snap in 2018 which delayed the transplant date. The Kitchen Table trial had a typical fertilizer regime for peppers as well as black plastic mulch, while added fertilizer was not allowed at the Everdale site and plastic mulch was not used.

Baby trials (with single replications of each variety) were conducted by five additional farms, including two in Ontario, two in Nova Scotia, and one in Quebec.

Planting Specifications

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

<i>Plot size</i>	<i>12 seedlings/plot including check varieties</i>
<i>Row spacing</i>	<i>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.</i>
<i>Seeding method</i>	<i>Seeded in greenhouse and transplanted</i>

Planting and Harvest Dates

<i>Location</i>	<i>Seeding</i>	<i>Transplant</i>	<i>First Harvest</i>
<i>Kitchen Table</i>	<i>May 1, 2018</i>	<i>May 29, 2018</i>	<i>August 2018</i>
<i>Everdale</i>	<i>April 13, 2018</i>	<i>June 9, 2018</i>	<i>August 2018</i>

Varieties and Seed Sources

Pepper varieties in this trial consisted of six varieties from the North American Variety Trialing Network, as well as two additional varieties ('Peace Work' and 'Early Perfect Italian') chosen by Canadian trial coordinators to address regional grower interests. Varieties in the North America-wide network were selected by researchers based on broad consultations with vegetable growers and seed companies for the specialty vegetable market. 'Ace' was the check variety, a commonly-used variety that can be compared with less-known varieties.

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	Source	Type	Organic Certification
PB-01	Flavorburst	Yellow	Bejo (via Johnny's Selected Seeds)	F1	No
PB-02	Whitney/Zsa Zsa	Hungarian	Bejo (via SeedWay)	F1	No
PB-03	SBGO 10408	Orange	Ball/Pan American	unreleased line	No
PB-04	Ace	Red	Johnny's Selected Seeds	F1	No
PB-05	King of the North	Red	Hudson Valley Seed Company	OP	Yes
PB-06	Early Red Sweet	Red	Turtle Tree Seeds	OP	NO
PB-07	Peace Work	Red	Fruition Seeds	OP	Yes
PB-08	Italian Red Heart	Red	Wild Garden Seeds	OP	Yes

Table 1. Varieties and Seed Sources

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)
- 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 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 and Marketability

As would be expected from the differences in management and environment discussed under Trial Locations, the Kitchen Table Seed House site was a more favorable environment for the peppers, with higher yields overall (Figures 1a –b, and Table 2). At the Everdale site, ripening was delayed and some varieties did not produce a harvest before the end of the

season (Figure 2a-b, p6). For those fruits that did mature, primary issues affecting marketability at both hub sites included blossom end rot, other disease issues, and sun scald.

Despite the differences in conditions between these sites, ‘Peacework’ and ‘Early Red Sweet’ were top performers in terms of total yield and marketable yield, suggesting that this variety is quite resilient to challenging conditions while also performing well in more favorable conditions. ‘Ace’ was had abundant fruits in both sites but also produced a higher number of unmarketable fruit.

