

35TH ANNUAL New York Wine Industry Workshop

5,6,7 April 2006 **PROCEEDINGS**



Tasting



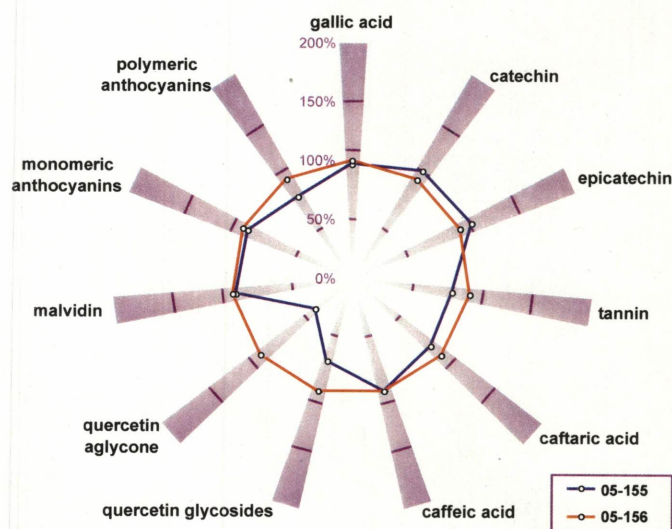
Winery Management



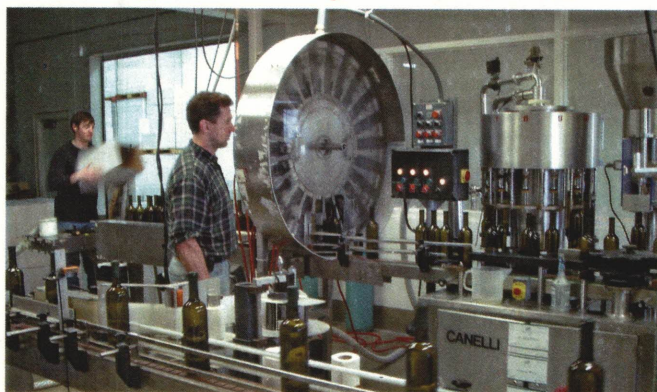
Wine Marketing



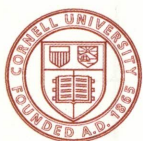
Wine Phenolics



Bottling & Quality Assurance



Trade Show



Cornell University



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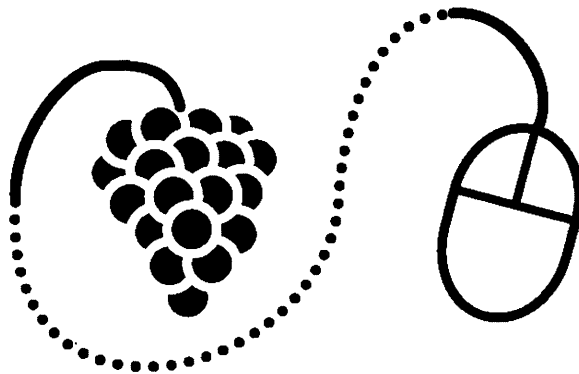
Internet Journal of Viticulture
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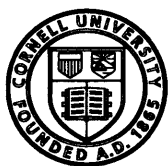


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35TH ANNUAL New York Wine Industry Workshop

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This conference is organized and hosted by the Cornell Enology Program, Department of Food Science & Technology, NYS Agricultural Experiment Station, 630 W. North St., Geneva, NY 14456-0462 in cooperation with the New York Wine & Grape Foundation



Cornell University



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Printed by Communications Services
NYS Agricultural Experiment Station
630 W. North St.
Geneva, NY 14456-0462

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Grape Fungal Infection and Wine Quality

Lorenza Conterno^{I,II}; David Gadoury^I, Vincenzo Gerbi^{II}, Luca Rolle^{II}, Robert Seem^I, Wayne Wilcox^I, Giuseppe Zeppa^{II}, Thomas Henick-Kling^I.

^I indicate Authors directly involved in the study described in part I; ^{II} indicates Authors directly involved in part II

*An Enologist since 1987, Dr Conterno started to work as wine microbiologist in 1991. Her activity in wine applied research begun at the Enology Research Institute of Asti and continued at the University of Turin, where she obtained her PhD in 1998. During her PhD she studied the yeast microflora of Barolo wines. Afterwards she dedicated most of her researches to wine alcoholic and malolactic fermentation. In 2000 she joined the Enology Group of Cornell University headed by Dr Thomas Henick-Kling, where she is currently Research Associate. Her major interests are molecular biology and physiology of *Brettanomyces bruxellensis*, winery sanitation, yeast ecology, and malolactic bacteria physiology. She is co-author of 37 publications.*

I) Effects of diffuse powdery mildew on bunch rot, berry microflora, and wine quality.

Production of grapes (principally cultivars of the European species *Vitis vinifera*) for high-quality wines requires a high degree of suppression of powdery mildew (*Uncinula necator*). Severe infection of either fruit or foliage has well-documented and deleterious effects upon crop and wine quality. We found that berries nearly immune to infection by *U. necator* due to the development of ontogenic resistance may still support diffuse and inconspicuous mildew colonies. Fruit with diffuse mildew colonies appear to be healthy and free of powdery mildew in late-season visual vineyard assessments. Nonetheless, the presence of these colonies was associated with: (i) elevated populations of spoilage microorganisms on berries, (ii) increased evolution of volatile ethyl acetate, acetic acid, and ethanol from berries, (iii) increased infestation of fruit clusters by insects attracted to the aforementioned volatiles, (iv) increased rotting of clusters by *Botrytis cinerea*, (v) increased frequency of perceived defects in wines prepared from fruit supporting diffuse powdery mildew colonies, and (vi) higher incidence of perceived unripe, green flavors in the resulting wines. Prevention of diffuse infection required extending fungicidal protection until fruit were fully resistant to berry infection, approximately four weeks after bloom is completed. Despite the fact that this may not produce a perceived improvement in disease control due to the insidious nature of diffuse powdery mildew, the prevention of diffuse colonization will eliminate secondary deleterious effects upon crop and wine quality.

