Wine Packaging Alternatives

Not All Good Wine Comes in Glass Bottles

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Introduction

As the global climate changes, vineyards and wineries all over the world are being affected by the increase in warmer temperatures. England, a country better known for their beer then their wine, is now able to produce wine that some wine critics like Jancis Robinson are calling "far from a joke" (Robinson 2007). The current global climate change, while affecting some wineries in Europe for the better, could have a potentially devastating effect on the current premium American vineyards in the next century (White and others 2006). The increase in greenhouse gases has been linked to many industries, including the wine industry. In 2001 a total of 6.3 billion tons of green house gases were emitted into the atmosphere with the wine industry producing 5.34 million tons, which is equivalent to 0.08 percent of the world's total green house gas emissions. The amount emitted by the wine industry was equal to approximately 1 million passenger cars running on fossil fuel for one year (Colman and Paster 2007). Today's consumers are becoming more aware of their own "carbon footprint" and are looking to purchase more environmentally friendly products. Many industries, including the wine industry, have taken notice of this trend and are implementing new "green" products in the market place. Wineries now have several options to choose from when it comes to packaging their wine which include Constar International's new PET bottle with MonOxbar™ technology, lighter weight glass bottles, and wine bottled in Tetra Pak cartons.

History

Thousands of years prior to the rise of the Roman Empire, winemakers in Mesopotamia and Egypt stored their wine clay flasks called amphorae rather than in glass bottles or steel fermentation tanks. The first glass vessel was made in Mesopotamia in 1600 BC, but these were small ornamental vessels. It was not until 250 BC during the Babylonian Empire that glass

making became easier and less expensive to produce. However, it was not until the rise of the Roman Empire that glass products became more accessible to the common people. It was quickly determined that glass was a good way to store wine because glass had no affect on the flavor of the wine and a person could easily see the type of wine being stored in the bottle. From its development during the Roman Empire until the 19th century, manufacturing glass bottles was difficult because bottles were hand blown and varied widely in size. Bottles typically held anywhere between 700 ml to 800 ml of wine. Because of the discrepancy in bottle size, consumers never truly knew the actual amount of wine they were purchasing. When purchasing wine, consumers often brought their own containers with them so they were certain about the quantity they were buying. It was not until the mid 19th century that glass blowing technology improved to the point of mass production. In 1821 mass production was made possible by the split mold process which ended the age of blowing mold process. The split mold process allowed for different shapes to be produced using a mold. This allowed for packages to be branded with a paper label. Semi-automation was developed in 1887 by the Ashley Glass Company in Castleford, Yorkshire in the United Kingdom enabling them to produce over 200 bottles an hour. Glass production became fully automated 16 years later using a process developed by an American engineer named Michael Owens (2008a). Many wine bottle styles are named after the region where they are primarily manufactured. The Bordeaux, the Burgundy, and the German Riesling are the three main styles of bottle currently being mass produced (Lindsey 2010).

Glass

Glass bottles are the most popular way to package wine today. Glass is made from silicon dioxide, a relatively inexpensive quartz sand. Silicon dioxide and other materials must be mined before being made into glass. After the silica dioxide and the other materials have been

extracted, the materials are placed into gas burning kilns. Once the bottles are formed, the interior of the bottles are chemically treated to make the bottles nonporous (Athens 2009; Colman and Paster 2007).

In the past decade, wine bottles have been gradually gaining weight because people typically associate heavier glass bottles with higher quality. The total weight gain for a glass wine bottle is about a pound. Despite glass being recyclable, it is actually more economical for wineries to use virgin glass because of the cost required to transport used or recycled glass over long distances.