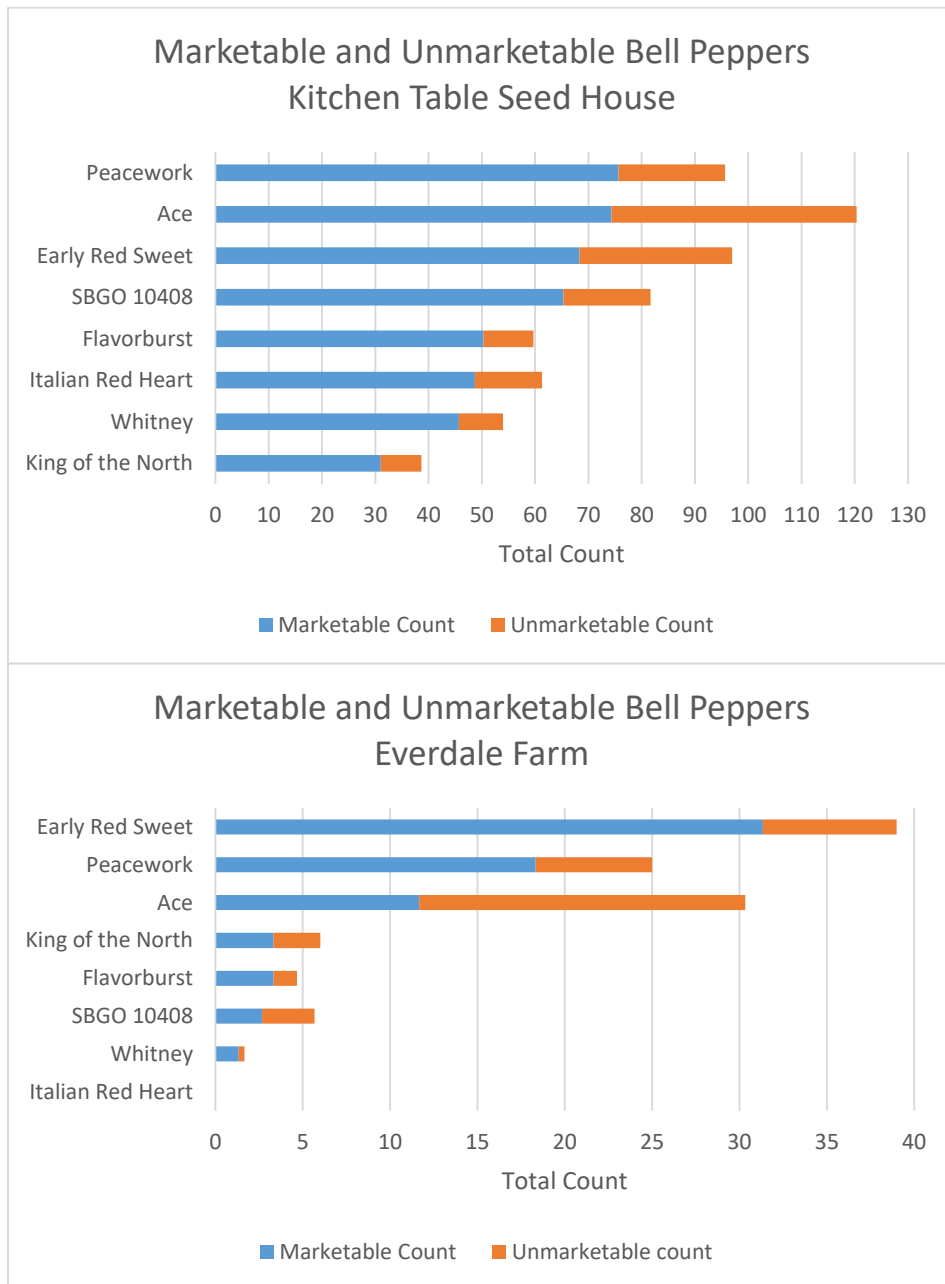


Figure 1a - b. Season total count (across all harvests) of marketable and unmarketable fruits from 9 pepper varieties at Kitchen Table Seed House and Everdale Farm trials in 2019.

Kitchen Table Seed House Yield Measures				
Variety	Average Fruit per Harvest	Average Marketable Fruit per Harvest	Average Marketable Weight per Harvest (g)	Percent Marketable Weight
Flavorburst	8.52	7.19	1517	84%
Whitney	7.71	6.52	1129	85%
SBGO 10408	11.67	9.33	1598	80%
Ace	17.19	10.62	1333	62%
King of the North	5.52	4.43	852	80%
Early Red Sweet	13.86	9.76	821	70%
Peacework	13.67	10.81	1164	79%
Italian Red Heart	8.76	6.95	890	79%
Everdale Farm Yield Measures				
Variety	Average Fruit per Harvest	Average Marketable Fruit per Harvest	Average Marketable Weight per Harvest (g)	Percent Marketable Weight
SBGO 10408	3.4	1.6	428	47%
Whitney	1	0.8	188	80%
Peacework	15	11	1470	73%
Early Red Sweet	23.4	18.8	1587	80%
Ace	18.2	7	1198	38%
King of the North	3.6	2	416	56%
Flavorburst	2.8	2	534	71%
Italian Red Heart	0	0	0	0%

