Final report:
Chinese cabbage (loose-head type) (*Brassica rapa* ssp. *pekinensis*) variety trials

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Introduction:

The “OP Leafy greens variety trials'' was a pilot project coordinated by the Bauta Family Initiative on Canadian Seed Security in the spring and fall of 2014. The goal was to develop methodology and collect data on leafy green crop varieties of interest for Canadian organic market gardeners and seed producers through a participatory network of variety trials conducted on organic farms.

Leafy greens were identified as being a crop category of interest through an initial consultation with seed and vegetable producers engaged in projects with the Bauta Family Initiative on Canadian Seed Security. Some of the main reasons for selecting this crop category were:

- Heavy reliance on hybrid varieties, including the spinach variety “Tyee” that was being discontinued and the Chinese cabbage variety “Bilko F1” which was rumored to be on the verge of being discontinued.
- Interest in identifying reliable OP varieties for which seed could be produced by Canadian seed producers to increase Canadian seed security.
- Interest in identifying OP germplasm with resistance to bolting, particularly in the spring/summer and in hot conditions.
- Leafy greens typically have good nutritional qualities and high levels of beneficial secondary metabolites, vitamins, and minerals.
- Leafy greens are an important dietary component in the cuisines of many cultures and variety trials could help people identify and save seed from varieties that are culturally relevant to them and work to adapt it to their local growing conditions in Canada.

The final selection of crops and associated traits of interest identified for trialing were:

Spinach (*Spinacia oleracea*):

- Spring: heat tolerance, bolting resistance
- Fall: yield, flavour, cold tolerance, bolting resistance

Chinese cabbage, barrel-head or Napa type, (*Brassica rapa* ssp. *pekinensis*)

- Spring: heat tolerance, bolting resistance
- Fall: head quality (tightness), uniformity, cold tolerance, fungal disease tolerance (“melting”), bolting resistance

Chinese cabbage, loose head type, (*Brassica rapa* ssp. *pekinensis*)

- Fall: Screening trial for varieties of interest and cultural relevance. General interest in vigour, yield, appearance, flavour, and tolerance to local conditions.

In this report, we present the results of the Chinese cabbage, loose head type, (*Brassica rapa* ssp*. pekinensis*) variety trials

Trial design and methods

Trial site:

The loose head Chinese cabbage trial was conducted at Black Creek Community Farm, in North York, Ontario (Figure 1). It is a certified organic farm and also an urban agricultural centre that engages, educates and empowers diverse communities through sustainable food (www.blackcreekfarm.ca). The trial was for fall production.

