BC FoodWeb

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RESEARCH SUMMARY

Reducing post-harvest irrigation in sweet cherry production

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Production Type
- Tree fruit

Practice Benefit(s)
- Reduced irrigation and water use

Research Location
- Okanagan Valley, BC

KEY TAKEAWAYS

- **Post-harvest watering** of 'Sweetheart' cherry trees was **reduced by 30% and 50%** with **no negative effects** on fruit quality and yield, timing of flower bud development, or flower bud cold hardiness over three years.

Key Terms:
- *Flower bud cold hardiness: the coldest temperature that a flower bud can withstand without being damaged.*

Figure 1. 'Sweetheart' cherries. Photo by Elizabeth Houghton.

HOW CAN THIS RESEARCH BE USED?

- 'Sweetheart' cherry growers can experiment with **reducing their post-harvest watering by 30-50%** (volumetrically), compared to their standard practices.
- Growers should continue to **monitor** the effects of water reductions on their crops, as results may be unique to each orchard.

WHY WAS THIS RESEARCH DONE?

Our objective was to investigate whether reducing post-harvest irrigation in 'Sweetheart' cherry orchards would negatively affect fruit quality, yield, the timing of flower bud development, or flower bud cold hardiness.

The Okanagan Valley is one of the main production areas for sweet cherry in Canada, alongside other high-value tree fruits and wine grapes. Irrigation strategies that improve water-use efficiency while safeguarding crop yield and quality need to be evaluated to improve agricultural climate resiliency in the face of increasingly likely water restrictions.

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Agricultural production in arid and semi-arid areas, such as the Okanagan, relies on a sufficient supply of water for irrigation. However, these areas, which already have low annual precipitation, are expected to become drier and hotter with climate change. Agricultural water restrictions have become increasingly common across western North America as a result of droughts, reduced winter snow accumulation, and earlier snow melts.

Previous studies have shown that reducing irrigation post-harvest did not negatively affect fruit yield or quality for apricot, Japanese plum, peach, and sweet cherry. However, there has been limited research on the impact of water reductions on flower bud development and cold hardiness, factors that directly impact fruit yield and quality. If flower bud cold hardiness is weakened, buds can be killed or damaged by frost in the winter. Similarly, if flower bud development occurs too early in the season, buds can be killed or damaged by cold snaps in the spring. Changes in the timing of flower development can also affect the flower's synchronization with pollinator activity, which is critical for fruit development.

Figure 2. The four seasons at a sweet cherry orchard from this study. Photos by Elizabeth Houghton.

WHAT WAS THE OUTCOME?

In the seasons following post-harvest water reduction during this three-year study, **we found that reducing the volume of water applied after harvest by 30% and 50% had no negative effects on fruit quality and yield (Figure 4), the timing of flower bud development, or flower bud cold hardiness.** The traits did however vary between sites due to site-specific factors such as latitude, longitude, elevation, temperature, and establishment year.

Reducing irrigation after harvest did not negatively affect any of the fruit qualities we measured including fruit firmness, size, colour, sugar content, acidity, and stem pull force (the force required to pull the stem off the fruit).

Figure 3. Sorting cherries by colour and size. © University of British Columbia (Okanagan), CC BY-SA 4.0 DEED