Wine Quality. Wine produced using Pinot Noir grapes in which 20-30% of the berries supported diffuse powdery mildew colonies were described as flat and bitter, with plastic, dusty and moldy flavors. Sensory analysis of similarly-prepared Chardonnay wines showed that those made from mildew-free grapes were preferred to those made with grapes with diffuse powdery mildew. Grapes with less infection (1-2%) were also described as earthy and with plastic, paper, and rotten apple flavor. Wines

prepared from grapes supporting substantial diffuse powdery mildew infection were generally perceived as inferior due to their lack of cleanness and body, compared to wines prepared from mildew-free grapes.

Berry microflora. Berry surface microflora was studied using various agar media appropriate for fungal and bacterial growth: YM agar to grow yeast and mould, YM agar added with cycloheximide (YMC) to select yeasts such as *Brettanomyces/Dekkera bruxellensis* and *Hanseniaspora spp*, Lysine agar (LYS) to select non-*Saccharomyces* yeasts, and MLB to enhance bacteria growth. Results indicated a quantitative (30- to 100-fold) difference in microbial populations on berries supporting diffuse powdery mildew versus mildew-free berries. Additionally, high populations of non-*Saccharomyces* yeast and lactic acid bacteria were recovered from berries with diffuse powdery mildew. Colonies that developed on YMC were identified based upon their microscopic characteristics as *Hanseniaspora*. Sixty colonies (20 for each of the three replicated samples) randomly isolated on YM agar and LYS agar were further analyzed. A portion of the 26S rDNA gene was amplified by PCR, purified, sequenced, and compared to registered sequences from the NCBI Blast database to discriminate the yeast species involved. *Hanseniaspora* yeast predominated on berries with diffuse powdery mildew (70%) along with *Metschnikowia* or *Candida*. Although *Hanseniaspora* will not persist during alcoholic fermentation, and will be quantitatively passed by *Saccharomyces*, its activity may be detrimental to wine quality because of its capacity to produce acetic acid and various ethers.

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II) A study on *Botrytis cinerea* noble rot in Italian Passiti Wine

Passiti wines are special wines produced in Italy characterized by a post harvest drying step of the grapes. The quality of these grapes is beneficially influenced by development of *Botrytis cinerea* as noble rot, like in the more famous Sauternes and Hungarian Tokay wines. Few studies can be found in the scientific literature related to Passiti production and quality. Among the various Passiti produced in Italy, Caluso Passito is the appellation of the Passito wine produced in Piedmont. The appellation Caluso Passito DOC belongs to wines produced in the Canavese area of Turin Province, with Erbaluce grape, at least 15 degree of alcohol, obtained from grape harvested in September and let dry in special rooms until March. From the production of the grape must to the end of the aging process 4 years pass. Average production is 15,000 liters per year (about 4,000 gallons).

A three year study on Caluso Passito was carried out at the University of Turin (DIVAPRA department, Agricultural Faculty) with the main aim to highlight the peculiar characteristics of this product in order to promote its production and consumption. In this project, funded by the Piedmont Region, winemaking practices, microbiology and flavor aspects were analyzed.

The grapes are stored in boxes which allow very good airflow or individual clusters are hung on special structure in well aerated rooms with large opened windows protected by wire screens. During drying one of the more interesting microbiological events is encouraged to occur: the growth of *Botrytis cinerea* as noble rot. While *Botrytis* grows, the grapes must be protected from development of saprophytes like *Penicillium*, *Aspergillus*, *Mucor* mold that are just consuming sugars and producing substances that are inhibiting alcoholic fermentation and enzyme that most likely will influence color stability and wine aroma.

In order to encourage the noble rot occurrence and avoid detrimental fungi, great care must be taken during the drying step. Unfortunately this step is still left to empiric practices and the actual factors affecting the fungus biology and development are still unknown. The frequency of opening and closing windows is the only control exerted so far: too dry an environment will lead to too dry raisins, with low must yield. Too high humidity will promote sour rot that will cause grape loss and decreased quality of grape must (high volatile acidity).

We monitored the temperature and humidity over the entire after harvest grape drying period but could not observe a correlation with laccase activity of gluconic acid (noble rot markers). Probably these two parameters alone are not enough to provide useful suggestion in order to enhance the beneficial *Botrytis* establishment. Grape composition, skin thickness and grape health may also play an important role. It has been found in literature (mostly reviewed in Doneche, 1993) that grape berries must be undamaged, and short periods of humidity (3-4 days) alternated with long dry periods (10 days) will help in the development of *Botrytis* as the noble rot infection. This seems to start only later in the drying step,

in January. Up to 50% of the berries will be infected by the fungus hyphae. Their penetration can occur through microscopic ruptures originated by drying of the tissues. The fungus will invade the epidermal layer giving to the berry a bruised color (blue-brown and opaque). The skin becomes more permeable and the water evaporation increases. A profound chemical transformation occurs: although sugars are consumed as well as acids (especially tartaric acid), water evaporation leads to an increase in the sugar concentration (30-40%) but to a moderate acidity. The glycerol content in the grape must is 5-7% and poly alcohols and gluconic acid (1-2.5 g/L) are increased. The presence of oxydase enzymes, colloids (glucans), characteristic aromatic compounds, and their precursors also characterize the juice. The content of yeast available nitrogen availability is lowered, with obvious consequences on the alcoholic fermentation. Antimicrobial compounds identified as heteropolysaccharides termed "Botrytine" cause the increase of production of glycerol and acetic acid (Ribéreau-Gayon *et al.*, 1979).

In this study an attempt to improve the winemaking process was carried out.