Table 2. Yield measures for 9 pepper varieties at Kitchen Table Seed House and Everdale Farm trials in 2019. Results represent the average from three 10-plant plots per variety over all harvests. Results are colour-coded on a spectrum from green to red—green cells are the most favourable and red the least favourable for each trait. All results are the mean of three plots for that variety.

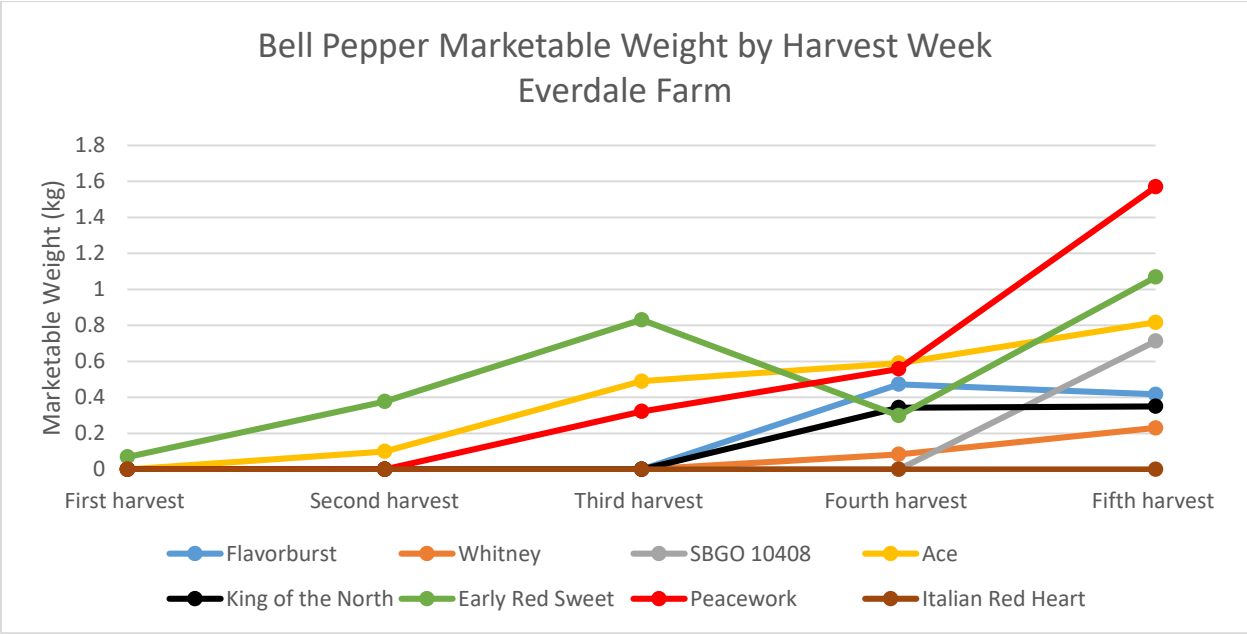
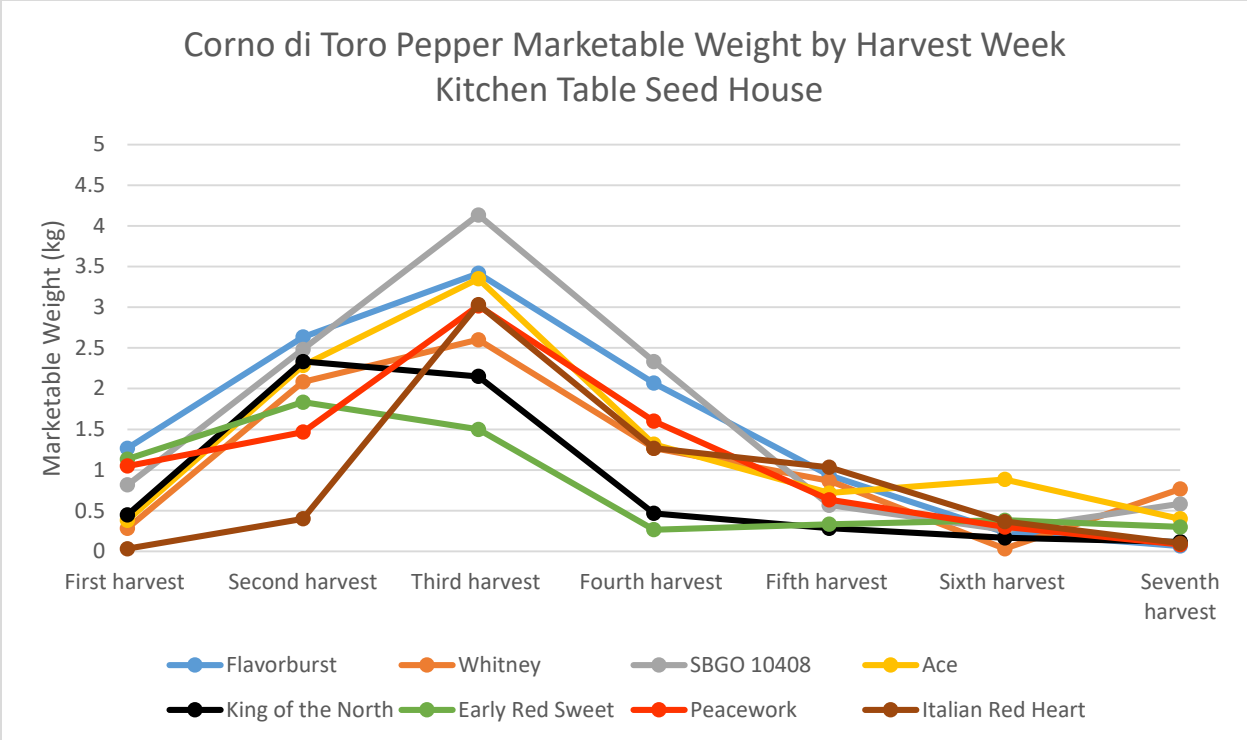


