BC FoodWeb

Peer-reviewed research

RESEARCH SUMMARY

Don’t forget sunscreen: Protecting tree fruits during extreme heat events

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Production Type
- Tree fruit

Practice Benefit(s)
- Increased resilience to extreme heat

Research Location
- Okanagan Valley, BC

KEY TAKEAWAYS

- **Intense and prolonged heat** can cause **widespread losses** in tree fruit crops, and is only going to become more pronounced with climate change.
- A **foliar protectant** is a product that is sprayed on leaves to protect crops from sun damage and heat stress. They are inexpensive and easily applied with existing farm machinery.
- We found that foliar protectants reduced the occurrence and severity of sunburn damage in apples, making them a promising tool for **climate resilience** in Canadian tree fruit. However, more research needs to be done to determine the best time, frequency, and concentration for application.

Figure 1. Apple tree. Photo by Jamil Rhajiak.

HOW CAN THIS RESEARCH BE USED?

- Foliar protectants can be used to **protect fruit quality** during extreme heat events.
- There are different types of foliar protectants on the market, including ones with a kaolin clay, calcium carbonate, or wax base. We tested a **calcium carbonate-based** spray in this study.

WHY WAS THIS RESEARCH DONE?

As part of developing a “climate resilience toolbox” for Canadian tree fruit, our research team tested the use of foliar protectants on apple trees. Extreme weather events, such as droughts, floods, heat waves, and cold snaps, are predicted to occur more frequently and become more extreme. For example, the unprecedented heat wave that hit North America in 2021 had major impacts on the BC tree fruit sector. Regardless of the crop grown, these events can cause significant losses in crop yield and quality.

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Canadian tree fruit producers need tools to help improve the resiliency of their crops to extreme weather events, such as heat waves. The use of sprayable foliar protectants as a "sunscreen" to protect fruit from sunburn and reduce water stress have been explored extensively in the United States but not in Canada.

This study evaluated the effect of a locally produced calcium carbonate-based foliar protectant on apple sunburn and water stress. Foliar protectants are particularly appealing because they are inexpensive to purchase and easily applied using commonly available spray equipment. They work by blocking, reflecting, and/or scattering the sun's rays and thus reducing fruit and leaf temperatures. This study was initiated just as the 2021 heat wave hit the province, providing a unique opportunity to test the efficacy of the foliar protectant for maintaining fruit quality under extreme heat conditions.

Figure 2. Oasis-O, the calcium carbonate-based foliar protectant used in this study. Photo by OrCal Inc.

WHAT WAS THE OUTCOME?

We found that the foliar protectant reduced the occurrence and severity of sunburn damage in apples (Table 1). The biggest impact that the foliar protectant had was on the shape of the fruit: 46% of the un-treated (control) apples were asymmetrical at harvest while only 29% of the treated (sprayed) apples were asymmetrical.

The foliar protectant had no effect on fruit yield, weight, size, sugars, acidity, or firmness. As the heat wave developed, soil moisture remain higher in the treated plots than in the un-treated plots, although more work needs to be done to verify this observation. The foliar protectant had no effect on indicators of plant water stress, such as leaf transpiration rate (the speed at which water is being released by leaves into the environment), photosynthesis rate, and stem water potential (a measure of water activity in the plant stem).

Figure 3. Examples of apple sunburn damage. Photo by the research team.

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Table 1. Percentage of asymmetrical, sunburned, or severely sunburned apples in control (untreated) plots and in plots sprayed with a foliar protectant (treated plots).

	Apples in un-treated trees (control)	Apples in trees treated with foliar protectant
Asymmetrical	46%	29%
Sunburned	79%	70%
Severely sunburned	37%	28%

WHAT'S NEXT?

Although the foliar protectant showed some promising results in protecting tree fruit quality, the amount of sunburn damage was still much higher than acceptable in a commercial orchard. More research needs to be done to investigate the best time to apply a foliar protectant, how often, and at what concentration. Future research should also look at the effects of foliar protectants on other crops and varieties, and over multiple years, to determine when and where these products are most effective.

HOW WAS THE RESEARCH DONE?

We conducted the research in a 20-year-old orchard at Agriculture and Agri-Food Canada's Summerland Research and Development Centre in 2021. The orchard contains 5 rows of trees x 20 trees per row of Fuji apples grafted onto Malling 9 rootstocks.

Each row was split into two 10-tree plots and treatments were randomly assigned so that each row had one treated plot, where the foliar protectant was sprayed, and one un-treated (control) plot (Figure 4). All measurements were taken from two healthy trees in the centre of each plot.

		X				X					X				X				
		X					X					X		X					
			X		X									X			X		
		X		X									X				X		
				X			X						X			X			

Figure 4. Diagram of the experimental design. Trees sprayed with foliar protectant are marked green and trees left untouched are marked white. "X" indicates measurement trees.

The treatment tested was a calcium carbonate-based foliar protectant, called Oasis-O, which was sprayed three times:

- When fruits were 1-2 cm in diameter (June 2)
- When fruits reached 4-5 cm (June 25)
- Four weeks later (July 22)

We measured stem water potential, leaf photosynthesis rate, and transpiration rate five times throughout the summer. Soil moisture was monitored using two soil moisture probes installed at a depth of 5-15 cm in the orchard's central tree row (one probe in each plot).

On November 2, we harvested, counted, and weighed apples to determine crop yield and average fruit weight. We then randomly selected thirty apples from each tree and assessed them for sunburn damage, fruit height, diameter, firmness, soluble solids, acidity, and dry matter.

Figure 5. Apple tree sprayed with foliar protectant. Photo by the research team.

ABOUT THIS BRIEF

This brief is based on the following scientific journal article:

Hannam, K. D., & MacDonald, J. L. (2023). Tools for climate resilience in tree fruit II: a calcium carbonate-based foliar spray showed potential for protecting fruit quality during an unprecedented heat event. *Canadian Journal of Plant Science, 103*(2), 228-232. https://doi.org/10.1139/cjps-2022-0079

Want to learn more?

- For questions regarding this research, contact Kirsten Hannam at kirsten.hannam@agr.gc.ca
- For more information on apple sunburn and management techniques check out "Apple Sunburn 101" https://treefruit.wsu.edu/article/apple-sunburn-101/
- The foliar protectant used in this research is called Oasis-O by OrCal Inc and can be found at https://orcalinc.com/orcal-products/solar-protectants

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