

Models for Estimating Cold Hardiness of ‘Sweetheart’ and ‘Lapins’ Sweet Cherry in the Okanagan Valley

Farm Adaptation Innovator Program – Research Factsheet

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Background

Suitable growing conditions for sweet cherry establishment are expanding in the Okanagan Valley as a result of climate change and orchards are being established further north and at higher elevations than ever before. With crop expansion into more extreme growing sites, and as climate change predicts greater weather variability and extremes, there is concern for an increased risk of flower bud cold damage from the fall to spring.

Flower bud cold damage can reduce fruit yield and quality. Up until now, no frost management decision support tools based on location specific modelling for Okanagan cherry growers have been available.



Project Objectives

- Develop models that can be used to predict the temperatures that cause 10%, 50% and 90% flower bud damage in ‘Sweetheart’ and ‘Lapins’ sweet cherry flower buds from the fall to spring in the Okanagan Valley
- Validate these models with data that were not included in model development and to areas outside of its development location
- Create an open access frost management decision support tool from the models’ predictions

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Modelling Cold Hardiness

Data used in the models:

- Seven seasons of 'Sweetheart' and four seasons of 'Lapins' flower bud cold hardiness measurements from orchards in Summerland, BC
- Daily temperature

Variables used to predict cold hardiness:

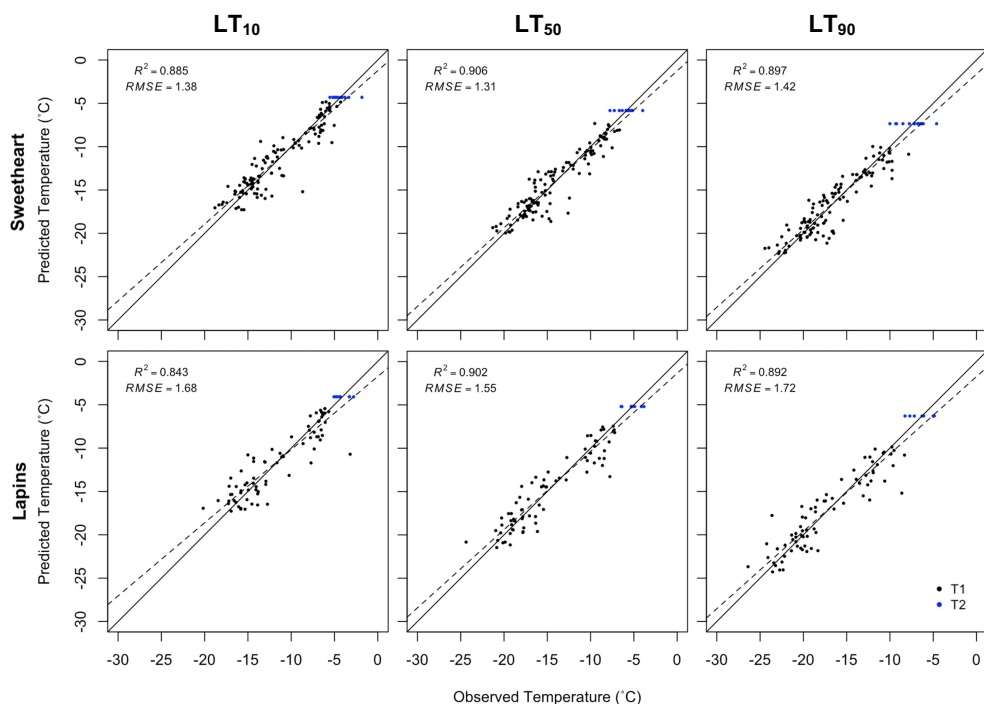
- Mean temperature from up to three days prior
- Accumulated chilling and forcing units

Model predictions:

- **LT₁₀**: the temperature that causes lethal damage to 10% of flower buds
- **LT₅₀**: the temperature that causes lethal damage to 50% of flower buds
- **LT₉₀**: the temperature that causes lethal damage to 90% of flower buds

Model structure:

- To improve model fit in the spring, when flower buds rapidly lose cold hardiness, models were split into two time periods: T1 - fall to late winter and T2 - spring



