Canadian Agri-Science Cluster for Horticulture 2

Progress Report December 2014

Activity 3, Apple 2
Improving Tree Fruit Storage Management Using Weather Based Predictions of Fruit Quality at Harvest

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Activity Objectives

- Create an inventory of data from the industry and previous projects on apple fruit quality at harvest (i.e. firmness, soluble solids content, starch index, internal ethylene concentration and/or titratable acidity) and physiological storage disorders after harvest of major cultivars;
- Acquire additional data on apple fruit quality and physiological storage disorders of major cultivars;
- Evaluate existing bioclimatic models of apple fruit quality and physiological storage disorders and develop/update additional ones;
- Implement the bioclimatic models in the weather-based computer system CIPRA (Computer Centre for Agricultural Pest Forecasting) in order to provide timely information and to obtain rapid feedback from the apple fruit industry.

Research Progress to Date

Inventory of data: Data on fruit quality at harvest (firmness and starch index) from commercial orchards were obtained for 7 cultivars ('Cortland', 'Empire', 'Gala', 'Honeycrisp', 'McIntosh', 'Redcort', and 'Spartan') from 2000 to 2013 in 12 sites in Quebec. At least 80 datasets (years-sites) were available for each of these cultivars. Furthermore, fruit quality data at harvest (firmness, soluble solids content, and titratable acidity) for 'Gala' and 'Ambrosia' cultivars were recently obtained from experimental orchards in British Columbia.

New data on fruit quality and physiological disorders: 'Honeycrisp' apples were harvested in Quebec and Ontario during the growing seasons of 2013 and 2014. These apples were sent to Simcoe (ON) to be placed in storage after taking standard fruit quality measurements. Boxes of apples are being removed from storage on a monthly basis to make quality assessment. The main objective is to obtain additional

data on the evolution in time of physiological storage disorders, such as soft scald, soggy breakdown, and CO_2 injury. Obtaining such data will help improve our understanding of the impact of weather (i.e. temperature and rainfall) at specific phenological phases of fruit development. Furthermore, 'McIntosh' apples were also harvested during the growing season of 2014 to complete previous studies on the impact of weather on the risks of low temperature disorders development in storage, with the specific objective of predicting when the disorder will occur during storage.

Evaluation of bioclimatic models: Bioclimatic models to predict risks of low temperature disorders (i.e. vascular browning) in 'McIntosh' and risks of superficial scald in 'Cortland' were already implemented in CIPRA. For some regions of southern Quebec, the model for low temperature disorders predicted an intermediate risk for the growing season of 2014. Apple producers of these regions were informed to take appropriate measures accordingly.

Bioclimatic model implementation: A bioclimatic model that predicts 'McIntosh' apple firmness at harvest, expressed as a function of weather and fruit phenological stages, was implemented in CIPRA. Preliminary evaluations of this model were made for the cultivar 'McIntosh' using data from commercial orchards in Quebec. Also, models to predict risks of soft scald and soggy breakdown development for 'Honeycrisp' apples in storage will be implemented in CIPRA before the next growing season (2015).

Early Outcomes (if any) or Challenges
A bioclimatic model to predict apple firmness at harvest is already implemented in CIPRA. The ones for soft scald and soggy breakdown will be implemented before the next growing season (2015). A scientific publication for the soggy breakdown model was submitted recently.
One of the major challenges in this project is to evaluate of the bioclimatic models for fruit quality at harvest and in storage, using data from commercial orchards and multiple cultivars. The observed variability in fruit quality parameters between orchards and within orchards is quite high. We are looking for mathematical approaches that will help managing this variability in commercial orchards.

Key Message(s)
In this project, bioclimatic models of apple quality at harvest and in storage will be updated or developed based on historical data and on new information obtained during the project. All models will be integrated in the CIPRA (Computer Centre for Agricultural Pest Forecasting) software and made available to the Canadian apple industry.

CIPRA - Apple
Low temperature breakdown