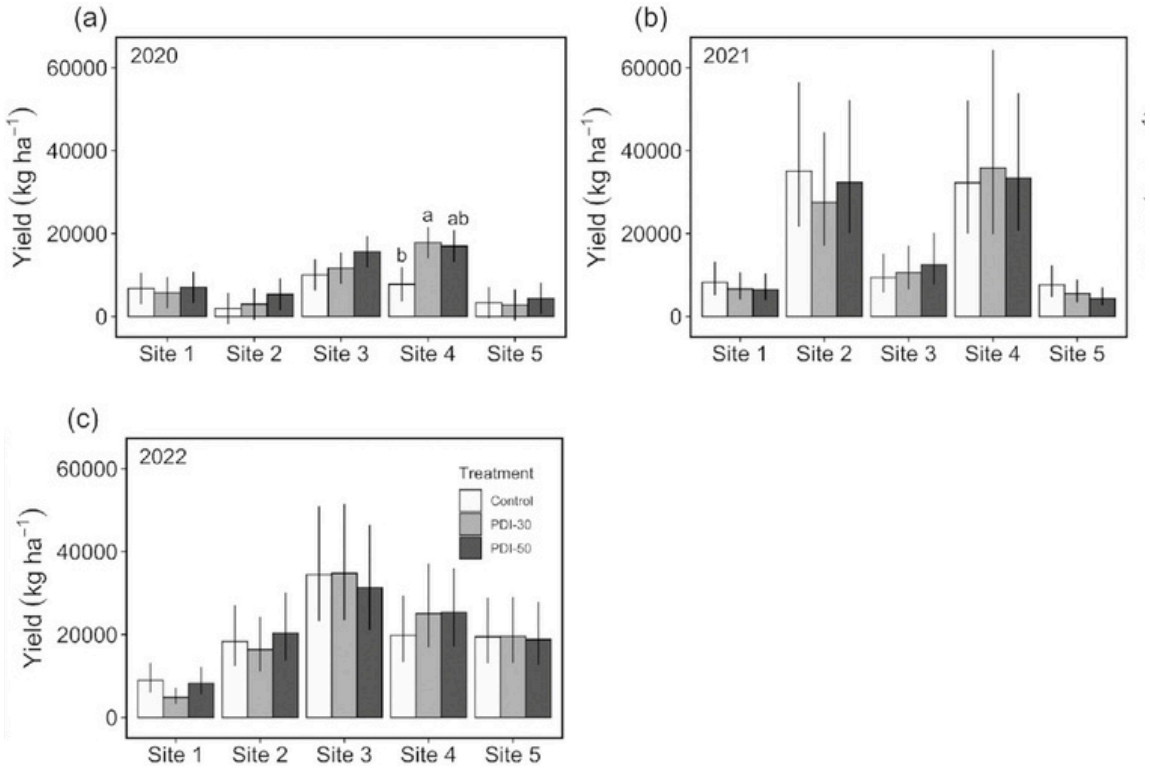

Figure 4. Average fruit yield (kg/ha) by year *(a)* 2020, *(b)* 2021, *(c)* 2022. Yield was only affected by treatment in 2020 at site 4, where yield was higher in the 30% deficit plots compared to control plots (full irrigation).

Flower bud cold damage was not influenced by post-harvest irrigation deficit and ranged from 26% to 95% in 2020, 0.2% to 17% in 2021, and 0% to 37% in 2022. The high level of bud damage in the first season was likely due to a rapid cold snap event in early January.

WHAT'S NEXT?

Overall, findings from this study have the potential to improve sustainable tree fruit production through water conservation in the Okanagan Valley and other semi-arid regions. According to our findings, reducing post-harvest irrigation is a viable response to water restrictions that safeguards fruit yield and quality and will not increase the risk of flower bud frost damage.

Figure 5. Sweet cherry flower buds in the winter. Photo by Elizabeth Houghton.

RESEARCH SUMMARY

We chose to reduce irrigation based on growers' standard practices, so that other growers can easily apply these findings. However, this caused variations in the volume of water reduced between study sites and years. As such, further research in which water reductions are applied in a more uniform manner, for example as a percentage of crop water use (evapotranspiration), is recommended.

HOW WAS THE RESEARCH DONE?

This study took place in five commercial sweet cherry orchards in the Okanagan Valley, British Columbia, over three growing seasons (2019-2022). Each orchard was planted with 'Sweetheart' sweet cherry cultivar grafted on Mazzard rootstock.

At each orchard, three treatments were applied:

- Control: 100% of growers' standard irrigation
- 27-33% volumetric reduction in irrigation
- 48%-53% volumetric reduction in irrigation

The range in percentages, such as 27-33% instead of exactly 30%, was a result of limitations in sprinkler settings. Six treatment replicates were applied at each site. Each replicate consisted of three rows of 18 trees, with four trees in each treatment used for measurements, and six trees used as buffers along each side (Figure 6).

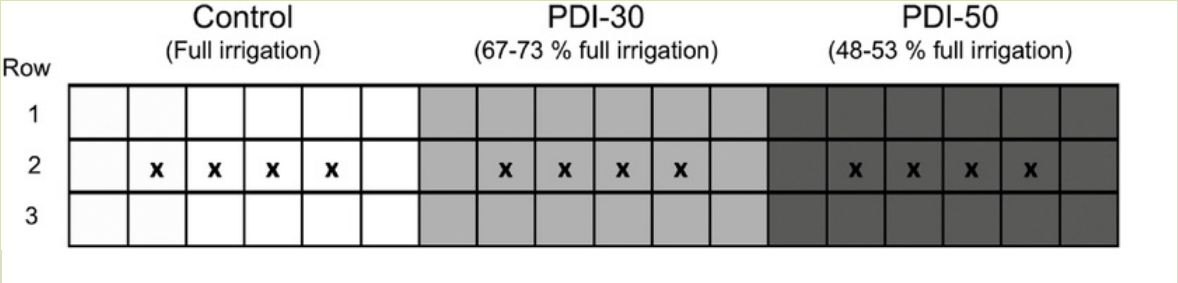

Figure 6. An example of one replicate with three irrigation treatments. Buffer trees and measurement trees (x) are represented by squares. PDI = "post-harvest deficit irrigation".

Fruit quality was assessed after subjecting cherries to one of three conditions: immediately after harvest, six weeks of commercial cold storage, and six weeks of commercial cold storage followed by "shelf-life conditions" at 20°C for five days. Fruit quality included fruit firmness, size, colour, stem pull force, sugar content, and acidity.

We recorded flower bud development weekly each spring, from side green stage to full bloom. To test flower bud cold hardiness, we collected bud samples weekly or bi-weekly from October to January. The samples were then cooled in a programmable freezer at a rate of -4°C/h for nine hours until -36°C was reached. Software was used to determine lethal temperature for the buds. To evaluate cold damage in the field, we collected flower buds, cut them open longitudinally, and recorded the proportion of damaged tissues, as indicated by browning.

ABOUT THIS BRIEF

This brief is based on the following scientific journal article:

Houghton, E., Bevandick, K., Neilsen, D., Hannam, K., & Nelson, L. M. (2023). Effects of post-harvest deficit irrigation on sweet cherry (Prunus avium) in five Okanagan Valley, Canada, orchards: II. Phenology, cold hardiness, fruit yield, and quality. Canadian Journal of Plant Science, 103(2), 184-200. https://doi.org/10.1139/cjps-2022-0201

Want to learn more?

For any questions regarding this research, contact Elizabeth Houghton at elizabeth.anne.houghton@gmail.com

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