CLIMATE CHANGE ADAPTATION PROGRAM

Postharvest Deficit Irrigation for Improved Resilience of Sweet Cherry to Climate Change

Farm Adaptation Innovator Program – Research Factsheet

Louise Nelson[1], Kirsten Bevandick[2], Elizabeth Houghton[2], Kirsten Hannam[3], Denise Neilsen[3], Julien Picault[4]

PhD student Elizabeth Houghton downloading soil moisture content measurements from a cherry orchard experiencing different levels of postharvest deficit irrigation

Geographic Applicability	This study was completed at a range of elevations and latitudes in the Okanagan Valley, but findings may apply to stone fruit grown in other regions of BC
Commodity Relevance	This study was conducted on 'Sweetheart' sweet cherry but findings may apply to other varieties and other stone fruit
Timeline	2019-2022

[1]Professor Emerita, Biology Department, University of British Columbia, Okanagan Campus, Kelowna
[2]Graduate Student, Biology Department, University of British Columbia, Okanagan Campus, Kelowna
[3]Research Scientist, Agriculture and Agri-food Canada, Summerland Research and Development Centre, Summerland
[4]Professor of Teaching, Economics, University of British Columbia, Okanagan Campus, Kelowna

The purpose of this project was to investigate the overall impacts of postharvest deficit irrigation (PDI) on sweet cherry in five Okanagan orchards. This study builds on earlier research investigating PDI in sweet cherry in the Okanagan and other semi-arid fruit growing regions in the world.

This research supported the development of a cost benefit analysis for adopting PDI in the Okanagan and a sweet cherry cold hardiness predictive model used to develop an open access frost management decision support tool.

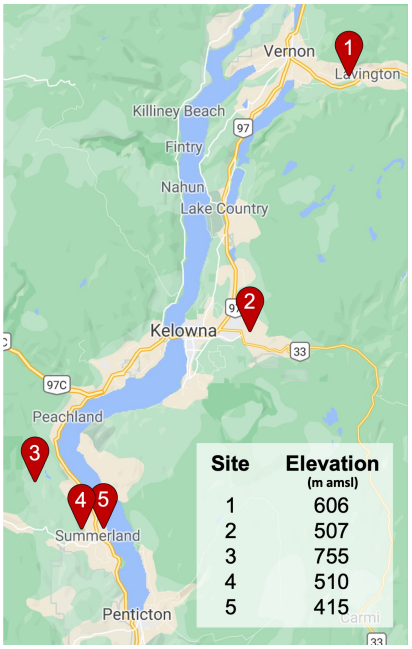
Study Objectives

- Determine the effects of two levels of postharvest deficit irrigation (27-33% and 47-52% decrease in water volume) on sweet cherry:
  - Plant water stress
  - Photosynthesis
  - Fruit yield and quality (pre/post storage)
  - Tree growth
  - Flower bud spring phenology
  - Flower bud cold hardiness
  - Soil moisture and gas exchange
- Determine the costs and benefits of adopting postharvest deficit irrigation in Okanagan orchards

Study Design

This study was conducted in five Okanagan orchards. Three treatments were applied at each site:

a) Full irrigation
b) 30% postharvest irrigation reduction
c) 50% postharvest irrigation reduction



Site	Elevation (m amsl)
1	606
2	507
3	755
4	510
5	415

Six replicates of each treatment were applied in 2019, 2020, and 2021. Plant water stress, photosynthesis, fruit yield and quality, tree and vegetative growth, flower bud phenology and cold hardiness, and soil moisture were measured each year after the treatments were applied. Soil gas exchange was also determined for two years after treatment application.

Limitations

This study was conducted in five commercial cherry orchards ranging in age (established 2006-2017) over three seasons. Therefore, there was variability between and within site replications. As well, long-term compounding effects of water stress were not determined.

Next Steps

This research indicates that growers can likely reduce irrigation after harvest in most orchards without negatively affecting cherry tree function and fruit yield and quality. It also highlights that a more user-friendly threshold for cherry tree water requirements needs to be established.

Key Findings

- Overall, PDI (27-33% and 47-52%) had no effect on:
  - Preharvest plant water stress (measured using stem water potential) and photosynthesis the season following PDI application
  - Tree growth (tree cross sectional area, new wood pruning weight, leaf area)
  - Fruit yield and quality, both at harvest time and after storage
  - Flower bud spring phenology or cold hardiness
- Overall, during PDI application, trees experienced slightly more water stress and decreased photosynthesis when compared to full irrigation. However, no effect of PDI was observed in the season following application.
- Adopting PDI in Okanagan cherry orchards has many benefits, including water saved for agricultural, non-agricultural, and ecosystem demands, and few costs. PDI adaptation will be increasingly beneficial in years of drought.

Climate Adaptation Implications

Reducing postharvest irrigation by 50 % saved an estimated 838,000 L ha^{-1} $year^{-1}$ of water compared to full irrigation in 2020 and 2021. Adapting PDI could help improve cherry orchard resilience to climate change and help conserve water, as an increase in future water demands in the Okanagan Valley is projected.

Definitions

Postharvest deficit irrigation (PDI): apply reduced amounts of water during the non fruit-bearing stage after harvest, a time when fruiting trees are less sensitive to water stress

Stem water potential: The potential for water movement from one part of the plant to another, often used as a reference water stress indicator in fruit trees

Cold hardiness: A plant's ability to tolerate cold temperatures, it is typically measured as the lowest temperature a plant can experience before experiencing irreversible damage

For more information

Follow these links for additional information on related topics:

Previous project investigating the effects of PDI on Okanagan cherry orchards:

https://bcfoodweb.ca/sites/default/files/res_files/FI12-2018-factsheet-Postharvest-Deficit-Irrigation.pdf

https://bcclimatechangeadaptation.ca/wp-content/uploads/2022/Resources/FI12-Expanding-Cherry-Production-BC-Climate-Change-2018-report.pdf

Climate change adaptation strategies and projects in the Okanagan region:

https://bcclimatechangeadaptation.ca/regional-adaptation/okanagan/

Sweet cherry production in BC:

https://www.bctfpg.ca/

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