

# NYWGF RESEARCH - FINAL REPORT

**Funding for fiscal year:** 2025-26

## SECTION 1:

**Project title:** Time-temperature dependence of off-aromas, corrosion, and liner degradation in canned wines

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**Co-PI Collaborators with contact info:**

**New Research**  **Continued Research**

**Amount Funded** \$ 75,000

## SECTION 2:

**Project Summary Impact Statement:**

Prior studies with BPA and BPA-NI epoxy cans have demonstrated that wines with  $<0.5$  mg/L molecular  $\text{SO}_2$  may be stored at room temperature for up to 6 months before elevated levels of  $\text{H}_2\text{S}$  (“rotten egg” off-aroma) or corrosion occur. However, storage temperature and time remain key but poorly defined drivers of chemical stability and package performance in canned wines. This work determined that formation of  $\text{H}_2\text{S}$  and associated “reduced” aromas in canned wines is strongly time–temperature dependent. For the median wine, storage at  $50^\circ\text{C}$  for 2.5 d was the equivalent of storage at  $20^\circ\text{C}$  for 180 d, and a  $10^\circ\text{C}$  increase in temperature decreased shelf-life by  $\sim 4.6$ -fold. Additionally, we discovered that a substantial fraction ( $\sim 25\%$ ) of cans are mislabeled with respect to their liner. The major learning for canned wineries is that they should avoid storage at temperatures  $> 50^\circ\text{C}$  for even short periods of time (a few hours) to avoid excessively comprising shelf-life, and that producers should validate the identity of the liner they receive.

**Objectives:** To develop a Time-Temperature equivalence equation to allow prediction of estimated shelf life of canned wines at different storage temperatures, and to evaluate the effects of elevated temperature on canned wine sensory properties.

**Materials & Methods:**

- i) Wines: Canned wines (2 wines per partner, 20 total wines, 150 cans of each wine) will be provided by industry partners. Wines will be canned by the partner wineries using their standard practices. Dissolved oxygen will be measured in a representative sample of cans. Wine

chemistry (pH, TA, free and total SO<sub>2</sub>, EtOH, CO<sub>2</sub>, total anthocyanins, copper, chloride, organic acids) will be measured by the Sacks lab using standard methods unless values are provided by the winery. Wines will be selected to cover a range of styles and molecular SO<sub>2</sub> values.

- ii) Storage experiments: Cans will be stored at different temperatures at Cornell University.
- 20 °C (room temperature)
  - 50 °C (extreme expected at loading dock or parking lot)

For two wines, expanded trials will be performed at four temperatures (4, 20, 35, and 50 °C)

iii) Time Points and Sampling: Wines will be characterized initially (t=0) prior to can storage. Following storage, wines will be sampled at four time points. The cooler temperatures (4 °C and 20 °C) will be sampled at 0.5, 1.5, 3, and 6 months. The 35 °C treatment will be sampled at 7, 14, 30, and 60 days. and 50 °C treatments will be sampled at 1, 3, 8, and 15 days. For each time point (n=4) and each Wine × Temperature combination (n=16), replicate cans (n=3) will be used.

iv) Testing:

- H<sub>2</sub>S was measured as described by (Allison et al., 2022)
- Dissolved aluminum was measured by ICP-AES as described in (Montgomery et al., 2023)
- Liner degradation: Cans were torn down, and the interior visually inspected for corrosion on a 1-5 scale, as described in (Montgomery et al., 2023)
- For the two wines undergoing additional storage times, electrochemical impedance spectroscopy (EIS) will be performed on six coupons cut from the three cans (two coupons per time point) to characterize liner integrity, as described in (Sheehan et al., 2024)

v) Sensory evaluation:

In July 2025, cans at different time points and temperature regimens underwent an informal sensory evaluation by the industry participants.

## Results/Progress

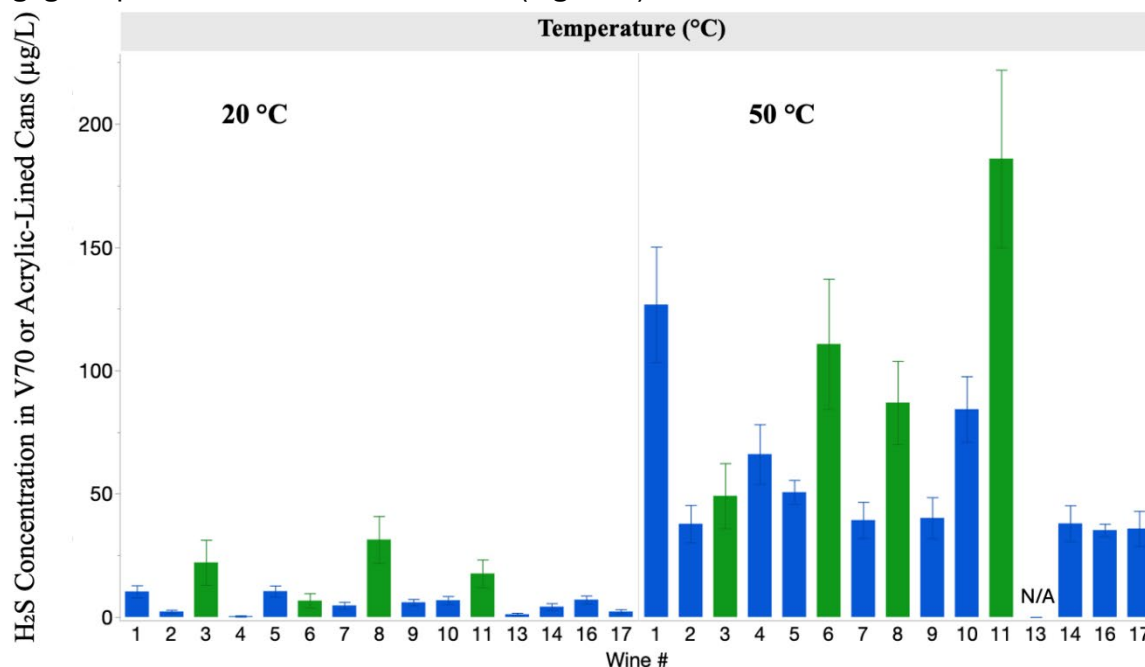
### 1. Wineries did not always receive the liner they expected from their can supplier:

