

CANOVI Trial Brief

Heat-Tolerant Lettuce 2025

Executive summary: In 2025, CANOVI completed its third year of heat-tolerant lettuce variety trials on farms across Canada. Based on three years of national data ($n_{2023} = 53$, $n_{2024} = 37$, $n_{2025} = 37$), Magenta was once again the top-rated lettuce variety among growers, receiving some of the highest ratings for uniformity, marketability, flavour, bolt resistance, disease and pest resistance, and overall performance. While bolt resistance varied among different lettuce varieties, Magenta consistently showed strong resistance throughout the trial years. Although slightly less bolt-resistant than Magenta, varieties like Sangria, Bronze Beauty Arrowhead, and Biscia Rossa were also well-liked by growers.



Background: Leafy greens are a critical part of market gardens, with participants consistently ranking leafy greens as a high priority crop in need of breeding improvement. Given the challenges of climate change and increasing summer temperatures, this trial aims to evaluate lettuce varieties sourced from open-pollinated (OP) and regionally grown seeds for their ability to perform in the middle of the summer, specifically their tolerance to premature bolting and their ability to maintain other desirable qualities.

Varieties: We chose three market classes that had the fewest options for heat-tolerant varieties: Batavian, Butterhead, and Oak Leaf. Four varieties were selected for each market class. All varieties included were open-pollinated. Seeds of all varieties were grown in Canada, except Gentilina, which was grown in New York State within the same bioregion of southern Ontario and Quebec.

Results: Significant differences were identified among the 12 varieties across all agronomic traits. Magenta (Batavian from Saanich Organics) had the highest ratings for bolt resistance, disease and pest resistance, flavour, marketability, and overall performance, but it had a lower germination rate compared to other varieties (Fig. 1). Sangria (Butterhead from Salt Spring Seeds) and Bronze Beauty Arrowhead (Oak Leaf from Sage Gardens) were the best rated in overall performance within their market classes. Regional differences (East vs West) were observed for the overall variety performance, but both Magenta and

Bronze Beauty Arrowhead were the best in both regions. Uniformity, scorch resistance and bolt resistance were better scored in the West region.

In 2025, most farmers selected Magenta, Sangria and Biscia Rossa as the varieties they would grow again, within each of the corresponding market classes. Interestingly, 100% of the East growers responded that they would grow Bronze Beauty Arrowhead again, making it a stand out in the region, close in performance to Magenta.

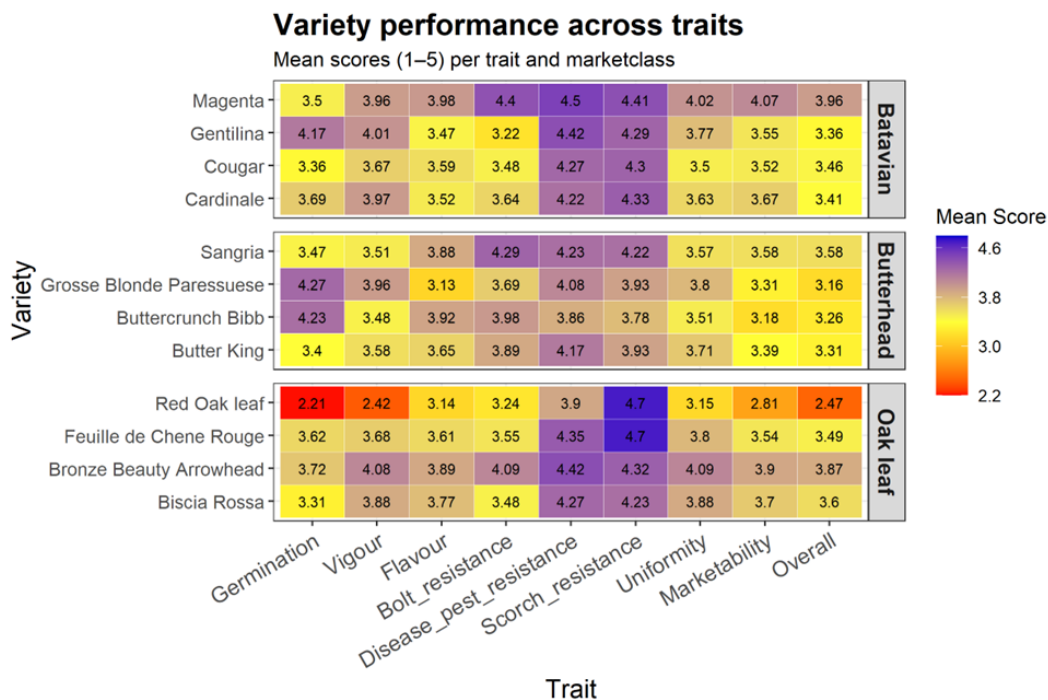


Figure 1. Variety means heatmap across variety and agronomic traits. Higher scores are represented in blue/purple, mid scores in yellow, and low scores (relative to the mean) are in red/orange. Scorch and disease and pest resistance means include 2024 and 2025 ratings only.

Takeaways and next steps: Over three years, Magenta was the strongest performing variety across agronomic traits, especially bolt resistance. Varieties showed variability in their germination, bolt resistance, and disease and pest resistance across different environments and years, which suggests that growers can adjust their lettuce selections based on their specific growing priorities, risk tolerance, and on-farm resources.

We encourage participants to [access SeedLinked to review](#) which lettuce varieties worked best in their specific regional climate and farming systems, with national data also available to act as a point of reference as needed.

More results can be found in the full report below.

Trial data analysis and report by Ambar Carvalho (UBC) and Michelle Dang (SeedChange). For more information, please visit seedsecurity.ca or email mdang@weseedchange.org.

CANOVI Full Report

Heat-Tolerant Lettuce 2025

1. TRIAL DESIGN

1.1. Participant Locations

In 2025, 50 participants across Canada (Fig. 1) participated in this trial with 36 completing the trial (78% completion). The University of British Columbia (UBC) acted as the mother site of this trial, planting three replicates of each variety as part of their trials. Over the three trial years (2023 through 2025), 79 unique farms completed the trial.



Figure 1. Map of lettuce trial participants across Canada from 2023 to 2025.

1.2. Lettuce varieties included in the trial

Table 1 shows the full list of the lettuce varieties included in this study and their agronomic and breeding history. The full breeding history of each variety can be found in Supplemental Table 1.

Table 1. Overview of the agronomic and breeding history of the lettuce varieties included in this study.

Market Class	Cultivar	DTM	Breeder	Seed Grower
Batavian	Cardinale	60	French Heirloom brought back to popularity by Frank Morton of Wild Garden Seeds	Greta's Family Gardens, ON
	Cougar	55	Frank Morton of Wild Garden Seed, an OSSl variety	Hawthorn Farm Organic Seeds, ON
	Gentilina	48	Heirloom adapted by Fruition	Fruition Seeds, NY, USA
	Magenta	50	No records on the breeding history but well documented online to be heat tolerant	Saanich Organics, BC
Butterhead	Buttercrunch Bibb	50	George Raleigh at Cornell University and an All-America Selection winner in 1963	Jardin de l'Écoumène, QC
	Butter King	60	AAFC in Ottawa in 1965	Thyme Again, ON

	Grosse Blonde Paressuese	55	Vilmorin, a French seed company, in the 1800's	Jardin de l'Écoumène, QC
	Sangria	55	Bred from Mereville des Quatre Saisons by Vilmorin in 1989, the PVP expired in 2009	Salt Spring Seeds, BC
Oak Leaf	Bronze Beauty Arrowhead Oakleaf	46	Introduced by the Germania Seed & Plant Co. in the 1940s	Sage Garden, MB
	Biscia Rossa	50	Italian heirloom, dates back to at least 1977	La société des plantes, QC
	Red Oak Leaf Alberta	60	Heirloom, breeder unknown	Wild Rose Heritage Seed Company, AB
	Red Oak Leaf Quebec	45	Heirloom, breeder unknown, dates back to the 1770s	Ferme Tournesol, QC

1.3. Planting

We asked participants to plant a minimum of 10 plants at approximately 8-12" spacing. In all regions, we recommended seeding in mid-May to early June for transplanting just after the summer solstice (June 21). Using these planting dates, varieties with 50-60 days to maturity are ready for harvest in mid-August. Participants used their usual organic methods for soil fertility and weed management.