The limited production by itself does not allow to invest in proper machinery for crushing, and destemming is very often done by hand. Grapes are crushed and usually macerated for 6 to 24 hours in order to increase the juice yield. The effect of the pectolytic enzyme Rapidase CB in 24 hours of maceration has been evaluated. As expected, treatment with Rapidase CB resulted in musts with higher content in poly-phenols (in particular polymeric tannins and pro-antocyanidins). However, the treated musts did not reveal a darker color, compared to the untreated one. The longer maceration time increased the juice yield by 6% (Zeppa *et al.*, 2001). In order to protect the juice from unpredictable development of wild micro flora (wild yeast and acetic acid bacteria) it is recommended to add a yeast starter culture to the grapes already at the beginning of the long skin maceration. Browning reaction during skin contact time (maceration) will lead to earlier color stability. The use of this enzyme did not improve the process but further studies with different enzymes preparation may lead to different results. Long maceration time did not cause the appearance organoleptic defects, and no increase in costs.

Sensory analysis of several Passiti (different wineries and different vintage) also was part of this study and revealed a high variability among year of production and among wineries indicating rather diverse production practices. However wine analysis by GCO revealed that the longer the wine is aged the lower is the amount of fruity (raspberry, wild strawberry) and floral aromas detected, and the higher is the amount of compounds described like, caramel and hazelnut. Aging also lead to a lower amount of grassy and hay like aromas. Citrus and rose aromas tend to be stronger in young wines. Predominance of these compounds in most but not in all young wines may also be related to the winemaking practice and to the grape quality.

A comparison among Caluso Passito, Cinque Terre Sciacchetrà, Passito di Pantelleria (three among the more important Italian passiti) volatile compound highlights the higher contents in ethyl esters and

alcohols (Gerbi *et al.* 2003). Caluso Passito showed the higher concentration. Acetyl esters are also in higher concentration in Caluso Passito. All three wines contain isobutanol, and isopentanol, but Caluso Passito is characterized by the presence, almost exclusive, of 2-ethyl-1-ethanol and furfural. Originated by *Saccharomyces* fermentation and found in all three wines, were the γ -butyrolactone (from glutamic acid) and the 2-phenylethanol. Characteristic of Caluso Passito and Sclacchetrà is benzaldehyde (bitter almond).

Varietal terpene and norisoprenoid aroma compounds were characterizing the three wines: linalool is characteristic of Passito di Pantelleria (from Muscat grape). If found in Caluso Passito and in Cinque Terre Sclacchetrà it must come from small amount of aromatic variety accidentally used or to the Bosco, Albarola e Vermentino (typical grapes of Sclacchetrà) the aromatic composition of which is still unknown. The prevalent terpenes in Caluso Passito are 1,4-cineol and 4-terpineol, meanwhile in Cinque Terre Sclacchetrà 1,4-cineol, limonene, α -terpineol, and 4-terpineol are found in higher quantity.

The norisoprenoid β -damascenone was always found in the wines, especially in Cinque Terre Sclacchetrà. Vitispirans (*cis* and *trans* isoform) were not detected in Passito di Pantelleria, but in Caluso Passito and Sclacchetrà, probably because of the long maceration, characteristic of their winemaking process. They may also be originate during aging in bottle.

Data analysis by Principal Component Analysis clearly distinguished Passito di Pantelleria from a second group where Caluso Passito and Cinque Terre Sclacchetrà were not clearly discriminated.

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Phenolic Analysis in White Wines and Juices at ETS Laboratories

Steven F. Price – ETS Laboratory

Steve began working for ETS Laboratory in 1995. The recent emphasis at ETS has been to develop analytical methods for measuring phenolic compounds in the vineyard that predict eventual wine phenolic composition.

He started Price Research Services, Inc., Corvallis Oregon in 1995 which focuses on research support for wineries, development of vineyard production practices for optimum quality.

The importance of phenolic compounds in red wines is so great that the phenolic composition of white wines is often overlooked. The critical phenolic components for white wines are not as well understood, the sensory effects of these compounds have not been studied in the same depth, and the effects of viticultural and winery processes on white phenolics are not as widely known as for red grapes and wines.

At ETS Laboratories we have offered phenolic analysis of red wine for over ten years. We analyze red grape phenolics and offer rapid analytical tools for monitoring phenolics in red fermentations. Although we do not advertise the capability, we also analyze white juices and wines for phenolic composition.

Red and white, what is the difference?

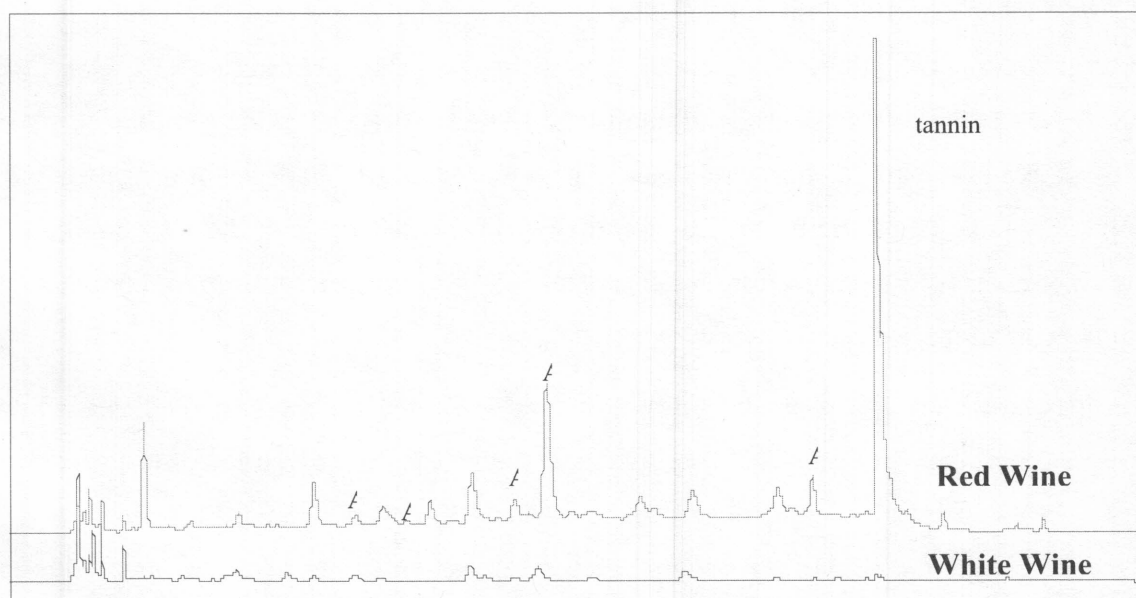
There are two major factors that cause the difference between red and white wine phenolic composition. Red grapes contain anthocyanins and red wines are fermented in the presence of grape skins and seeds.