Figure 2a-b. Marketable weight for each harvest shown for each variety for six harvests starting in August and ending in October. Plants were harvested once per week.

Issue Affecting Marketability

Upon harvest, we sorted fruit into marketable and unmarketable based on any type of damage or quality issues. The most common issues affecting marketability at the Kitchen Table Seed Hub trials were blossom end rot, other rots, sunscald, and insect damage, all of which were widespread across varieties.

Flavour and Sugar Content

‘Flavorburst’, ‘Ace’, and ‘Peacework’ were ranked highest for flavour by tasters at the Kitchen Table Seed House site (Figure 3). Brix values did not completely align with this result, as shown in Table 3.

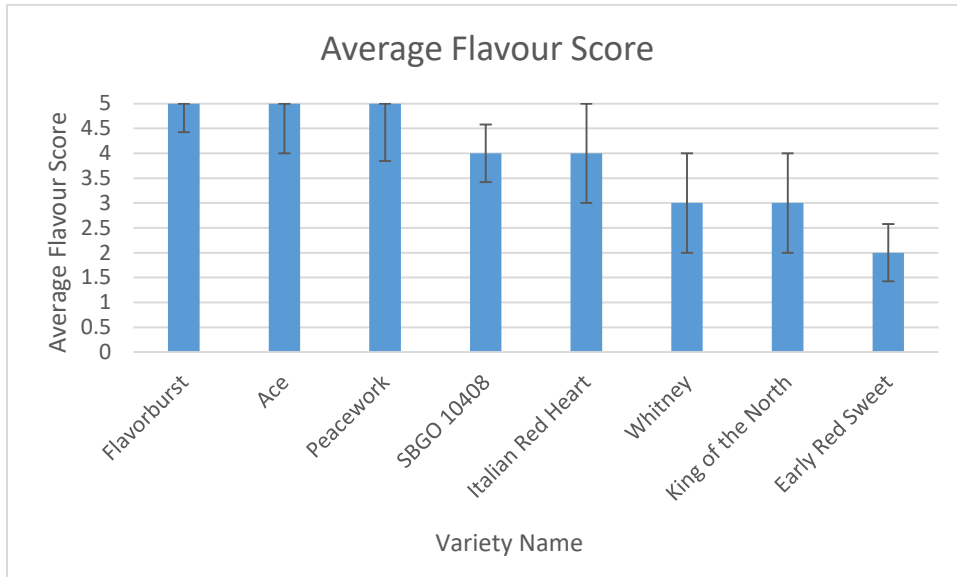


Figure 3. Flavour scores submitted by three tasters for a bell pepper trial at Kitchen Table Seed House. Error bars represent standard deviation.

Variety Name	Brix value
Ace	10
Early Red Sweet	10
Italian Red Heart	10
Flavorburst	9
Whitney	8.5
SBGO 10408	8
Peacework	8
King of the North	7.5

Table 3. Brix values for 8 pepper varieties, grown at Kitchen Table Seed Hub in 2018.

Baby Site Results

Overall impressions of the varieties were mixed. The most common problems were poor ripening due to a cold/short season with a severe early cold spell after the peppers were planted. Standouts for flavour included ‘Ace’, ‘Flavorburst,’ ‘SBGO 10408,’ and ‘Peacework,’ with the ‘Ace’ and ‘Flavorburst’ noted more for sweetness and the other two varieties noted as

less sweet but juicier. For productivity, standouts in farmer comments included ‘Ace,’ ‘Peacework,’ and ‘SBGO 10408,’ while other varieties received mixed reviews—fruit was commonly too small or did not ripen quickly enough. One farmer added an additional variety, ‘King Crimson,’ which they noted as having good fruit quality, earliness, and ripening, though less prolific than ‘Ace’ or ‘Peacework.’ Additional comments on varieties are displayed in Table 3.

Variety	Strongest Points	Major Flaws	Other Notes
Ace	-Marketable -High productivity -Strong fruit set, taste -Good ripening	-Plants were short, resulting in breakage/loss	
Early Red Sweet	-Early ripening that continued through the season -Nice plant structure	-Small fruits -Declining quality in late harvest	-Variable shapes
Italian Red Heart	-Bushy structure	-Late maturing/too late to ripen	-Long and pointy shapes
King of the North	-Strong fruit set -Good plant structure	-Late maturing/too late to ripen	
Peacework	-Early maturing -Good marketability	-Plants prone to lodging/breakage	-Longer shapes
SBGO 10408	-Excellent fruit quality -Good sized fruit through season	-Fewer fruits than some varieties	
Whitney			-Variable shapes

Table 3. Farmer comments on bell pepper varieties.

Authors

Alexandra Lyon

Chris Thoreau

Nicolas Buchheister

Katherine Cramer

Centre for Sustainable Food Systems at UBC Farm
University of British Columbia

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

For questions or additional data, please contact alexandra.lyon@ubc.ca.

Completed December 2019

Acknowledgements

We are deeply grateful to the farmer participants in the CANOVI project. We also thank our collaborators in the North American Variety Trial Network, especially Dr. Julie Dawson at the University of Wisconsin-Madison.

This research is also 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](#), and by The Bauta Family Initiative on Canadian Seed Security.