1.4. Evaluation

Participants evaluated varieties using the desktop or mobile [SeedLinked app](#) for germination, vigour, bolt resistance in hot weather, scorch tolerance, uniformity, marketability, flavour, disease and pest resistance, and overall performance on a scale of 1 (low) to 5 (high). Compared to the previous year, appearance was removed as a variable for observation, and scorch tolerance and disease and pest resistance were added. We provided a rubric that defined the rating scale for each trait. Further planting and evaluation details are available in the [2025 Lettuce Trial Protocol](#) and [datasheet](#).

1.5. Data Analysis

Farmer ratings, photos, and reviews were available on the SeedLinked website immediately after trial closure. In addition, CANOVI researchers compiled the 2023, 2024, and 2025 lettuce data for statistical analysis and present results in this trial report.

2. RESULTS

2.1. Would you grow this again?

Farmers were asked to answer the question "Would you grow this variety again" at the end of year trial, based on their observations throughout the season. **Fig. 2** shows a summary of the 2025 responses, and **Fig. 3** shows the summary of responses per region. From these results, we highlight the following:

- **Magenta (84%), Sangria (74%), and Biscia Rossa (86%) were the top varieties within their market classes**, with Biscia Rossa being the most popular variety across all market classes.

- **Red Oak Leaf had the lowest percentage of farmers that would grow this variety again (38%)** which aligns with results from the previous two years' results.
- Compared to 2024, in 2025 there was an increase in the percentage of growers that would grow again Biscia Rossa (13%), and Feuille de Chene Rouge (17%), among others.
- Compared to 2024, there was a decrease in the percentage of growers that would grow again Magenta (-3%), Buttercrunch Bibb (-23%), Sangria (-5%), and Red Oak Leaf (-7%).
- 100% of the East region farmers responded they would grow Bronze Beauty Arrowhead, whereas only little less that 75% of farmers in the West region (**Fig. 3**).
- Feuille de Chene Rouge also had a higher percentage of farmers that would grow the variety again in the East region than the West region.

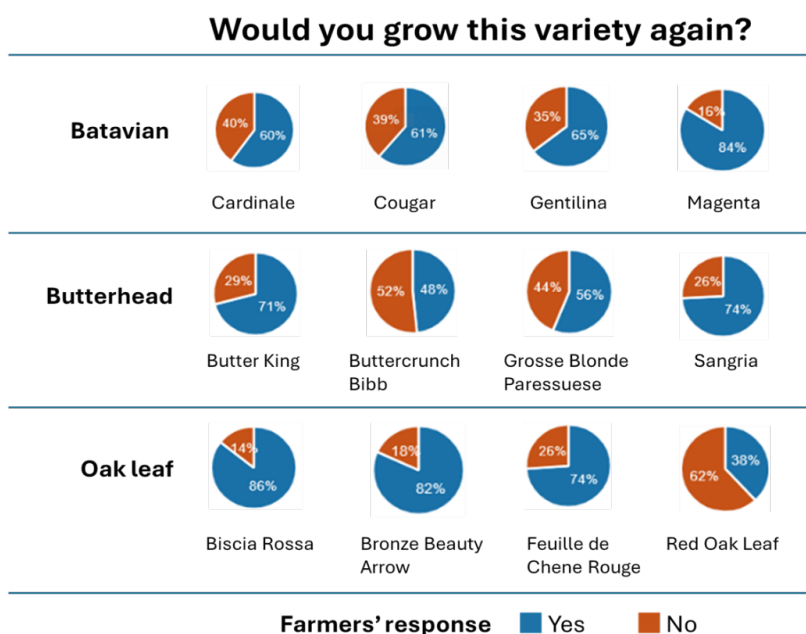


Figure 2. Pie chart summary per lettuce variety indicating the percentage of farmers that **would (blue)** or **would not (orange) grow** each variety again, split up by market class.

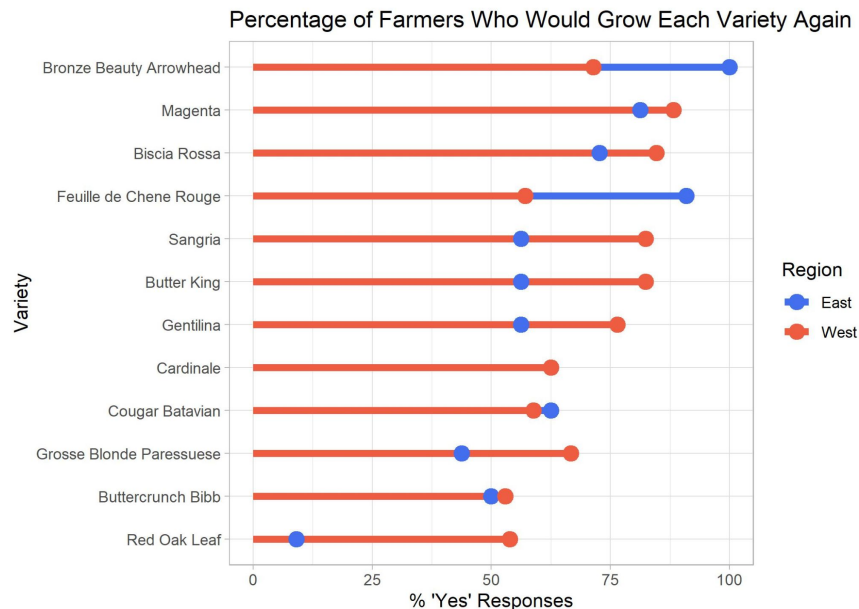


Figure 3. Lollipop type plot showcasing the farmers' preferences of varieties they would grow again comparing responses between the West and East regions. The red lines and dots represent the farmers in the West region, and the blue lines and dots the ones in the East region.

2.2. Main effects on variety performance

The significance level results of the analysis of variance (ANOVA) are presented in **Table 2**. This type of analysis evaluates the effects of each factor in the variety performances. The factors included in the model include variety, year, variety by year interaction, hardiness zone, variety by hardiness zone interaction, and region. The region factor grouped participants by East coast (Ontario, Quebec, Nova Scotia, and Prince Edward Island) versus West coast (e.g., Alberta, British Columbia, and Saskatchewan).

From this analysis, we highlight the following:

- **Variety and year both had a significant effect** in all the evaluated traits with the exception of disease and pest resistance. This means there were significant variations among varieties for these traits, as well as differences within varieties between years.
- **Hardiness zone had a significant effect** in the variation of most traits with the exception of vigour and overall performance. This could be due to the weather and soil differences among hardiness zones, as well as a low statistical power as there were variations in the number of growers in specific hardiness zones.
- **Region was a significant source of variation** only for one trait: **scorch resistance**. This may be attributed to regional climate differences, affecting the variety performance between the East and West Coast.

- The variety by year interaction effect was a significant source of variation for germination and vigour only. Read more about this in section 2.4.
- Finally, the interaction between variety and hardiness was not a significant source of variation for any of the evaluated traits.

Table 2. Significance levels from ANOVA analysis for variety, year, hardiness zone, regions, and their interaction across traits. This included data collected across 79 unique farms across three years (2023-2025).