The phenolic composition of white grapes is actually remarkably similar to red grapes. Although there is significant genetic variation between varieties, the only major difference between red grapes and white grapes is anthocyanins. Closely related varieties such as Pinot noir and Pinot blanc have identical phenolic composition of skins, seeds and juice with the lone exception of anthocyanins in the skins. A study of a white chimera in a Pinot noir red cluster (a cluster with half red grapes and half white) showed no differences in more than thirty phenolic compounds except for the five anthocyanins compounds found on the red Pinot noir side.

White grapes contain tannin in the skins, flavonols such as quercetin, tannin and flavan-3-ols in the skins and cinnamic acids in the pulp. The factors that influence phenolics in red grapes have the same effects in whites. Sun exposure causes an increase in tannin and flavonols in the skin, seed ripening reduces the extractability of the seed phenolics and ratios of juice to skins and seeds influence the potential phenolic composition of juices and wines.

The differences between red and white wine making have a greater effect on the phenolic composition of red and white wines than the effects of grape composition. With the exception of cinnamic acids in the pulp, phenolic compounds are found in the skins, seeds and stems. It is the extraction of these compounds during fermentation and maceration that create the major differences between red and white wines. Although the visual presence of anthocyanins dominates a comparison between red and white wines, it is the extraction of tannin and other phenolic compounds from the skins and seeds during winemaking that really sets red wines apart from whites. White wines typically contain 10 to 50 mg/L of tannin, red wines range from 250 to more than 2000 mg/L tannin.

A chromatogram of a red and white wine is shown below. Anthocyanins, marked with an A, are only a small part of the difference.



Phenolic compounds present in white wines

The primary grape phenolic compounds found in white wines are cinnamic acid esters, tannin, and lesser amounts of skin and seed components such as benzoic acids, flavan-3-ols, flavonols and flavanones. White wine also contains compounds modified in wine such as oxidation products of cinnamic acids, free cinnamic acids, tyrosol and flavonol aglycones.

At ETS, our standard white wine phenolic panel reports gallic acid, catechin, astilbin, caftaric acid, caffeic acid, grape reaction product, p-coumaric acid, quercetin glycosides, quercetin aglycones and tannin.

Gallic acid is a benzoic acid present in grape seeds, oak barrels and oak adjuncts. Gallic acid is typically in low concentration unless the wine has seen considerable new oak.

Catechin is a flavan-3-ol from grape seeds. Catechin seldom reaches significant levels in white wines. It is a useful marker of seed extraction related to skin contact or pressing.

Astilbin is found only in grape skins. It is a useful marker for skin extraction in pressing and skin contact studies.

Caftaric acid is present in grape pulp and grape skins along with coutaric and fertaric acid. These cinnamic acids are readily oxidized in the presence of grape oxidative enzymes. When oxidized, they form a reactive quinone that can oxidize other phenolic compounds. In the presence of glutathione, the quinone reacts to form **grape reaction product** (GRP), a caftaric acid-glutathione adduct. In the presence of additional oxygen GRP can oxidize further to form complex oxidative polymers. Caftaric acid can also lose its tartaric ester to form free **caffeic acid**. Similarly, coutaric acid can become **p-coumaric acid**. The cleavage of the ester bond is an enzymatic reaction caused by enzymes in microorganisms or by enzymes present in commercial enological enzyme preparations.

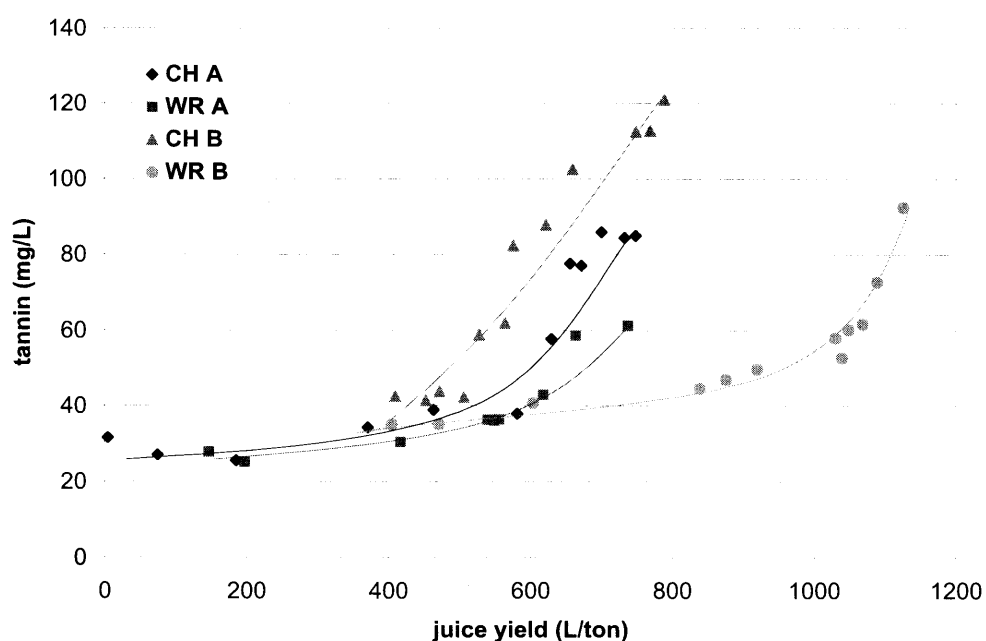
Quercetin glycosides are flavonols are present in grape skins. They are extracted into white wine during skin contact and pressing. The attached sugar may hydrolyze to form **quercetin aglycones**. The hydrolysis may be caused by glycosidase enzymes in microorganisms or by glycosidase activity in commercial enzyme preparations. Enzyme preparations high in glycosidase activity are often deliberately used in white fermentations to release glycosidically bound aroma constituents. An often unnoticed side effect is the liberation of flavonol aglycones.