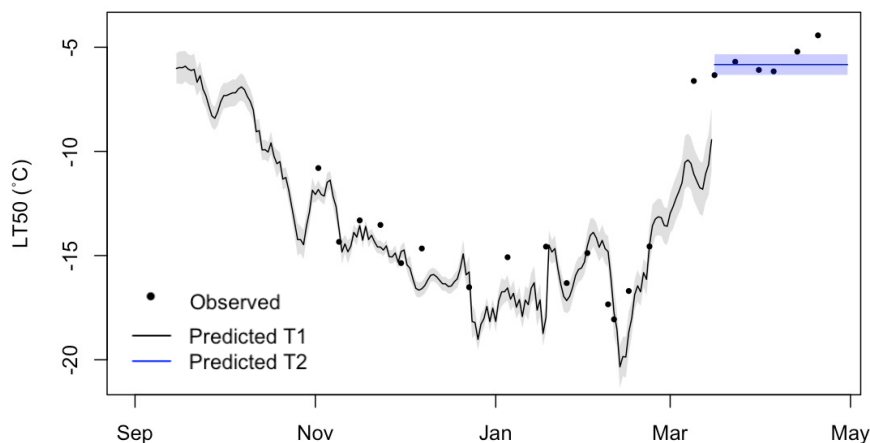
Model Evaluation

Plotting the models' predicted lethal temperatures against the actual lethal temperatures that were measured shows excellent agreement between predicted and observed LT₁₀, LT₅₀, and LT₉₀ for both 'Sweetheart' and 'Lapins'.

Model Validation

In general, the models did a good job predicting lethal temperatures when compared to years of data not used in model development and to several locations within Summerland, BC. However, caution must be taken when using this model to predict spring lethal temperatures as limited data were available for model development during this period.

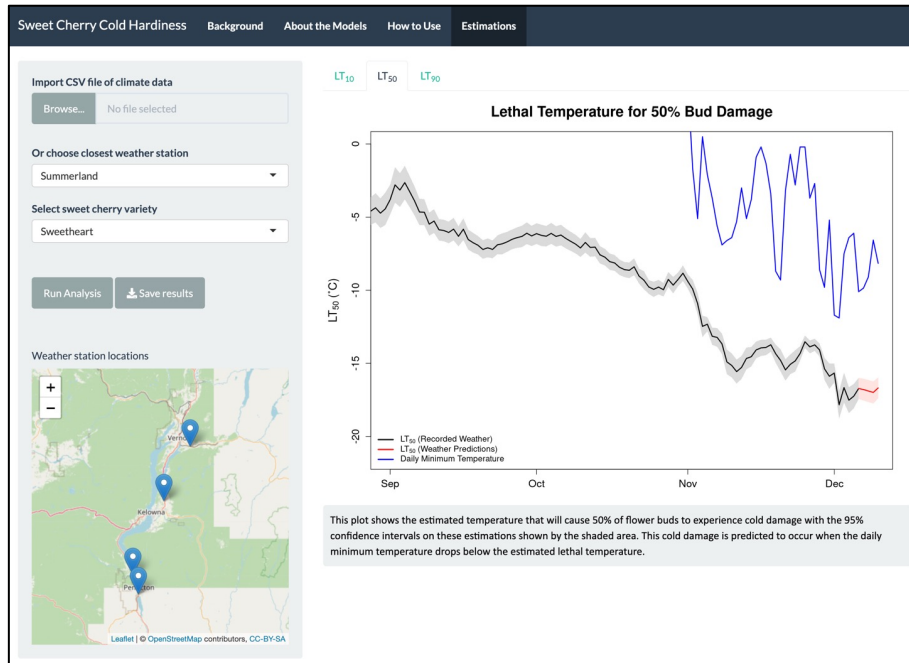
LT₅₀ Model Validation



Model validation example: Graph comparing the 'Sweetheart' model's predicted LT₅₀ temperatures to observed LT₅₀ temperatures for an orchard located in Summerland, BC

Predicting Sweet Cherry Cold Hardiness

The cold hardiness predictive models for 'Sweetheart' and 'Lapins' flower buds LT_{10} , LT_{50} , and LT_{90} throughout the fall to spring season can be used to aid in frost management decision making. These models can be accessed online at: sweetcherry.shinyapps.io/cherrycoldhardiness



Open access website application for sweet cherry cold hardiness predictive models that can be used to aid in frost management decision making. These models are applicable to the cultivars 'Sweetheart' and 'Lapins'. Application to other cultivars has not been validated. Cold hardiness can vary widely within and between orchards in the Okanagan Valley. Users are encouraged to seek advice from the appropriate experts if they do not feel certain about the predictions made using these models.

For more information

Follow these links for additional information on related topics:

Fruit tree low temperature stress:

<http://treefruit.wsu.edu/web-article/environmental-stress/>

Climate change adaptation strategies and projects in the Okanagan region:

<https://bcclimatchangeadaptation.ca/regional-adaptation/okanagan/>

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