Trait	Germination	Vigour	Flavour	Bolt resistance	Disease & Pest resistance	Scorch resistance	Uniformity	Marketability	Overall
Variety	***	***	***	***	--	***	***	***	***
Year	*	*	--	*	--	***	**	***	*
Hardiness Zone	**	--	**	**	*	**	*	***	--
Region	--	--	--	--	--	*	--	--	--
Variety x Year	***	**	--	--	--	--	--	--	--
Variety x Hardiness	--	--	--	--	--	--	--	--	--

Significance levels are based on the p-values of the F-tests. *** p<=0.001, ** p<=0.01, * p<=0.05, -- Not significant

2.3. Varietal performance

When comparing the performance of individual varieties to each other, there were significant differences between varieties across agronomic traits between 2023 and 2025 (**Table 1** and **Fig. 4**). Some highlights include:

- **Magenta performed significantly better** than other varieties for bolt resistance, uniformity, marketability, flavour, disease and pest resistance, and for overall performance.
- The top varieties for each market class were **Magenta, Sangria, and Bronze Beauty Arrowhead** (Batavian, Butterhead, and Red Oak Leaf respectively)
- Red Oak Leaf was the worst rated for most traits, with exception for scorch resistance, across years.

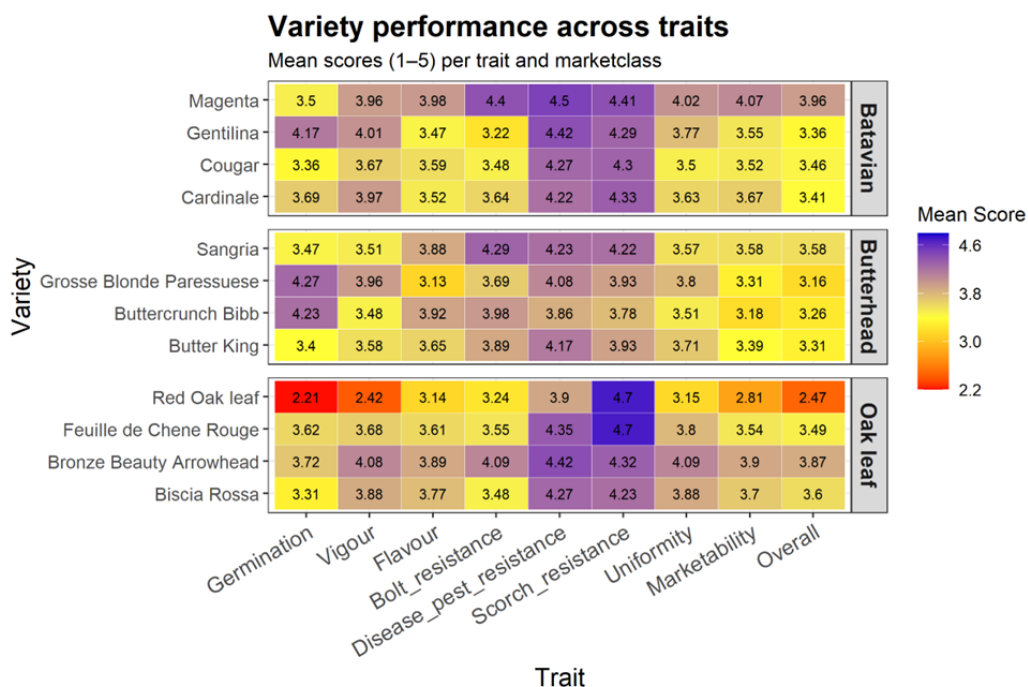


Figure 4. Variety means heatmap across variety and agronomic traits. Higher scores are represented in blue/purple, mid scores in yellow, and low scores (relative to the mean) are in red/orange. Scorch and disease and pest resistance means include 2024 and 2025 ratings only.

2.4. Variety by Year interaction

To understand how stable the varieties performed between years, we evaluated the interaction between variety and year. By estimating variety yearly means, we are able to compare each variety to each other between years. Figures 5, 6, and 7 showcase those interactions within each market class.

Cross-over interactions, meaning varying performance for specific varieties across years, between variety and year were observed for germination, vigour, uniformity, marketability, and overall performance.

- **Germination:** An improvement of germination was observed for Butter King from 2023 to 2024 and 2025 (Fig. 5A). Red Oak Leaf Alberta, on the contrary, had a significant decline in germination scores. Similar results were observed for vigour, Butter King had higher scores in 2024 and 2025 compared to 2023, while Red Oak Leaf Alberta worsened over time.

Variations in germination could be due to different varieties having varying levels of heat-tolerance during the germination stage of this trial across the years. Although we asked growers to germinate their lettuce just before the peak summer heat, many regions across Canada are facing increasingly warmer and/or erratic temperatures earlier in the season. This premature heat could be affecting lettuce germination, especially given that lettuce is a cool weather crop. Variations in germination could be due to the different systems farmers use to germinate their seed, as well as differences between seed lots between years.

- **Flavor:** a scalar interaction was the predominant effect of year in the scores (Fig. 5C). This means that most varieties had a similar change over time. Overall, flavour scores slightly improved in 2024 and decreased in 2025.
- **Bolt resistance:** Similarly, there was a mainly scalar interaction effect for bolt resistance scores across years (Fig. 6A). A slight decrease in the scores was observed between 2023 and 2025, with a subsequent increase in 2025. Biscia Rossa and Bronze Beauty Arrowhead had a decrease in score from 2023 to 2024 and 2024 to 2025.
- **Disease and pest resistance and scorch resistance:** both had a scalar interaction between 2023 and 2024 (Fig. 6B and 6C). Overall, all varieties scored better in 2024 when compared to 2023 for both traits.
- **Uniformity:** Cross-over interactions were observed for crop uniformity, with significant variation across varieties and years within the butterhead market class (Fig. 7A). For example, Butter king had the lowest score in 2023, but the highest in 2025, whereas Grosse Blonde Paressuese had the highest score in 2023 and the lowest score in 2025.
- **Overall performance:** The overall variety performance also showed cross-over interactions between variety and year, but the best performing varieties remained the same for each market class, those being Magenta (Batavian), Sangria (Butterhead) and Bronze Beauty Arrowhead (Oak leaf) (Fig. 7C).

