

When Shipping Wine, Weather is Not Always Your Friend

by [Mick Winter](#)

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If you're not taking responsibility for your wine shipments door to door, you're endangering the time, money and energy you've invested in growing and producing quality wine. That was the very clear message delivered to participants attending a panel discussion at the recent **Unified Wine & Grape Symposium** in Sacramento, California.

Dr. Christian E. Butzke, Associate Enologist, **University of California, Davis** moderated a discussion on "Assuring Wine Quality During Shipment and Storage." Panel members included **Patrick Mahaney**, vice-president, wine quality, **Robert Mondavi Winery**; **Glenn O'Dell**, director, technical services, **Turner Road Vintners**; and **George Soleas**, director, quality assurance, **Liquor Control Board of Ontario**, Canada.

If attendees weren't previously concerned about what might happen to their wine shipments, they likely were after the panel. Industry experts presented solid evidence that temperature extremes were a common experience for travelling wine, particularly those shipments going to hot-weather regions, such as the American South, in summertime, and cold-weather regions, such as the northern US and Canada, in the winter. Fortunately, they also presented ways that those effects could be minimized.

Christian Butzke has been working for the past couple of years with Robert Mondavi Winery and **Delicato Vineyards** in an American Vineyard Foundation project to determine the effects of temperature extremes and fluctuations on wine. He and others involved in similar efforts use state-of-the-art "data loggers", electronic devices that can record and store a variety of measurements over periods of time. In this case, the temperatures of wines and the surrounding air are monitored during shipment of wine in the United States, as well as by ocean from Europe through the Panama Canal to California.

The temperature data loggers used are inexpensive and available from a number of companies. They're placed inside bottles as well as at various locations in the shipping container or truck. Results can be read into Excel spreadsheets.

Butzke set the scene for the speakers to come with an overview of procedures and results. Monitoring

Bottle Aging Reactions

O₂ uptake: 6.8°F
(Ribereau-Gayon 1933)

Browning: 14°F
(Berg & Akiyoshi 1956)

EC formation: 28°F
(CEB 2001, preliminary)

SO₂ decline (W): 66°F
(Ough 1985)

Dou
of

*Courtesy of Dr. Christian Butzke,
UC Davis*

of shipments during winter showed clearly that wine can freeze, or come close to freezing. Temperature fluctuations have an impact not only on the aroma of wine, but also on more general chemical reactions. Oxygen uptake, which is connected with the movement of the closure under temperature fluctuations, browning reactions in whites, ethyl carbamate formation, and decline of free SO₂ in white wines.

These different reaction rates can double as a result of temperature changes. For example, increasing the temperature by 14 degrees Fahrenheit can double the speed of browning. Higher temperatures have an exponential effect.

The result of all these factors is that, even if there is no discernible damage to the wine, there can be more subtle changes that will lead the customer, or a wine writer, to misjudge the true nature and quality of the wine.

Mondavi's Shipping Experience

Mondavi's Patrick Mahaney stressed the reality of what can happen to wine after it's left home to get out in the world. According to Mahaney, gross damage from freezing or overheating "is not too frequent, but when a whole container gets damaged, it's a big problem." For Mahaney, the major problem is the next level down, where they have concerns "about what happens to the wine quality if it's exposed to heat, not with obvious damage, but just that the wine is not going to be what we'd hoped it would be."

So Mahaney tested wine temperatures during regular commercial shipment, both summer and winter, domestic as well as transoceanic. Mondavi's typical domestic shipment goes piggyback from truck to rail to truck. Monitored transoceanic shipments were in container ships. The winery also evaluated the effectiveness of reusable insulation quilts as an alternative to refrigerated containers.

Mahaney used a two-channel electronic data logger; one channel for ambient temperature, the other for liquid temperatures. One 750-ml bottle per case contained a model wine solution. One case with a data logger was below the insulation quilt--the use of quilts is standard operating procedure for Mondavi--and another data logger was in a case that was not insulated by the quilt.

Domestic Summer Shipments

Mahaney tracked shipments to the Midwest, East and South. Mahaney emphasized that while the results were a bit on the extreme side, it was important to remember that they were not atypical. "These are typical of what you could find if you had a shipment that went to one of these regions of the country during a heat wave--which happens frequently," said Mahaney.