These compounds are far less soluble than the glycosides and in rare instances, cause a flavonol haze.

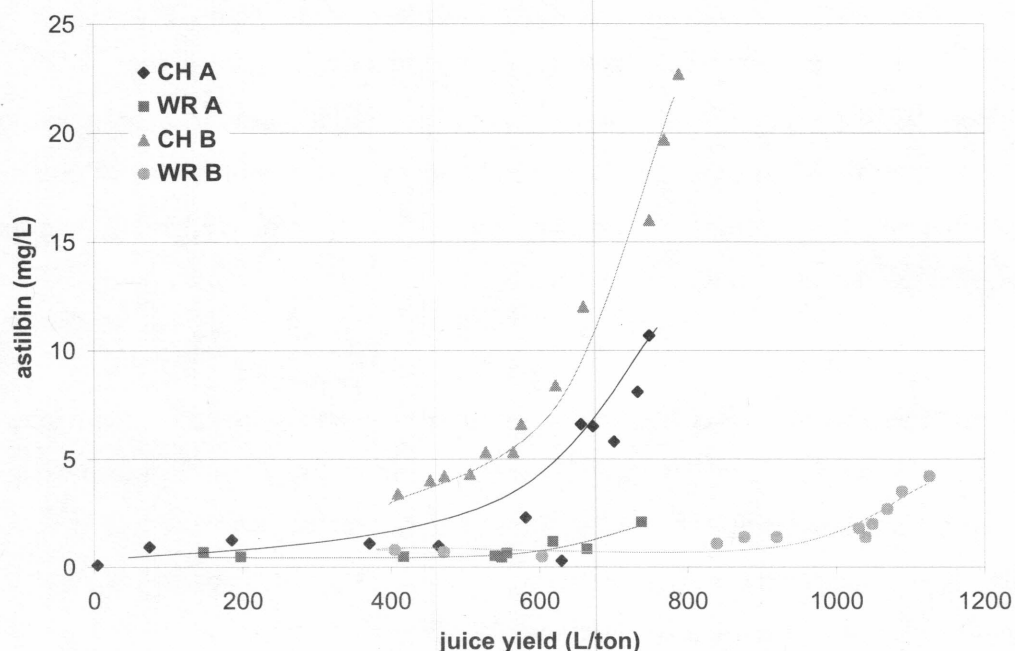
Tannin in white wine comes from grape tannin and oak. It may also include large complex oxidation products from cinnamic acid oxidation. Grape tannin is a flavonoid polymer (condensed tannin) and is extracted during skin contact and pressing. Oak tannin is a complex mix of hydrolysable tannins including ellagitannin and gallotannin. Oak toasting greatly reduces available tannin in oak and most white wines have very little tannin from oak. Tannin is defined as large complex polymers of phenolic compounds that can precipitate proteins. The oxidation products from cinnamic acid oxidation add phenolic polymers to the complex mix of tannins. Using the ETS tannin assay, these compounds can be identified at 320 nm. We have shown that they are closely related to juice browning.

Example – Press Cuts

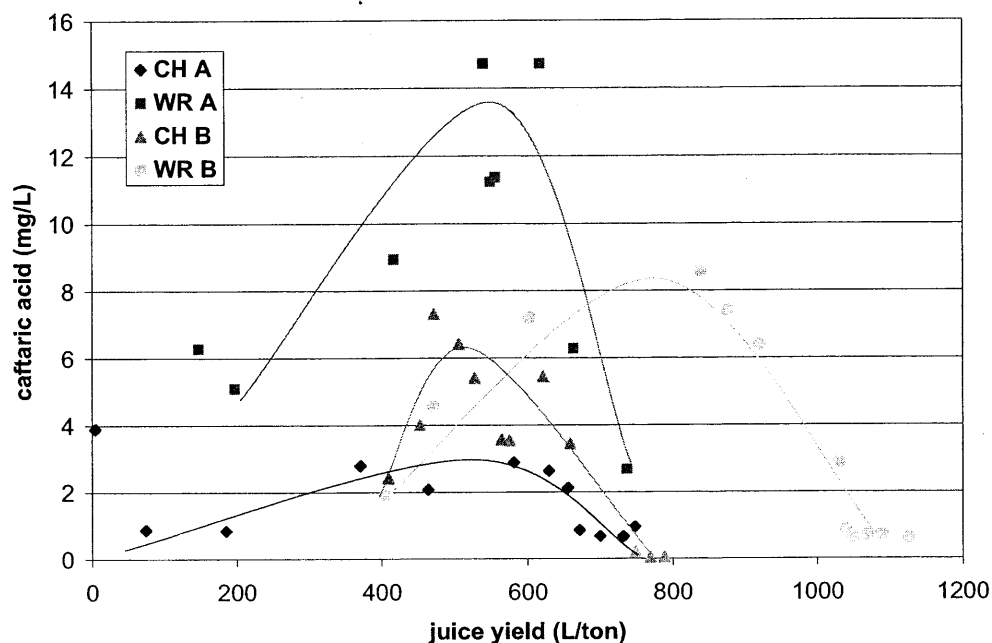
Pressing is both extractive and oxidative. In red wines, one of the signatures of a press wines is the low level of cinnamic acids. These compounds are lost due to oxidation during pressing. Extraction from skins during pressing is much less in white grapes than red wine, but it is still significant and may have important sensory relationship to harshness. The charts below show the extractive effects of pressing two Chardonnays and two Rieslings.