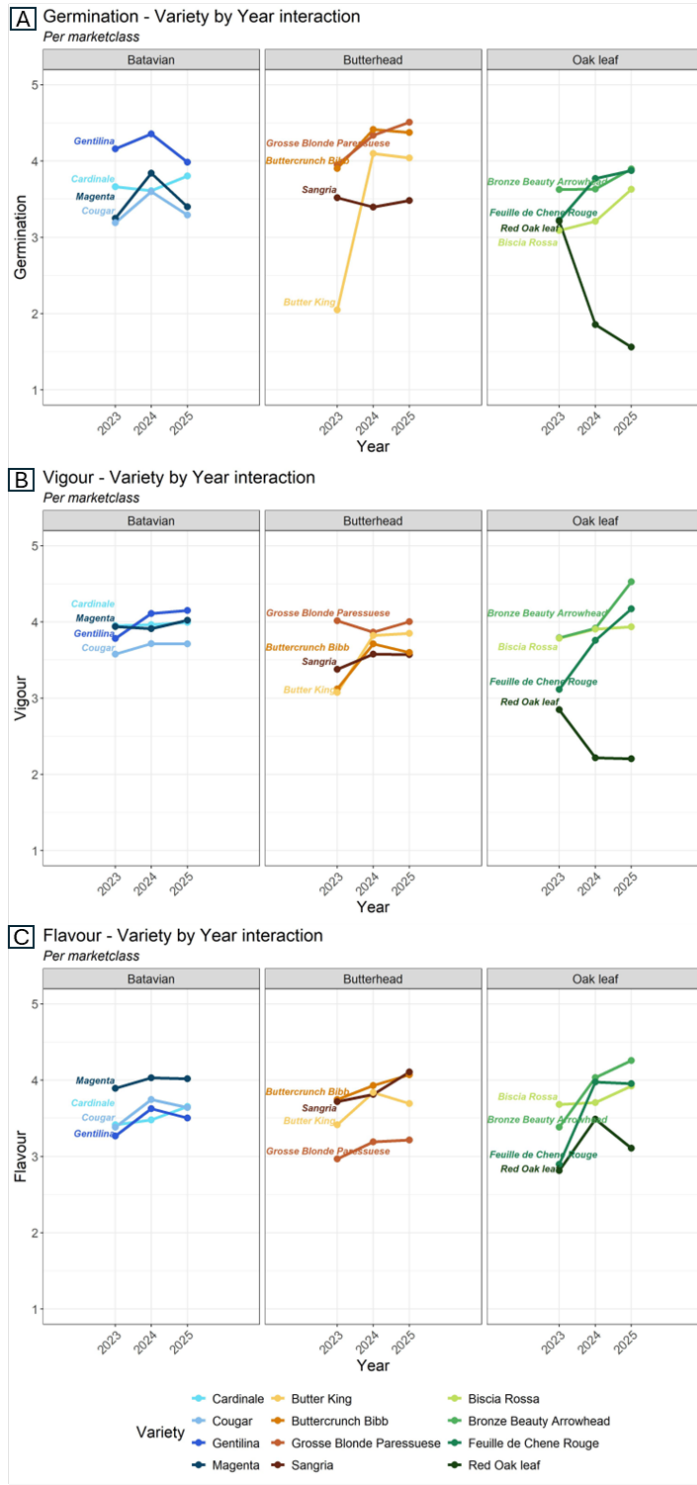


Figure 5. Variety by year interaction plots for A: Germination, B: Vigour, and C: Flavour.

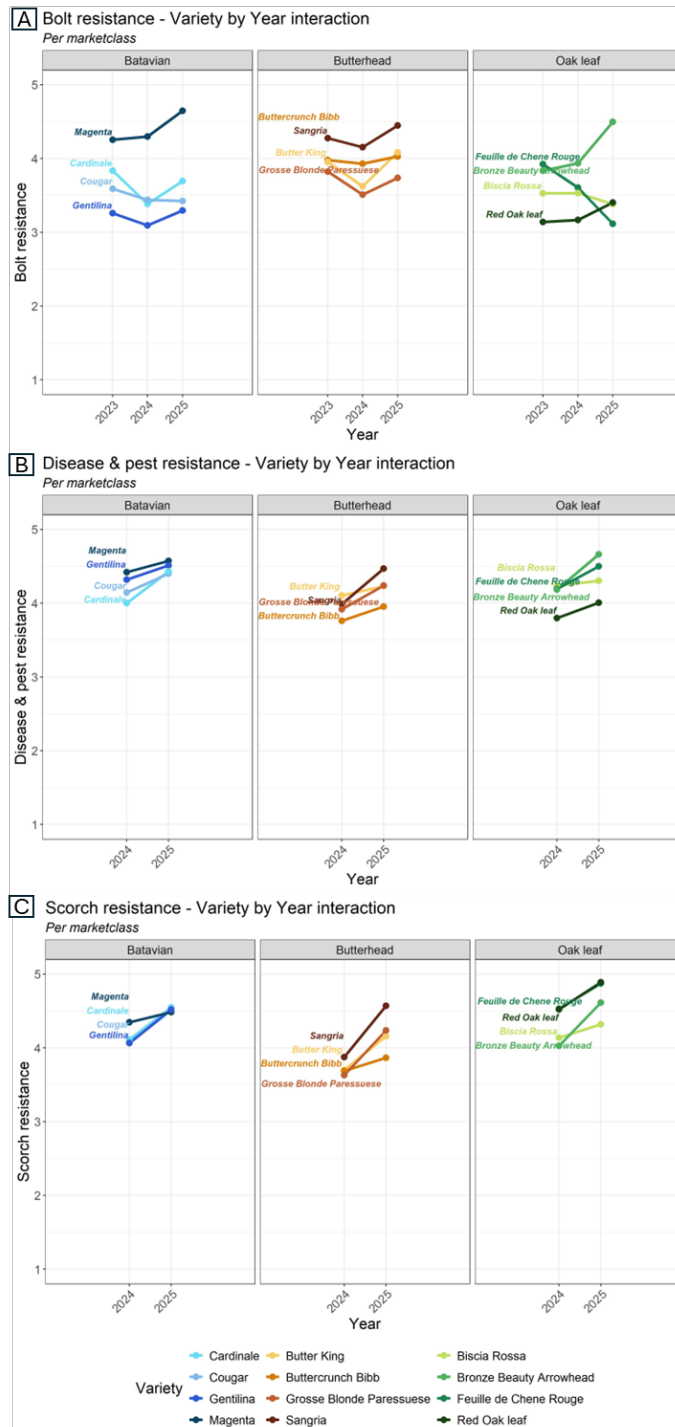


Figure 6. Variety by year interaction plots for A: Bolt resistance, B: Disease and pest resistance, and C: Scorch resistance.

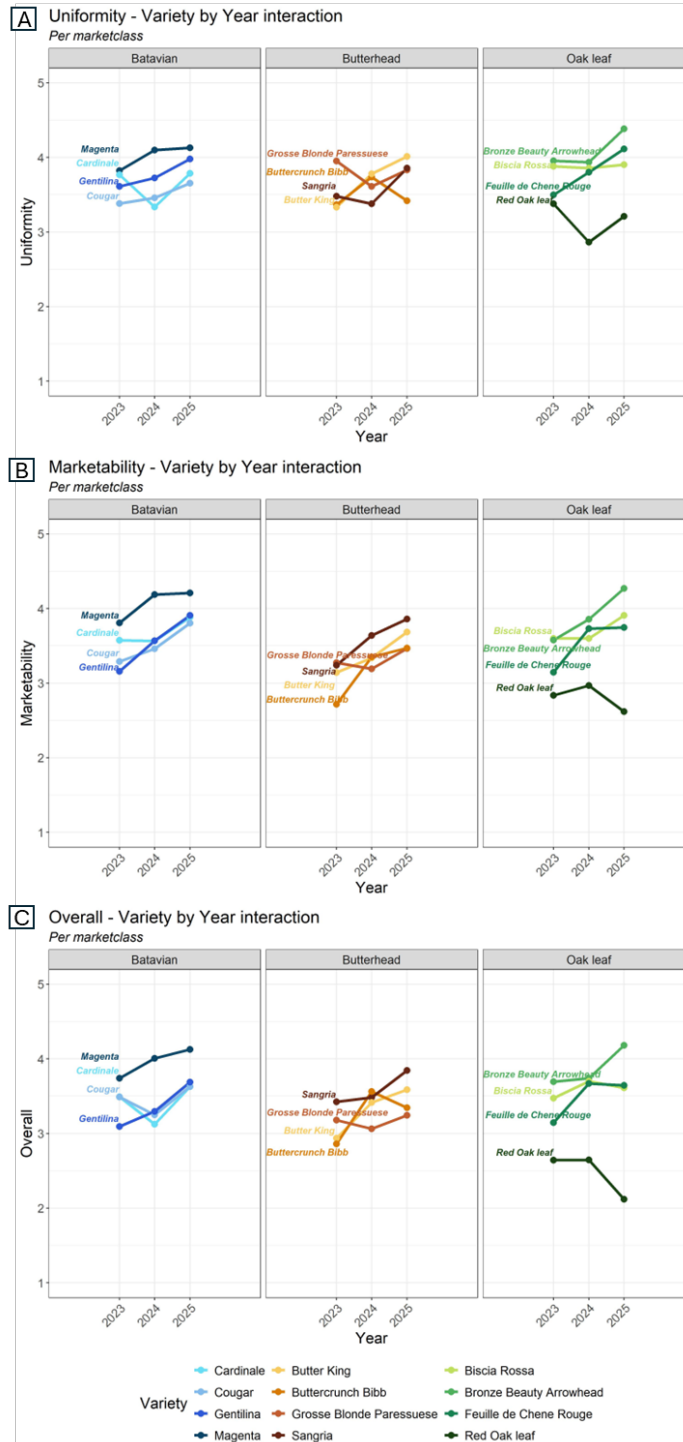


Figure 7. Variety by year interaction plots for A: Uniformity, B: Marketability, and C: Overall performance.