infrared (FT-IR) analyses of can liners revealed that several cans (4 of the 15 wines) had acrylic liners as opposed to the V70 liners expected by the winemakers. Valspar V70 liners. Unsurprisingly, these cans also showed very high levels of H<sub>2</sub>S accumulation, especially at elevated temperatures. Follow-up liner verification revealed that these cans packaged with acrylic liners rather than V70. These wines were therefore treated separately in subsequent analyses. We recommend testing cans from new suppliers for their liner composition. A short extension article about this was prepared: <https://cals.cornell.edu/news/2025/06/wine-or-cider-can-liner-terminology-precision-matters>

### 2. Time and Temperature affect H<sub>2</sub>S formation and “reduced” aromas in canned wines

Canned wines (n=15) were sourced from participating wineries and stored at two temperatures, 20 °C (across 4 timepoints up to 180 days) and 50 °C (across 4 timepoints up to 15 days). Two

wines were also evaluated at 4 °C and 35 °C across four time points. H<sub>2</sub>S formation in canned wines is governed primarily by temperature (Figures 1 and 2). H<sub>2</sub>S formation is strongly dependent on storage temperature, with the highest H<sub>2</sub>S formation at 50 °C after 15 d and negligible production at 4 °C after 6 mo (Figure 2).



**Figure 1.** Average H<sub>2</sub>S formation in wines stored in V70-lined aluminum cans (blue bars) and acrylic lined cans (green bars) at 20 °C for 180 d and 50 °C for 15 d. Wine 13 was not included in the 50 °C study. Error bars represent standard error among replicates.

The equivalent number of days of storage at 50 °C to 180 d of storage at 20 °C were calculated (Figure 6). The median value was 2.5 d at 50 °C was equivalent to 180 d at 20 °C. For two wines that underwent expanded temperature range testing, electrochemical impedance spectroscopy (EIS) was used to evaluate liner barrier properties. A good correlation was observed between short-term degradation of the liner and long-term formation of H<sub>2</sub>S.

At an informal tasting with participating wineries in July 2025, it was observed that nearly all canned wines that had undergone short term high temperature storage (50 °C, 14 d) had unacceptable levels of “reduced” off-aromas, usually described as “burnt match”, “cabbage”, “skunk”, or “egg”. This results align with the chemical testing results and indicate that avoiding high temperature storage is critical for canned wine producers.

**Technology Transfer Plan:** Results from this work are currently in preparation for publication in the Journal of Agricultural and Food Chemistry.

[Extension Publication]: Sacks GL, Goddard JM, Montgomery A, Ramirez H, Abegunde A. "Wine or cider can liners terminology – Precision Matters." *Appellation Cornell*. **Jun 13 2025**.  
<https://cals.cornell.edu/news/2025/06/wine-or-cider-can-liner-terminology-precision-matters>

[Extension Presentation, in person]: Sacks GL and Roberson A, "Update on Canned Wine – Time x Temperature Dependence" – New York, NY and San Francisco, CA. **July 10 2026**.

[Extension Presentation, virtual]: Sacks GL and Roberson A, "Update on Canned Wine – Time x Temperature Dependence" – online. **Dec 15 2025**.

### **SECTION 3:**

**Project summary and objectives:** Prior studies on canned wines have demonstrated that wines with <0.5 mg/L molecular SO<sub>2</sub> may be stored at room temperature for up to 6 months before elevated levels of H<sub>2</sub>S ("rotten egg" off-aroma) or corrosion occur. However, the dependence of off-aroma formation on storage temperature in canned wines is not studied. This work evaluated the time-temperature dependence of canned wine shelf-life.

**Importance of research to the NY wine industry:** "Alternative" packaging such as canned wines represents an area of growth for the NY wine industry, but there is a lack of data regarding the stability of wine in cans at non-ideal temperatures. Knowledge of the time-temperature dependence of canned wine shelf life will allow NY wineries to make informed recommendations for wine storage and distribution.

**Project Results/next steps:** For the median wine, storage at 50 °C for 2.5 d was the equivalent of storage at 20 °C for 180 d. Additionally, we discovered that a substantial fraction (~25%) of cans are mislabeled with respect to their liner. Canned wineries should avoid storage at temperatures > 50 C for even short periods of time (no more than a few hours) to avoid excessively comprising shelf-life, and wineries should validate the identity of the liner they receive.