Tannin is readily extracted during pressing and different grapes have very different responses to pressing. The two Rieslings have distinctly different extraction curves. The tannin in Riesling A is increasing at lower juice yields than Riesling B. Pressing is resulting in tannin levels approaching red wine levels in CH B.



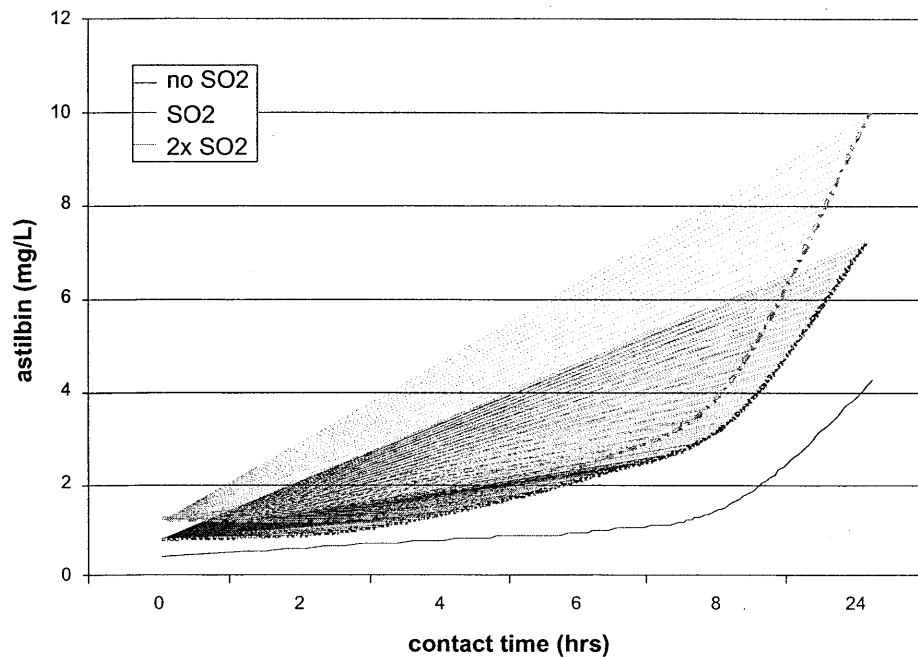
Astilbin, a marker of skin extraction shows an even stronger response than tannin, particularly in Chardonnay B, the sample with the highest tannin. The Rieslings have much lower levels of astilbin, perhaps due to lower astilbin levels in the skin. The chart clearly shows the importance of press cuts and the difficult balance between juice yield and potentially harsh phenolics.



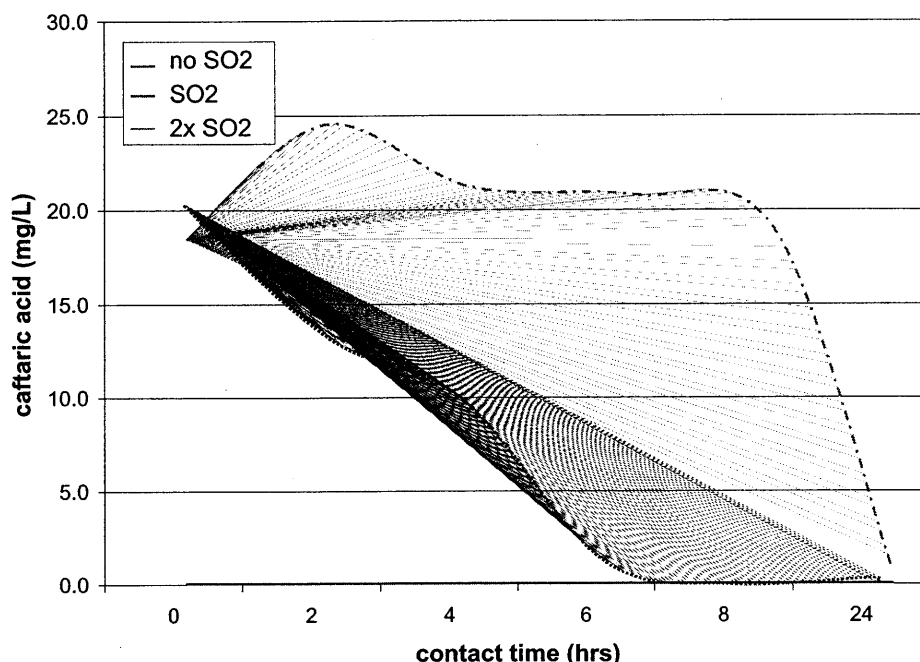
Caftaric acid is present in both grape pulp and skins. Increased pressure extracts more skin components and more caftaric acid, but the oxidation that accompanies the end of the pressing cycle results in oxidative losses that exceed any additional extraction.

Example – SO₂ and Skin Contact Time

In this example, Chardonnay grapes were lightly crushed and left at room temperature with no SO₂, standard rates, or twice standard rates. The concept of the trial was to simulate the transport of mechanically harvested fruit.



Skin contact time increased extraction of astilbin. Tannin extraction increased in a similar manner (data not shown). What was surprising was the effect of SO₂ on extraction. SO₂ is added to white grape to prevent oxidation but SO₂ also increases the extraction potential of grape juice. By six hours, grapes with SO₂ had more than twice the astilbin content as grapes with no SO₂. Doubling the SO₂ increased extraction even more.



Effects of SO₂ on caftaric acid were primarily as an antioxidant. In the absence of SO₂, caftaric acid was all immediately oxidized. With standard SO₂ additions, the oxidation was delayed. With twice the usual amount of SO₂, there was little caftaric acid oxidation until more than 8 hours of contact time.