2.5. Variety performance variability among environments

In the first year of the CANOVI heat-tolerance lettuce trials, growers reported variable experiences with seed germination and bolt resistance across climate conditions that potentially influenced the success and data accuracy of their variety trials. Growers also mentioned variable experiences with disease and pest resistance in 2023, which encouraged us to include this trait in the 2024 and 2025 trials. To understand the variability experienced by growers, in addition to calculating overall means, we present this data using violin plots to understand how much they may potentially vary across climate conditions.

The variability of germination ratings across varieties is presented in **Fig. 8** with data from 2023, 2024, and 2025.

- Varieties with ratings concentrated near 4 and 5, like **Gentilina, Buttercrunch Bibb, and Grosse Blond Paresseuse**, suggest that they have high and stable germination rates across various growing conditions. These varieties would be good options for growers who prioritize high germination rates, or those who need reliable germination because of sub-optimal growing conditions (e.g., have poor germination conditions, limited space).
- Varieties with a highly variable spread of ratings, like Cougar, Butter King, Sangria, and Biscia Rossa, suggest that they have unstable germination rates across different growing environments. These varieties would work well for growers who like them, and are able to adapt their environmental conditions as needed to achieve their target germination rate.
- **Red Oak Leaf from Alberta** has consistently low germination as shown by most of its ratings concentrating near 1, suggesting that the low germination is a result of the genotype.

The variability of bolt resistance is presented in **Fig. 9**, and regional differences can be observed in **Fig. 10**.

- Varieties like **Magenta, Buttercrunch Bibb, Sangria, and Bronze Beauty Arrowhead** have ratings that concentrate near 4 and 5, suggesting that these varieties **can withstand bolting in a wide range of growing conditions**. Growers who grow lettuce under conditions that can lead to premature bolting, like extreme heat and drought, may benefit from growing these varieties to achieve a harvest.
- **Varieties with variable ratings, like Cougar, Gentilina, and Red Oak Leaf, indicate unstable bolt resistance** performance across growing conditions.
- Overall, most varieties had higher ratings in the West region than the East region, with the exception of Magenta, which saw improved scores in the East region.
- The variety rank based on the bolt resistance scores was similar between the West and East regions.

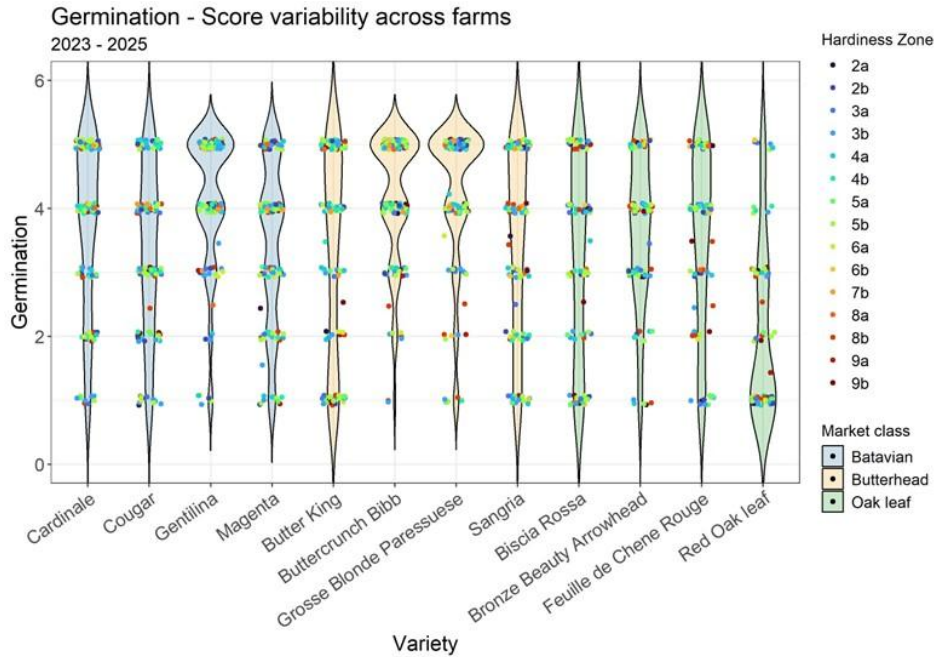


Figure 8. Violin plot showcasing the germination variability among farms and hardiness zones. Each dot represents a single farm in a given year (2023 through 2025).

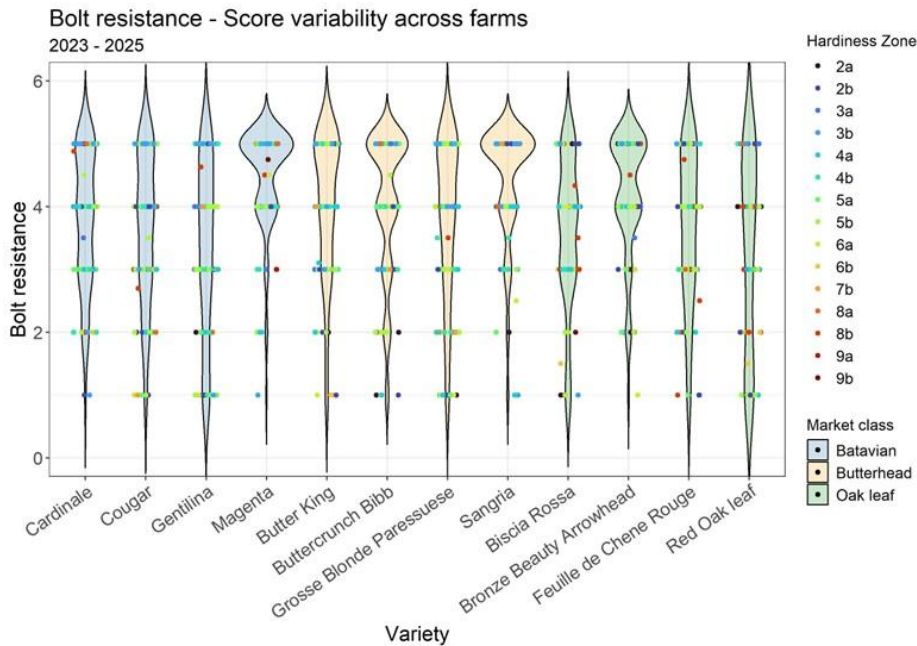


Figure 9. Violin plot showcasing the bolt resistance variability among farms and hardiness zones. Each dot represents a single farm in a given year (2023 through 2025).

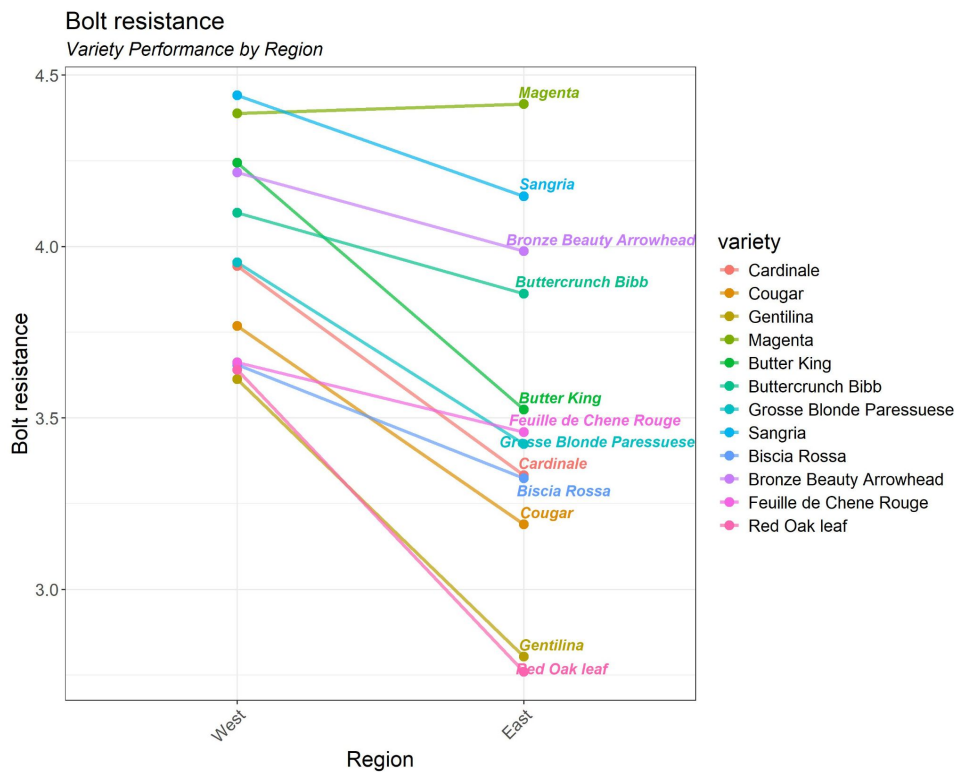


Figure 10. Bolt resistance varietal performance comparing West and East regions' mean scores between 2023 and 2025 evaluations.