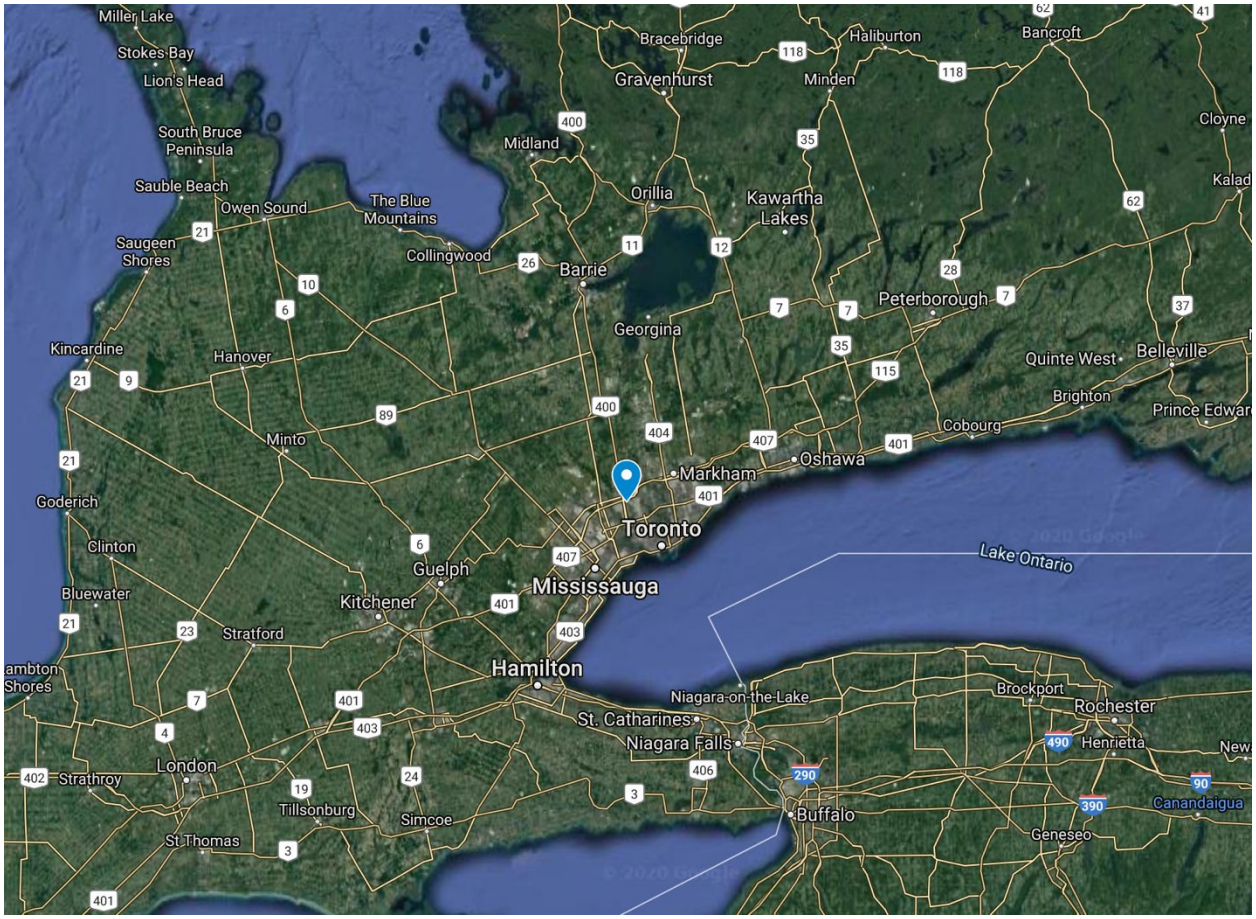

Figure 1: Loose head Chinese cabbage trial location, fall 2014.

Variety selection:

The trial manager searched a number of Canadian, American, and international seed companies or distributors for open-pollinated varieties of loose head Chinese cabbage available as certified organic (or in some cases untreated) seed. Priority was given to varieties from companies that are typically used as suppliers by Canadian organic farmers. The search was broadened to include small-scale Canadian, American, and International seed companies that may not be used by commercial market gardeners but are of interest because they carry varieties that are

not widely available. These varieties may contain traits of interest for adaptation to local conditions and organic cultivation. The full list of companies searched is in Appendix I).

The trial manager compiled an initial list of potential varieties for trialing. The producer conducting the trial chose a subset of varieties from the list for the trial, based on their own knowledge and interest, as well as the number of varieties they felt was manageable (Table 1). In this trial the goal was an exploration of the available germplasm and to identify culturally-relevant varieties for the producer, the farm, and the community they serve. As a result, this trial has no "reference" variety, and all the varieties in the trial are open-pollinated.

Table 1: Variety lists for each season and trial site.

Season (2014)	Variety name	OP/F1	Variety code	Source
Fall	Beka Santoh	OP	DDY-55	Kitazawa
	Tokyo Bekana	OP	HLZ-16	Kitazawa
	Chirimen Hakusai	OP	ERG-26	Kitazawa
	Vitamina	OP	VRR-92	Kitazawa
	White-Stemmed Pak Choi	OP	HVD-55	Southern Exposure

Seed distribution and blind trials:

Seeds were ordered, packaged in appropriate volumes for each trial, and distributed to the producer in a "trial kit". The trial kit included a booklet of instructions and data sheets, labelled stakes, a measuring tape, and an addressed envelope for returning the trial data (figure 2). Trials were "blind", meaning that the seed packets sent to the producer were identified by an alphanumeric code, rather than by the name of the variety. This reduces bias during the evaluation of the variety.

Figure 2 : Preparation of leafy greens trial kits.

Trial protocols:

The trial manager designed on-farm protocols and data sheets, with input from organic producers. Each variety in the trial was replicated, to account for differences in conditions that can occur within the bed. For each of three replicates, the varieties were laid out on the bed in a different order (randomized).

The trial was planted in a three-foot-wide bed, with three rows per bed and spacing of one foot between plants within rows. Each replicate had a total of 15 plants. Seedlings were started in a greenhouse and transplanted to the beds. Planting and transplanting dates, as well as other cultivation parameters were consistent with the methods used by the producer to grow Chinese cabbage crops. The producer collected both qualitative and quantitative data for a number of traits including germination, seedling emergence, growth habit, leaf type, yield, flavour, and bolting.

Seeds were planted in Peffer law medium in 128-plug trays on July 25th, 2014. Seedlings emerged by August 1st, and were transplanted on August 15th. The beds used had previously been fallow and were amended with farm-produced mixed vegetable compost. The soil type was Chinguacousy Clay Loam. There was no irrigation system. Plants reached maturity between the 10-19th of September. Most of the varieties did not bolt, but those that did bolted between October 20th and November 1st. Insect damage: Slug, cabbage moth, flea, aphids

Results:

Descriptions and overall ratings for the five varieties are presented in Table 2. Average head weight, as a proxy for yield, is presented in Figure 3.