Conclusion

The low concentration of phenolic compounds in white wine makes them only a minor component of white wine structure and quality. As a result, phenolic compounds in white grapes, juices and wines are often ignored. There have been very few studies on the enological significance of phenolics in white wines and there is almost no information on the sensory relevance of phenolic information.

Grape growing, fruit handling and winemaking clearly do have an effect on wine phenolic composition but using that information effectively will require additional information. Perhaps the most important step for a winemaker concerned about phenolics in white wines is to carefully tie sensory impressions to phenolic information. The studies shown above were part of a larger project to identify the key control points for phenolics in white wines. In-house research as well as cooperative research with University personnel will help further knowledge and help develop tools for making white wines with appropriate phenolic levels for the style and market.

Flight No. _____ Sample No. _____ Color _____

Fruit derived / varietal flavors: _____

Texture / Mouthfeel: _____

Overall / Balance / Structure: _____

Comments: _____

Flight No. _____ Sample No. _____ Color _____

Fruit derived / varietal flavors: _____

Texture / Mouthfeel: _____

Overall / Balance / Structure: _____

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The History of Tokaj

Thomas Laszlo – Heron Hill Winemaker

Thomas Laszlo began his career in wine production after obtaining a diploma in farm management from the University of Guelph. Initially, he worked as a Vineyard Manager in Niagara-On-The-Lake leading quickly into an assistant winemaking position at Henry of Pelham Estate Winery located in St. Catharines, Ontario. After several years at Henry of Pelham, Thomas Laszlo along with his family moved to Tokaj, Hungary to fill the position of Technical Director at Chateau Pajzos and Chateau Megyer. Starting with the 1997 harvest until the completion of the 1999 harvest, he oversaw the whole production, from grape to bottle, for the two Bordelaise owned Tokaji estates. After relocating to Niagara Falls, Ontario, for the next two years he continued his work in Tokaj as a Winemaking Consultant and in addition acted as a Liaison for Pajzos and Megyer travelling and making contacts throughout North America and Europe. During his time in Europe, Thomas worked closely with Bordeaux Oenologist, Michel Rolland and his team in order to improve the quality of the Tokaj region's dry white varietals. Due to Thomas Laszlo's extensive experience in dessert winemaking styles he has been called upon several times to act as a wine judge including the honour of representing Hungary as a judge at Vinexpo 1999 in Bordeaux. During the 2001 vintage Thomas Laszlo split his time between Ontario and Tokaj and as of 2002 he has resigned his duties in Hungary.

Since August of 2002 Thomas has been overseeing wine production at Heron Hill Winery located on Keuka Lake in the Finger Lakes Region of New York state in the position of Vice President of Winemaking Operations.

The region of Tokaj gave its name to the famous Tokaji wines. It is located on the northeast border of Hungary. The region is comprised of 28 villages and surrounded by the River Tisza and the River Bodrog that connect at the village of Tokaj. Other well-known villages in the region include Mád, Tarcas, Tállya, Sátoraljaujhely and Sárospatak. The village of Sárospatak is where the vineyards of Pajzos and Megyer can be found. This village holds great historical importance, as it was once the political, cultural, and religious center of Hungary.

Tokaj's history spans almost one thousand years. It is believed that the Celts were responsible for planting the vineyards and by the time the "Magyars" settled in the Carpathian Basin, estimated at about A.D. 895, the vineyards were already established. Being familiar with viticulture and winemaking from their previous nomadic existence, the Magyar tribes continued vine growing in the region. It is recorded that in the middle of the eleventh century, French settlers arrived in the region and contributed to its development. Italian wine growers in the thirteenth century were invited by King Béla IV in order to help re-establish the vineyards after the Mongol invasion of 1241. The Italian wine growers are thought to be responsible for bringing with them the Furmint vine, which remains the dominant grape variety of the region to this day. In the eighteenth century, many Germans were also drawn to the region because of its rich vineyards.

Tokaj's fame reached such heights in the sixteenth century that Italian writers documented that Tokaj wine contained gold. This belief that gold could be found in Tokaj is said to be the reason behind the attack on the Tokaj Castle in 1565 by Lazar de Schwendit, Marshal of the Habsburg forces. Speculation says that after the battle, thousands of vine cuttings were gathered and taken back to the estate of Lazar de Schwendit in Alsace where the vines were called Tokay. These vines in Alsace continue to be called Tokay (Pinot Gris) and are the source of much confusion for the wine buyer.

Although Tokaji wine was very popular in the earlier centuries, it is thought that the wines of Tokaj were dry until the 17th Century. Legend states that Aszú, (botrytis affected berries), was discovered in 1650 when the threat of a Turkish invasion in the region pushed back the harvest into late fall. When the grapes were finally harvested, the noble rot had set in the berries. It was not until the following Easter when the wine was pulled from the cellars and tasted, that they realized the botrytis jewel that had been uncovered.

Early records of vineyard classification of the entire Tokaj-Hegyalja date back to 1641 where laws regulated vineyard selection and maintenance procedures such as irrigation and the building of terraces. The Vine Law also established the official harvest start date of October 28th. In 1660 the wine laws included the regulation of aszú harvesting and wine making procedures.

The Rákóczi family played a very important role in the establishment of Tokaj as a leading wine region. They became landowners of Tokaj-Hegyalja when György Rákóczi, Prince of Transylvania (1630-1648), married Zsuzsanna Lorántffy and obtained her dowry of lands. Prince Rákóczi I quickly established a monopoly over the wine trade in the region and became very dedicated to the vineyards of Tokaj. In his commitment, the vineyards and wine trade excelled. When Ferenc Rákóczi II took charge of the lands in 1694, he was also enchanted with the vineyards of the region and furthered the development of Tokaj-Hegyalja.