The **variability of disease and pest resistance** is presented in **Fig. 11**, and regional differences can be observed in **Fig. 12**.

- Most varieties have a similar disease and pest resistance rating distribution.
- Within the Batavian market class, all varieties showed a similar rating distribution with ratings concentrating between 4 and 5.
- Within the Butterhead market class, most varieties showed a wider rate distribution, showcasing more variability than other varieties.
- Within the Oak leaf market class, Feuille de Chene Rouge showed the most stability across farms when compared to the other varieties.
- Qualitative observations about pest issues are also summarized in Table 3. Although not officially recorded, **many growers dropped out of the trial or reported crop failure because deer ate their lettuce, highlighting the need for mammal protection when growing lettuce.**

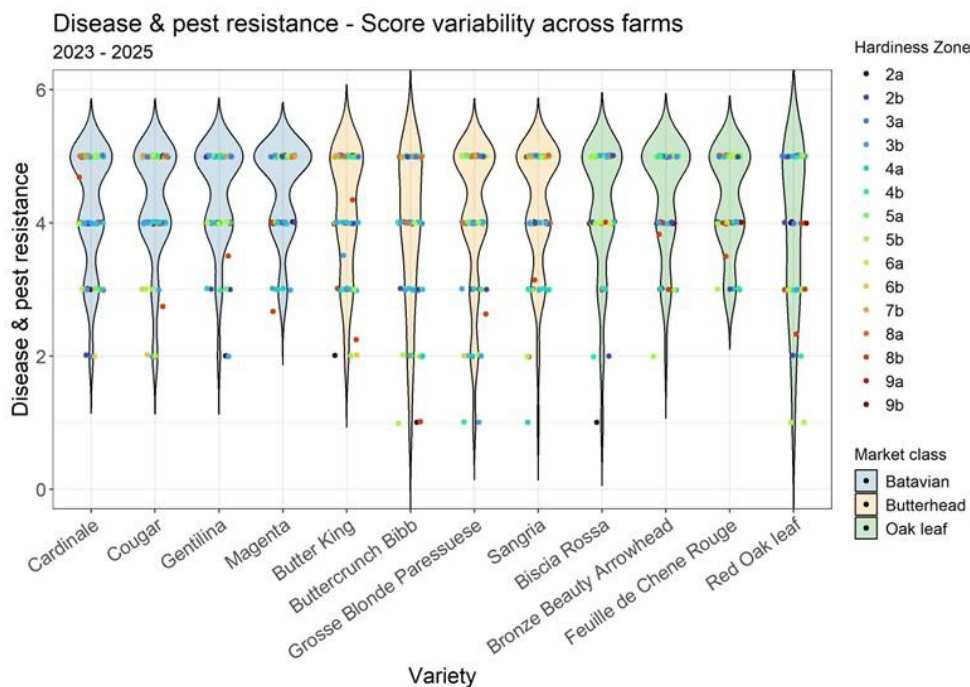


Figure 11. Disease and pest resistance varietal performance comparing West and East regions' mean scores between 2023 and 2025 evaluations.

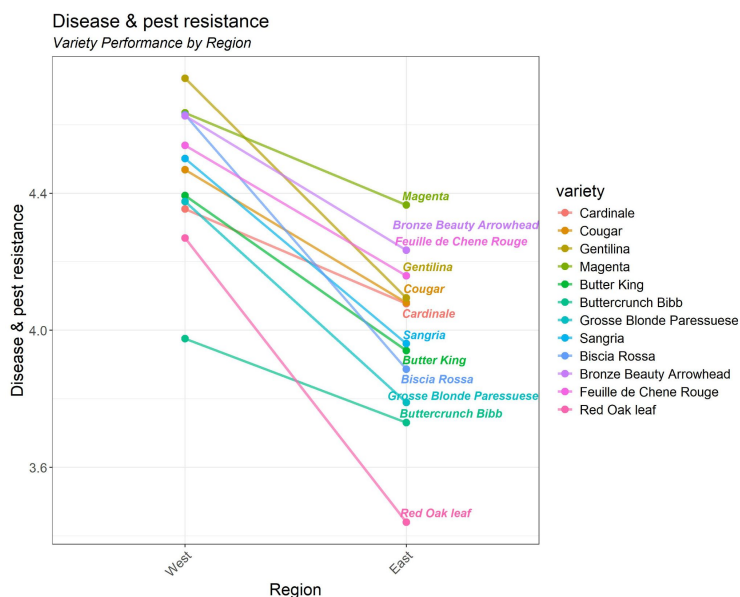


Figure 12. Disease and pest resistance varietal performance comparing West and East regions' mean scores between 2023 and 2025 evaluations.

The variability of scorch resistance is presented in Fig. 13.

- Feuille de Chene Rouge and Red Oak leaf had the strongest and least variability in scorch resistance, with concentrated ratings at score 5.
- For farmers that have observed an increase of scorching in their lettuce production, Feuille de Chene Rouge could be a good option to incorporate in their systems, specially given that this variety performed consistently well in most traits (see **Fig. 3**)
- Most other varieties showed a wide range of ratings, indicating high response variability across environments.

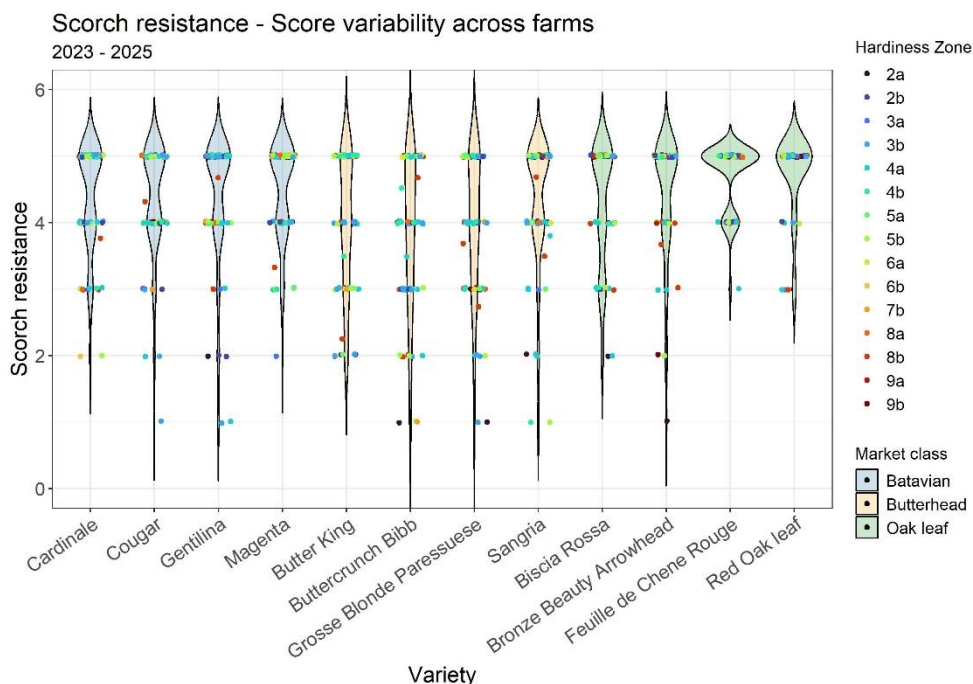


Figure 13. Violin plot showcasing the scorch resistance variability among farms and hardiness zones. Each dot represents a single farm in a given year (2023 through 2025).