The shipment from California to Atlanta sustained temperatures approaching 110 degrees Fahrenheit near the end of its trip. As Mahaney said, "Clearly you're going to have some serious problems with corks pushing. Even if you fill with proper ullage, you're still going to have enough expansion under those conditions to get cork pushing." Mahaney noted that corks will get pushed somewhere between 90 and 100 degrees--with proper ullage. With less ullage, the critical temperature is lower. And it's common, even with wine blankets, for wine temperature to reach 85 to 90 degrees.

Positioning in the container, whether the nose of the trailer or the tail, made little difference. The key was whether the case was under the quilt or not. Uninsulated wine approached 110 degrees, while wine under the quilt was 90 - 95 degrees.

Domestic Winter Shipments

Mahaney monitored wintertime shipments to the Upper Midwest and the East. Again, Mahaney emphasized that the results were extreme, but not atypical, as serious cold spells are the norm during the winter. Insulated wine shipped to Michigan reached a low point of about 25 degrees Fahrenheit, while wine not under an insulating quilt dropped to nearly 5 degrees.

Transoceanic

Mahaney tested shipments of wine from Italy to California, both in refrigerated containers, and in non-refrigerated, non-insulated containers. The refrigerated shipment started off by truck near Florence, was loaded onboard a ship at Livorno, passed through the Panama Canal, and arrived in California. Temperatures never exceeded 18-19 degrees Celsius. As Mahaney pointed out, "It's good to see that when you pay through the nose for a refrigerated container, that they actually do turn it on for the whole voyage, not just the twelve hours before they deliver it."

A monitored non-refrigerated container was trucked from Florence to Genoa, loaded onto a ship destined for Oakland, California, again with passage through the Panama Canal. Temperatures spiked near 30 degrees Celsius just on the road trip to Genoa. Temperatures gradually increased during the voyage, peaking through the Panama Canal, then slowly declined on the rest of its voyage. As it staged on the docks in Oakland waiting for truck transport, there were also daytime temperature spikes.

Mahaney said the only way to truly avoid problems was to avoid shipping during extreme temperatures, but since that was seldom an option, insulation quilts offered the most cost-efficient method of protecting the wine. He emphasized that the entire length of the shipment, door-to-door, was critical, and that downtime in staging yards can be a very critical period for the health of the wine.

For transoceanic shipments, Mahaney considered refrigerated containers the best insurance against high temperatures, although they're very expensive. Their experience is that exposure to temperature extremes is more likely during trucking and staging, than during the ocean voyage itself.

Turner Road and Insulation Covers

Turner Road Vintners' Glenn O'Dell, who previously conducted similar research with wine shipment temperature while at **Sebastiani Vineyards**, pointed out that "There is a tendency among winemakers to baby their wines right up to the time they get in the bottle, and then just trust in everything else downstream." "However," he cautioned, "Until the consumer opens the bottle and takes a drink of wine, they haven't yet made a judgment about how good a job you've done. If it doesn't pass that test, you've failed. And there are a lot of pitfalls out there."

The pitfalls Turner Road was concerned about included damage to the wine and its containers, including cork pushing and tartrate throwing, oxidation, and reduced shelf life, as well as more subtle changes to the aromas and flavors of the wine.

Refrigerated containers are still considered the best method of protecting wine shipments, but they're also the most expensive, about ten cents a mile, according to O'Dell. Availability can also be a problem, since when they're needed because of a hot spell, everybody needs and wants them.

Heated boxes, using a propane heater in the back of the truck, were one cold-weather option they investigated. The problem was that the heat was focused in one area, with hot spots that could actually cook the wine, while other areas in the truck were still too cold.

Turner Road historically had used insulated containers. They're effective and relatively inexpensive, about \$125 a load. But they were often hard to obtain during winter months, so the winery looked at other options. The first one they tried was an "insulated box".

They took a steel container with a wood deck, and covered it with an insulation quilt. Unfortunately, they found that the insulated box acted as a solar oven. It collected solar energy during daylight hours, and then kept it in at night, so that over time the heat in the box continued to build up, often as high as 140 degrees Fahrenheit. It was a good oven, but a poor wine storage container.