While glass bottles have traditionally been used to store wine, they also serve another important function. The bottle is what affects the aging process of wine. Glass bottles protect the quality of the wine by reducing oxygen permutation through the container. While other containers might be more economical and lighter in weight, they often do not preserve the quality of wine like glass bottles. Plastic containers made from polyethylene terepthalate (PET) are lighter, "greener", and 100 percent recyclable, but they may not be better than glass bottles. In the first few months after bottling wine in a PET container, the wine will taste the same as wine bottled in a glass bottle; however, after eight months to a year, that taste will change drastically. In comparison to wine packaged in a glass bottle, PET bottles allow a significantly greater amount of oxygen to enter the wine causing the wine to become severely oxidized and altering the aroma profile of the packaged product. Although most wine today is consumed less than a year after bottling, some wines are stored for a longer period of time. Wine that has the potential to be aged longer than a year should be bottled in glass because of its superior ability to prevent deterioration due to oxygen.

Light Weight Glass bottles

While consumers are asking for greener and more economical packaging, so are winery owners. In the last few years glass manufacturers have begun to slim down their bottles producing a greener and more economical bottle. Although the bottle has slimmed down and has become a little greener, it has not lost any of its sense of style. Glass manufacturers have come up with a new technique called "light weighting" which allows them to reduce the overall amount of glass needed to manufacture a bottle. "Light weighting", as it is called by manufacturers, is done by reducing the wall thickness and removing the punt or the indention normally found on the bottom of a glass wine bottle. By implementing this technique, manufacturers have seen a decrease in glass usage of 14 – 16%. This decrease in raw materials like sand and soda ash has resulted in an overall cost savings of 10%. Glass manufacturers are also using a greater proportion of recycled glass known as cullet within the final product. The EcoSeries, produced by Saint-Gobain Containers, is made up of three types of bottles: the Revolution, the Evolution, and the Inspiration, all of which are 750 ml bottles. The Revolution is the lightest of the three weighing in at 10.5 ounces and is available in the claret silhouette. Unlike the other two bottles, the Revolution has no punt. The Evolution weighs in at 14 ounces with a mid-size punt, followed by the Inspiration at 16.5 ounces with a full-punt, both of which are made in 750 ml claret shape bottles (Gannon 2009).

In 2009, a winery based in Hopland, California decided to package all 23 million bottles of their wine in light weight EcoSeries glass bottles. By switching to lighter weight glass bottles, greenhouse gas (GHG) emissions were reduced by 14% or 2,985 US tons CO_2. This reduction in greenhouse gases was equivalent to planting 70,000 trees and allowing them to grow for ten years (Fetzer-Vineyard 2009; Gannon 2009).

Figure 1. The EcoSeries bottle line produced by Saint-Gobain Containers made up of the Revolution, the Evolution, and the Inspiration. (2008b)

PET Bottles

In the summer of 2007, Constar International Inc., one of the leading producers of polyethylene terepthalate (PET) plastic containers, developed a new line of light weight PET bottles with MonOxbar™ technology. MonOxbar™ PET plastic bottles are made of a monolayer design that can offer several advantages over the traditional multilayer PET plastic counters. The monolayer PET bottles are tough and will not delaminate during filling and distribution like their multilayer counterparts (2009). The MonOxbar™ technology incorporated into the PET plastic containers' oxygen utilizes scavenging technology which protects their oxygen sensitive contents against oxygen during prolonged storage durations and temperature abuse encountered during distribution. MonOxbar PET plastic bottles are able to protect their oxygen sensitive contents by chemically reacting with the oxygen present in the bottle while physically slowing down the permutation of oxygen through the containers' side walls. Although this type of packaging can provide some protection for the wine, the PET bottles do not provide the same amount of protection as that of a traditional glass bottle. Air is still able to pass through the PET lining and

cause the wine to oxidize. The MonOxbar™ plastic bottles are the first 750 ml wine bottle made from PET and are commercially manufactured and distributed in North America (2007).