Table 2: Descriptions and overall ratings (1-9, 1=worst, 9=best) for all traits evaluated, Fall 2014.

Trait	Chirimen Hakusai	Tokyo Bekana	Beka Santoh	White Stemmed Pak Choi	Vitamina
Overall (1-9)	7	7	7	5	5
Uniformity (1-9)	5	9	9	7	5
Fungal resis. (1-9)	5	9	9	7	7
Insect resis. (1-9)	9	9	9	9	9
Bolting date	October 20th - November 1st	Did not bolt	Did not bolt	Did not bolt	Did not bolt
Leaf colour	Very light yellow, almost neon lime green	Similar to Chirimen Hakusai, less bright neon, very light lime green	similar to Chirimen Hakusai, less bright neon, very light lime green	Light jade green	Medium green with slight yellow spots
leaf texture	Slight savoy, very short stem, very large leaf, very tender and soft, some stems broke	Medium savoy, ruffle entire leaf	Medium savoy, ruffle entire leaf	Smooth with slight ruffle	Smooth with slight ruffle
Leaf shape	Wide and round, short stem, slight rippled edge	Short, ruffle, oval, rippled edges	Short, ruffle, oval, rippled edges	Very tall and narrow, skinny stalks, oval, 2/3 stalk vs 1/3 leaf	Tall, Narrow and thin stalks with very wide leaves, 50/50 stalk/leaf
Flavour (1-9)	7	7	5	5	7
Flavour description	Very mild and sweet, delicate sweet, like lettuce with mustard, no spice	Leaves and stem most elasticity, nutty, butter, spicy, medium mustard flavour, not light, strong flavour right away	Similar to Tokyo Bekana, but less nutty and butter, leaves and stem most elasticity	Boring, a little bland, similar to Vitamina, less strong and pungent mustard flavour, boring	Not spicy, medium mustard, stronger Pak Choy flavour, similar strong tasting, loose leaf cabbages in East Asian cuisine, slightly pungent, bitter aftertaste
Texture description	Very tender, crunchy, buttery	Not tough, but slightly chewy leaves & stems. Rubbery but not bad, less crunchy	Same as (Tokyo Bekana), no discernible difference	Hard crunchy stem, soft crunchy leaves	Tender, slightly tougher & stringier than Chirimen Hakusai, crunchy & soft
Comments	Good size, beautiful colour, very marketable, good taste. Would grow for sale again.	Similar to Chirimen Hakusai, slightly smaller, more compact, good taste	Similar to Chirimen Hakusai and Tokyo Bekana	Similar to Vitamina. Would grow again if I had a culturally specific market	By the time they fill out and are heavy enough for harvest, they are too large for customer preferences