Next they went to cargo quilts, a couple of inches thick, and used those for a long period of time. The quilts were effective, but had some drawbacks. The initial expense was comparable to a refrigerated container, so it made sense to recycle the quilts. Unfortunately they were bulky and heavy, took up a lot of warehouse space, caused employee complaints and potential injuries, and were difficult and expensive to return for re-use.

In 1993, they started experimenting with space blankets. These were less bulky, lighter, less expensive initially, and cheaper and easier to recycle. So they tested the effectiveness of both quilt and space blankets. The results showed that the quilts were marginally better, but both did an excellent job of holding the temperature. Even though ambient temperatures might reach around 100 degrees, wine temperatures peaked at well under 85 degrees. Cold weather tests showed similar positive results.

O'Dell found that the blankets were both temperature-effective and cost-effective, and Turner Road has been using them on most loads for nearly eight years. Blankets, which are basically bubble wrap with mylar film, are placed over the length of the load, over the sides and across the back. Their major function is to hold in the thermal mass so that it does not migrate out into the surrounding air space. Blankets cost around \$135, less in quantity. Return costs are about \$25, depending on distance, and they're reused for an average of five trips. Additional labor is about fifteen minutes per application. Five trips average out to about \$57 a trip, or five cents a case.

LCBO Policy on Temperature Controlled Containers (TCCs)

- *All shipments via land and ocean arriving between November 15th and April 1st must be in TCCs **
- *Wines > \$30 arriving into Canada between June 15th and August 31st must be in TCCs * * Does not apply to Spirits >_ 30% alc./vol.*

Exceptions:

- *Vintages Classics must always be in TCCs*
- *Crème liquors/liqueurs must always be in TCCs*
- *High sugar liquors must always be in TCCs*

Note:

- *The temperature of TCCs should be between 40°F (5°C) and 50°F (10°C)*
- *All containers arriving by ocean must be kept below deck*

Courtesy of George Soleas, Liquor Control Board Ontario

World's Largest Wine Buyer - And a Demanding One

Someone, besides the winemaker, who also cares about how the wine has survived its trip is the consumer, and George Soleas represents 11 million of them in Ontario, Canada. Soleas heads quality assurance for the largest liquor and wine buyer in the world. The Province of **Ontario's Liquor Control Board** (LCBO) imports spirits and wines from 50 different countries, and sells \$3 billion worth of alcohol beverages a year through 605 stores. It also performs quality assurance testing on about 14,000 products a year. Eight to nine thousand of those tests are on LCBO's own products, and the rest are on private consignments, i.e. yours.

In the year 2000, just one of their warehouses brought in 21.5 thousand containers of wine and spirits. Approximately 22-23 percent of those containers were temperature-controlled containers (TCCs), and the balance of about 17,000 were not temperature-controlled. The majority of TCCs arrived between November and April with the bulk in those two months, as the organization stocked up for Christmas and summer, their busiest times.

In 2000, only 19 containers contained frozen inventory (and 18 in 2001). In the same year only two containers contained overheated inventory (and none in 2001). When you consider the temperatures that Ontario experiences in the winter -- and in the summer -- .1 percent could be considered a remarkably low percentage of damaged inventory. And it is. But there's a reason. Because Ontario has instituted extremely stringent standards to make sure that wines that reach their province arrive in top condition.

All shipments received via land or ocean arriving between November 15 and April 1 must be in TCCs. Furthermore, wines that sell at a price greater than \$30 Canadian that arrive between June 15 and August 31 must be received in TCCs. All of the LCBO's "luxury" products must always be in TCCs, and this applies also to crème liquors, liqueurs and high-sugar liquors. All in TCCs, all year long.

The temperature of these TCCs must be between 40 and 50 degrees Fahrenheit, and all containers shipped by ocean must be kept below deck. So that there is no doubt, this is spelled out on each and every purchase order.

Of those containers that arrived in Ontario with frozen inventory, the majority were caused by faulty equipment or temperatures set incorrectly. In 2000, 53 percent of the frozen inventory was wine, and out of that 1,434 cases or 11 percent was totally destroyed and unsellable.

Potential "Quality" Problems related to Frozen and Over Heated Containers

Chemical Defects

- *high ethyl carbamate*
- *high volatile acidity*
- *re-fermentation*

Organoleptic Defects

- *mader*