PET bottles offer several advantages over traditional glass wine bottles. They are unbreakable, offer a greater flexibility in design, and are lighter than a traditional glass bottle. An Australian wine bottle manufacturer determined that for every ounce of glass made, 0.6 ounces of CO_2 gas was generated. For example, a traditional wine bottle weighs approximately 23 ounces. Therefore, 13.8 ounces of CO_2 was produced during manufacturing. In comparison, the US EPA estimates that for every ounce of plastic produced, an ounce of CO_2 is produced. During manufacturing of PET bottles only 1.9 ounces of CO_2 is produced in comparison to 13.8 ounces for a traditional glass wine bottle. The production of 750 ml MonOxbar™ PET plastic bottles produces 50 percent fewer greenhouse gases then the production of 750 ml virgin glass wine bottles (Constar 2004). A traditional case of wine containing twelve 750 ml glass bottles can weigh 38 pounds or more, while a case of wine using PET bottles can weigh approximately 22 pounds, a weight savings of 40%. The reduction in weight results in a smaller transportation cost and carbon footprint. In the end, a glass wine bottle will produce 1.8 times more CO_2 gas then a PET bottle traveling the same distance (Colman and Paster 2007).

Figure 2. Examples of Constar International Inc MonOxbar™ PET bottles for the Yellow Jersey of Boisset Vins & Spiritueux, Bourgogne, France. (2009)

Tetra Pak

As the global economy starts to rebound from one of the worst recessions since the Great Depression, consumers are seeking quality wine at affordable prices. Companies all over the world are trying to lower their overall cost while still being "green". Some wineries in the past couple of years have started to package their wines in aseptic Tetra Pak containers. Tetra Pak containers offer several advantages over traditional glass bottles. While both types of containers are recyclable and may be made from recycled material, most glass bottles used in the wine industry are virgin bottles. Tetra Pak has joined the green revolution and estimates that 70% of the material used in their containers comes from recycled material. Tetra Pak containers also have a significant weight advantage over traditional glass bottles. Tetra Pak containers primarily use packaging materials made from paper and weigh about 40g compared to glass bottles that weigh anywhere from 500g – 750g. The use of Tetra Pak containers, rather than glass bottles, results in the use of 92% less packaging material than glass bottles, 54% less energy over the life cycle of the container, 80% fewer greenhouse gases, 60% less solid waste volume, and 40-50% fewer trucks to deliver the same quantity of wine packaged in Tetra Pak containers than in traditional glass bottles (2008d; 2008c). Unlike glass bottles which are difficult to stack, Tetra Pak claims containers can be easily stacked during transport and storage (2005). Tetra Pak designed the Tetra Prisma container for the wine company French Rabbit. The Tetra Prisma was designed so that air could be squeezed out of the container after someone finished pouring a glass of wine. The French Rabbit's website claims that this type of design allows for an air tight seal preserving the wine longer than a traditional glass bottle (2006). Tetra Prisma offers a cheaper and greener alternative for wineries that tend to produce table wines. Since long term

storage or aging is not required for table wines, the advantages gained by using glass bottles is not necessary (2005).

Figure 3. Tetra Pak's wine bottles for French Rabbit. (Boisett-America 2006)

Bag in the Box (BIB)