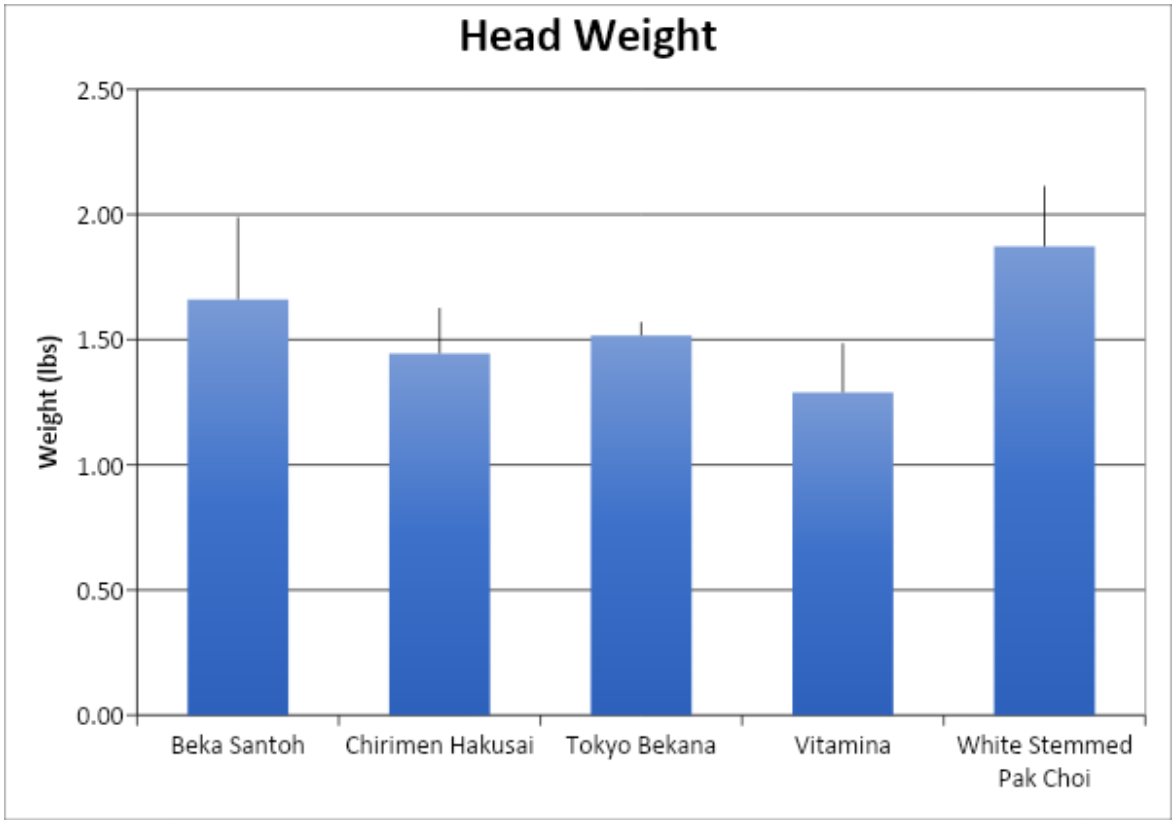

Figure 3: Average weight (lbs), of loose head varieties. Three heads were measured in each replicate. The value presented is the average value of the three replicates.

Discussion and conclusions

The grower had a preference for "Chirimen Hakusai" out of all the varieties, because it had a good size, nice colour, and was very marketable (Table 2), and expressed interest in growing it again. Bolting was not a significant problem for any of the varieties, there was only one variety that bolted (Chirimen Hakusai), and it occurred late in the season, after the time when the variety would normally be harvested. Tokyo Bekana and Beka Santoh also had high ratings and were noted to be very similar to Chirimen Hakusai. White stemmed pak choi had a lower rating, but was deemed to be interesting to grow again for a culturally specific market. Vitamina was also identified as interesting for a culturally-specific palate, but the plant was found to make heads that were too large for customer preference.

Overall, this trial allowed an exploration of loose head types of Chinese cabbage for basic agronomic performance and also for culturally specific preferences as experienced and identified by the grower conducting the trials.

Acknowledgments

We thank all the farmer participants who provided helpful information and feedback at different times during trial preparation, during the season, and after the trial. We thank all the farmer participants who conducted the trials and collected data on their farms. Thank you as

well to the Regional Coordinators of the Bauta Family Initiative on Canadian Seed Security who helped with implementing these trials in their respective regions. The presentation of the results was informed and inspired by the original report prepared by Gilberte Doelle, one of the participating producers.

Appendix: List of seed suppliers searched

Seed Company or Source	Location	Website
Vesey's Seeds	Prince Edward Island, Canada	veseys.com
Southern Exposure Seed Exchange	Virginia, USA	southernexposure.com
Adaptive seeds	Oregon, USA	adaptiveseeds.com
William Dam Seeds Ltd.	Ontario, Canada	damseeds.com
Stokes Seeds Ltd.	New Jersey, USA	stokeseeds.com
Ferme Coopérative Tourne-Sol	Quebec, Canada	boutique.fermetournesol.qc.ca
Seminova	Quebec, Canada	seminova.ca
West Coast Seeds	British Columbia, Canada	westcoastseeds.com
Stellar Seeds	British Columbia, Canada	bcecoseedcoop.com
Salt Spring Seeds	British Columbia, Canada	saltspringseeds.com
High Mowing Organic Seeds	Vermont, USA	highmowingseeds.com
Johnny's Selected Seeds	Maine, USA	johnnyseeds.com
Fedco Seeds	Maine, USA	fedcoseeds.com
Fruition Seeds	New York State, USA	fruitionseeds.com
Agrohaitai Ltd.	Ontario, Canada	agrohaitai.com
Kitazawa	California, USA	kitazawaseed.com
Park seed	South Carolina, USA	parkseed.com
Siskiyou seeds	Oregon, USA	siskiyouseeds.com
Solana seeds	Quebec, Canada	
Les jardins de l'écoumène	Quebec, Canada	ecoumene.com
Territorial Seed	Oregon, USA	territorialseed.com
Le potager d'un curieux	France	https://lepotagerduncurieux.fr/index.php?
Turtle Tree Seeds	New York State, USA	turtletreeseed.org
Restoration seeds	Oregon, USA	restorationseeds.com