2.6. Growers' observations and comments

Participants submitted various comments on individual lettuce varieties, climate conditions, and trial experience via SeedLinked, email communications, exit-survey results and conversations with regional coordinators. A summary of thoughts, observations, and experiences with specific varieties in relation to agronomic traits can be seen in **Table 3** or on SeedLinked.

For varieties that growers liked but bolted or got heat-scorched before harvest, growers mentioned that they would harvest those heads early or harvest those varieties for cut lettuce in the future.

Table 3. Summary table of growers' comments from the 2025 lettuce variety trial related to varietal performance. These observations only consider opinions from growers who did submit comments, and not growers who did not submit comments. Observations were included if at least 3 growers mentioned the same experience and/or opinion, although some unique individual observations were included and explicitly labeled as such.

Variety	Disease and Pest Resistance	Flavour	Bolt resistance	Overall
Cardinale	Plants held up well even with high insect pressure	Bland and not very sweet, somewhat bitter	Variable, some very resistant to bolting, others saw high susceptibility,	Good overall performance, but not very uniform
Cougar	Very little insect damage	Solid flavour	Resisted bolting, but lost sweetness earlier	Great looking and good overall, but not a stand out.
Gentilina	Very little insect damage	Somewhat bitter and tough, good when young. Others said good crunchiness.	Was the first to bolt.	Good size but bolted quite quickly.
Magenta	Great insect resistance	Some growers loved it, others found it a bit tough	Didn't bolt even at large size	Beautiful; bolt resistant
Buttercrunch Bibb	Little insect damage. One grower observed rot and tip burn.	Great flavour and crunch	Mixed reviews, two growers mentioned no bolting, one grower was disappointed	Ugly but delicious, decent vigour and good size
Butter King	No insect issues. Some brown spots and leaves and tip burn observed	Creamy texture, although some bitter after taste	Good resistance, started bolting after reaching large size. Some scorching observed	Ordinary, too much tip burn damage.
Grosse Blonde Paresseuse	Mixed reports of disease resistance	Mixed sweet/bitter flavour.	Decent bolting resistance, started bolting after reaching large size.	Decent variety, slow to grow, bad flavour lowers overall performance.
Sangria	No insect or disease damage reported	Nice flavour, not too sweet	Very good resistance to bolting, held up longer than other varieties	Looks great, uniform size
Bronze Beauty Arrowhead	No insect or disease damage reported	Very good, close to Magenta	No reports	Excellent variety, second best of the trial, beautiful
Biscia Rossa	Very little insect damage, one farmer reported complete crop loss after transplant due to disease	Good crunch and taste	Early bolter	Good looking lettuce, good size and very uniform
Red Oak Leaf Alberta	No insect damage, one report of powdery mildew	Tough and bitter	Early bolter	Terrible germination, poor performance overall
Red Oak Leaf Quebec	No disease or pests issues	Good flavour and crunch	Not as good as others, bolted earlier	Vigorous, good size, fast growing, good overall.

2.7. UBC Organic Farm results

UBC Organic Farm Mother Site

In the 2025 UBC trial, the first round of lettuce seedling was successful with the exception of Red Oak Leaf Alberta, which had very low germination. Red Oak leaf was re-seeded two weeks later, but the germination was low again, which meant this variety was ultimately not included in the field trial.

Even though some varieties were identified to have bolting issues according to the nationwide results, **none of the varieties had bolting issues at UBC farm in the three trial years. This is likely due to UBC having very mild weather and consistent irrigation. Butter King and Sangria had the highest overall performance ratings, with Sangria as a close second, similar to what was obtained nationwide.**

3. Supplemental Materials

3.1. Supplemental Tables

Supplemental Table 1. Breeding histories of lettuce varieties included in the CANOVI Heat-tolerant variety trial in 2023, 2024, and 2025.

Variety	Breeding history
Butter King 	The Canadian Journal of Plant Science reported on the development of Butter King in 1967 (Vol. 47). It was bred at the Central Experimental Farm Research Station in Ottawa from an Israeli variety, Rinat Hakfar. Three of the most vigorous plants that were also the slowest to bolt and to develop tipburn comprised the initial selection. Rigid selection in seed plots was continued for 4 years to eliminate variability in several traits and produce this remarkably uniform strain. Butter King was awarded the Bronze Medal in the 1964 All-American Selections open trial-ground competition and was introduced commercially in 1965 in the US and Canada. References: • cucurbitbreeding.wordpress.ncsu.edu/2016/06/02/lettuce-a-l/ • cdnsiencepub.com/doi/pdf/10.4141/cjps67-081
Grosse Blonde Paresseuse 	Grosse Blonde Paresseuse translates to The Big Lazy Blonde and is also known as Cuirassière blonde de Nonpareille, Very Large Yellow Paresseuse, and Large White Stone Summer Lettuce. The variety was introduced by Vilmorin in France and dates back to at least 1854. It was noted in variety trials in the late 1800's as well adapted to summer culture. References: • plus.lapresse.ca/screens/f2ebf65b-7edc-4ff5-8de7-89bbebf2d5f0%7C_0.html • horticultural-history.blogspot.com/2017/04/1885-e-l-sturtevant-lettuce-lettuce-and.html • tile.loc.gov/storage-services/public/gdcmassbookdig/descriptiondespl00vilm/descriptiondespl00vilm.pdf

Sangria 	Sangria was bred by Vilmorin from the variety Merveille des quatre Saison in 1987. According to the USDA PVP certificate issued to Vilmorin, the variety was bred to create a Butterhead type that was not only resistant to Bremia and LMV (Lettuce Mosaic Virus) but also much more resistant to heat than the parent variety. Sangria was released in the market in 1989 and the PVP expired in 2010. References: • apps.ams.usda.gov/cms/adobeimages/008900182.pdf • www.ams.usda.gov/sites/default/files/media/2016%20PVPO%20Application%20Status%20Report.pdf
Buttercrunch Bibb 	Buttercrunch Bibb was developed by George Raleigh at Cornell University in the late 1950's to early 1960s. It was a 1963 All-America Selection <i>Edible Vegetable</i> winner, which mentioned that this variety holds well under stress and has good bolt resistance. It was the first Cornell-bred crop variety to win this award. Buttercrunch Bibb was listed as a recommended home vegetable garden variety in Michigan State University Extension Bulletin E-760a in 1983, and in University of Minnesota Agricultural Extension Service Fact Sheet #104 in 1981. References: • cucurbitbreeding.wordpress.ncsu.edu/2016/06/02/lettuce-a-l/ • all-america-selections.org/product/lettuce-buttercrunch/ • conservancy.umn.edu/bitstream/handle/11299/207251/MN2000_FSY_104.pdf?sequence=1&isAllowed=y • archive.lib.msu.edu/DMC/Ag.%20Ext.%202007-Chelsie/PDF/e760arev5.pdf • www.seedquest.com/News/releases/usa/Universities/n3904.htm
Magenta 	We found no records on the breeding history of Magenta though it is well documented online to be heat tolerant.