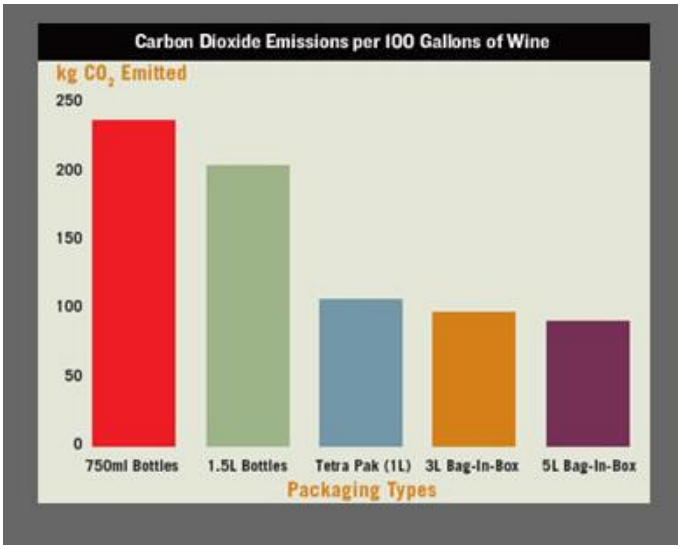
Bag in the Box, or box wines, first made their way onto the wine scene in the 1960s where they were traditionally used to package generic bulk wines which, at the time, were considered cheap. This type packaging is comprised of one or more layers of high-barrier flexible films known as the bladder which is nestled in a paperboard container (Fu and others 2009). The air tight bladder and the spigot are both able to protect the wine during short term storage. Times, however, have changed and the Bag in the Box design is now being given a second chance. The wine industry needs to remember that screw caps were once associated with cheap, low grade wines until producers in New Zealand started using them. Today screw caps are associated with quality, especially for certain varieties of young white wines. Bag in the Box design can offer a distributor and the consumer several advantages over a glass bottle. Those advantages include improved distribution, cost efficient packaging, and an easy to open and pour container. BIB come in several sizes 1.5 L, 3 L and the 5 L which is equivalent to two, four, and

ten 750 mL bottles of wine. A 4-6 L box weighs 40% less than a traditional glass bottle. This does not mean, however, that the carbon footprint over the entire lifecycle of the package is 40% less. Companies who have switched from traditional glass bottles to the BIB design estimate that there is a minimum of 50% reduction in carbon emissions. Although BIB design does provide manufacturers and consumers with a lighter weight product, the internal bladder that holds the wine can cause the wine to age even when unopened. This is because the plastic packaging is not hermitically sealed. Fu and others (2009) looked at the enological properties of white wine packaged in a Bag-in-Box container. It was determined that the overall quality of the wine was significantly affected by the oxygen transmission rate (OTR) of the package. They determined that color, free and total sulfur dioxide, total aldehyde, and total phenol content were all correlated with an increase of OTR. Time and temperature have a significant effect on the color development and SO_2 depletion during storage (Fu et al. 2009). In comparison to wine stored in a traditional glass bottle, wine stored in a BIB container for over a year tends to substantially degrade.

Figure 4. Shutter Homes Bag in the Box design for its Zinfandel Wine (2010).

Conclusion

In 2001, over 2.6 million liters of wine were produced globally; the global greenhouse gases emitted from the production and distribution of wine was over 5, million tons. Globally, over 6.3 billion tons of greenhouse gases are admitted yearly with the wine industry producing 0.08 percent of the global emissions. Some politicians like former Vice-President Al Gore and President Barack Obama are suggesting a carbon tax to regulate the amount of carbon dioxide produced by certain industries. This idea has caused some industries to look for greener alternatives. Like other industries, the wine industry has observed this trend and has implemented new "green" products in the market place. The graph below shows the impact of CO2 emitted per 100 gallons of wine using various types of packaging (Gannon 2008). Wineries now have several options to choose from when it comes to packaging their wine such as Constar International's new PET bottle with MonOxbar^{TM} technology, lighter weight glass bottles, wine bottled in Tetra Pak cartons, and Bag-in-Box wine. Although all these packaging alternatives weigh significantly less than traditional glass bottles and produce fewer greenhouse gases, wine does not age well in these types of containers.



Ultimately, the choice of the wine package is up to the consumer and wineries. If a wine is meant to be consumed within a year to two years after packaging, then bottling wine in some of the current alternative packages is an option, but if the wine is meant to be aged, then it is probably best to stay with glass bottles to ensure proper aging. Consumers should keep an open mind about purchasing wine that has been packaged in containers other then glass bottles. Wine bottled with screw caps were once thought to be cheap. So now we should also give these alternative packaging containers a chance to prove themselves before we label the wine inside them cheap. As consumers we have the ability to influence change in the wine industry through our purchasing power. This can be done by purchasing wine packaged in all types of containers.

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