Bronze Beauty Oak Leaf 	Bronze Beauty, also known as Bronze Beauty Arrowhead, was introduced by Germania Seed and Plant Co. It was an AAS bronze winner in 1947. It is not registered in the UPOV or <i>EU Common Catalogue Information System</i> databases for seed. References: • https://shop.seedsavers.org/bronze-arrowhead-lettuce • https://all-americaelections.org/product/lettuce-bronze-beauty/
Feuille de chene rouge and Red Oak Leaf 	The rather generic variety Red Oak Leaf does not seem to have much available breeding history information. Multiple websites, including the US National Gardening Association, date the oak leaf lettuce variety back to Vilmorin in 1771. References: • garden.org/plants/view/92473/Lettuce-Lactuca-sativa-Oakleaf/
Biscia Rossa 	Biscia Rossa translates to Red Snake. It is referenced in many places as an Italian heirloom variety and listed in the EU Seeds database where it is registered by Assosementi. It dates back to at least 1977. It is also known as, Rossa a foglia riccia da taglio (Red curly leaf for cutting). References: • www.sementi.it/documenti/registri/ITA-ortive/ortive-03.pdf • ec.europa.eu/food/plant-variety-portal/index.shtml
Cardinale 	Cardinale is noted in many places online as a French heirloom but has no details about its breeding or development history. It is listed in the EU Seed Database as registered (but surrendered) to Gautier Seeds in France. It is not listed in the UPOV database. Cardinale is not listed by Seed Savers Exchange. Seeds of Diversity Canada lists it but with no historical info. This variety is a non-heading variety, in contrast to the variety Head Cardinale, which was bred from Cardinale by Frank Morton and is carried by many North

	American small seed companies. References • https://osseeds.org/ossi_variety/head_cardinal/ • https://ec.europa.eu/food/plant-variety-portal/index.xhtmll
Gentilina 	This variety of Gentilina came from Fruition Seeds who have been growing it for over 10 years. The variety is described in several places as originating from Northern Italy. Franchi Seeds in Italy refers to Gentilina as a lettuce <i>type</i> (lettuce with large loose leaf with frilly leaves), and sells it under the variety name Grand Rapids, a popular looseleaf. As a result, Gentilina and Grand Rapids may have the same or similar histories. References: • franchisementi.it/?s=gentilina&post_type=product&type_aws=true • www.fruitionseeds.com/shop/vegetables/lettuce/organic-gentilina-lettuce/ • www.theheirloomseedstore.com/product/lettuce-lattuga-gentilina • ruthreichl.com/wp-content/uploads/2013/12/index1.php • issuu.com/italseeds/docs/email_franchi_seeds_of_italy_catalogue_2024
Cougar Batavian 	The variety Cougar Batavian is an OSSSI-plledged variety selected by Frank Morton. Its origin is described as an errant seedling in a flat of unrelated lettuce. It appears to be one of our Batavian types crossed to 'Brown Goldring.' This is distinct from the variety Cougar bred by Jodi Grossen of Seminis-Genecorp, described as a Romaine with dark green colored leaves, leaf surface moderately blistered, tall, wide long leaves. References • cucurbitbreeding.wordpress.ncsu.edu/2016/06/02/lettuce-a-l/ • cucurbitbreeding.wordpress.ncsu.edu/files/2016/04/vegetable-cultivar-descriptions-for-north-america-list-26-2002.pdf • osseeds.org/ossi_variety/cougar-batavian-2/ • hawthornfarm.ca/products/copy-of-cougar?_pos=1&_sid=aa85bfe5d&_ss=r

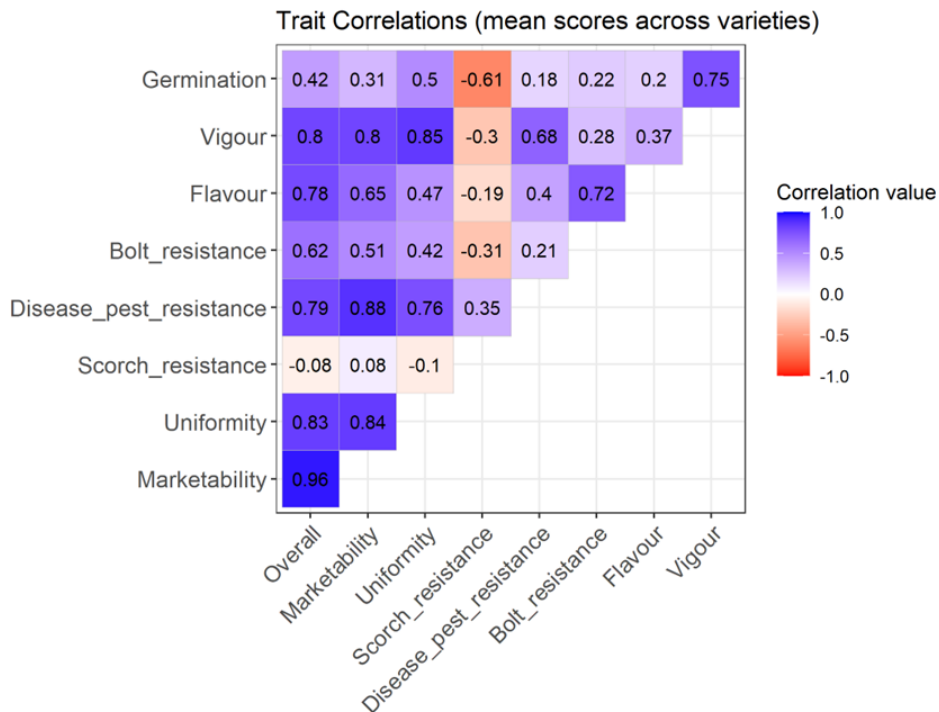
Supplemental Table 2. 2025 trait means for 12 lettuce varieties grown across 37 farms in Canada in 2025.

Market class	Variety	G e r m i n a t i o n	V i g o u r	F l a v o u r	B o l t r e s i s t a n c e	D i s e a s e & p e s t r e s i s t a n c e	S c o r c h r e s i s t a n c e	U n i f o r m i t y	M a r k e t a b i l i t y	O v e r a l l
Batavian	Cardinale	3.80	3.98	3.60	3.70	4.50	4.43	3.75	3.77	3.54
	Cougar	3.31	3.71	3.58	3.44	4.47	4.41	3.60	3.68	3.54
	Gentilina	4.01	4.16	3.44	3.33	4.58	4.40	3.93	3.82	3.61
	Magenta	3.43	4.02	3.97	4.63	4.64	4.37	4.08	4.11	4.04
Butterhead	Butter King	4.07	3.84	3.64	4.09	4.30	4.05	3.97	3.60	3.52
	Buttercrunch Bibb	4.39	3.59	4.02	4.01	4.02	3.75	3.38	3.35	3.27
	Grosse Blonde Paresseuse	4.53	4.01	3.15	3.75	4.31	4.12	3.79	3.37	3.17
	Sangria	3.52	3.57	4.06	4.44	4.54	4.45	3.83	3.77	3.76
Oak leaf	Biscia Rossa	3.61	3.90	3.87	3.38	4.37	4.20	3.84	3.79	3.52
	Bronze Beauty Arrowhead	3.93	4.48	4.21	4.50	4.73	4.49	4.33	4.15	4.10
	Feuille de Chene Rouge	3.87	4.14	3.90	3.12	4.57	4.75	4.06	3.63	3.55
	Red Oak Leaf	1.57	2.18	3.07	3.39	4.08	4.77	3.16	2.50	2.02

Supplemental Table 3. 2023 - 2025 East and West regional average ratings per evaluated trait

Trait	East	West
Bolt resistance	3.52 b	3.97 a
Disease and pest resistance	3.99 b	4.45 a
Flavour	3.70 a	3.55 a
Germination	3.66 a	3.50 a
Marketability	3.56 a	3.48 a
Overall	3.46 a	3.36 a
Scorch resistance	3.99 b	4.53 a
Uniformity	3.59 a	3.81 a
Vigour	3.78 a	3.59 a

3.2. Supplemental Figures



Supp. Figure 1. Correlation matrix between agronomic traits of 2023-2025 nationwide lettuce trial data. Blue colors indicate a positive correlation and red colors a negative correlation between any two traits. The associated values (known as r-values) indicate the strength and directionality of the correlation. Higher values indicate that two traits change strongly together, while lower values indicate that two traits change weakly or not at all with each other.