Tokaj wine became so sought after that Prince Rákóczi II used the wine to gain political favors. Wine was sent all over Europe reaching as far as Sweden. Some recipients included King Frederick of Prussia, Peter the Great, and Louis the XIV of France who is said to have given Tokaji Aszú the famous title of,

“Vinum Regum - Rex Vinorum.” Which means, “Wine of Kings, King of Wines.” This Latin quote appears on each bottle of Tokaji Aszú to this day.

Tokaji wines have long been thought to bestow medicinal and restorative qualities. These beliefs were only strengthened when such figures as the King of Prussia, Frederick the Great and King George V of England were said to have used Tokaji wines to speed their recoveries after illnesses. Frederick the Great was quoted when he labeled Tokaji wine as “a balsam for health”.

It was not only Tokaji wine that was believed to cure people of their ailments, but also the soil from the vineyards. The soil was shipped all over Europe in the hopes of curing such ailments as tumors, fevers, plague and dysentery. Physicians in Germany, London, and Austria recorded accounts of the soil’s healing properties in the early eighteenth century.

Unfortunately, as in the rest of Europe, Tokaj-Hegyalja was hit by the Phylloxera epidemic at the end of the nineteenth century. One year after a superior vintage in 1890, the region was hit by the epidemic leaving the vineyards lifeless by 1892. The vineyards were re-established by grafting vines onto the Phylloxera resistant American rootstock. The grape varieties planted were Furmint, Hárslevelű, and Yellow Muscat.

Within a few years the Tokaj Region began to flourish once again, but this was short lived. Hungary was soon to disappear behind the Iron Curtain in 1947 when the communist state monopoly took over all areas of wine production and trade in Hungary. This was accomplished through the establishment of state farms and wineries with the driving force of quantity over quality. Most of the production remained behind the Iron Curtain reaching markets primarily in the Soviet Union.

Communism was reaching its end in Hungary by the late 1980’s. The Tokaji region began its privatization in 1990 when foreign interests from France, England, Germany and Spain started to invest in winery estates. New wine laws were established in 1990 based on existing wine laws of EU countries. The Tokaji Renaissance was soon established which is known as a union of the Classified Vineyards of Tokaj. Presently, the union consists of nineteen Tokaji estates that share in the mission of, “ restoring one of the world’s most prestigious wines to its former glory ”

The Tokaj-Hegyalja appellation includes 28 villages and covers slightly over 5000 hectares of vineyard. There are two main soil types, loess and heavier soils of volcanic origin. Seldom does the vineyard altitude exceed 200 meters above sea level. Generally the best vineyards are located on gentle south facing slopes that are contained between hills to the East and West. A lengthy growing season with frequent “Indian Summers” coupled with the moisture generated by the nearby Bodrog and Tisza Rivers provide perfect conditions for the development of Noble Rot. Minute quantities of Aszú can be found

nearly every year but it is very infrequent to have aszú years of good quality and good quantity. Recently the following years are generally considered to be good vintages for the region of Tokaj: 2000,1999,1995,1993,1988,1983,1975,1972.

Prior to WWII, the winegrowers of Tokaj-Hegyalja were harvesting over thirty different types of grapes. Although Furmint was a dominant grape variety, the growers planted many different varieties in order to increase their chances of having aszú just in case the Furmint wasn't successful. Many of these varieties were extremely rare, indigenous grapes with names such as Góhér, Balafánt, Kővérszőlő, and Mézesfahér. A few red grape varieties could also be found.

Currently the Hungarian Wine Law allows only four grape varieties to carry the Tokaj name. These four varieties were selected for their consistency in quality and quantity. Despite the fact that these four varieties provide an excellent recipe for Tokaji Aszu, there are some curious growers that would like to rediscover some of Tokaj's ancient varieties. These individuals can be seen roaming about abandoned vineyards during harvest time searching for gnarled 100 year old vines, bearing but a few grapes, with the hopes that these forgotten treasures might be revived.

History of Grape Varieties

Furmint is an indigenous Hungarian variety found throughout Hungary but densely planted in Tokaj. It forms approximately 70% of the Tokaj vineyards, ripens late and routinely reaches peak maturity at the end of October. Although Furmint can usually reach 14° alcohol every year, it also maintains a high level of acidity that is very crucial in balancing sweet wines. Under optimal conditions for botrytis development, the thin-skinned Furmint is very susceptible to noble rot. It is the Furmint component of all great Tokaji Aszú that is responsible for the wine's excellent age ability.

Hárslevelü is another native variety which is much more widespread throughout Hungary than Furmint. This large, loosely bunched variety accounts for about 25% of the Tokaji vineyards. A late ripener, Hárslevelü often produces a more aromatic wine with softer acidity. Its real usefulness lies in its ability to better withstand excessive rainfall than the Furmint variety. In years where the Furmint is overcome by botrytis, the Hárslevelü variety still holds hope for Aszú production.

Yellow Muscat is a mutation of Muscat Blanc a Petits Grains that is thought to be the oldest known grape variety. With only 5% of Tokaji vineyards being planted with Muscat, it is usually quite rare to see the

varietal Tokaji Muscat on the shelf, and even more rare to see a sweet wine made entirely from this variety. The yellow Muscat ripens earlier than either Furmint or Hárslevelű, which makes it very suitable to be used as the base dry wine in aszú wine production. It is slightly lower in acid but by no means soft. Tokaji Muscat is very useful for enhancing the aromatic profile of aszú wine.

Zéta (formerly known as Oremus) is a recent addition to the blend of Tokaji grapes. This Hungarian crossing of Furmint and Bouvier was developed because of its ability to ripen early and for its excellent production of noble rot. Quite neutral as an independent varietal, Zéta is generally used as a blending component of aszú production. Currently the plantings of Zéta are well below 1% of the total vineyards in Tokaj.

The Wine Styles

Dry wine

With average yields of 5000 to 8000 kilos per hectare, the Tokaji vineyards produce a sizeable amount of dry wine. Even in great aszú years it is very rare for more than 20% of the harvest to be affected by noble rot. Much of the dry Furmint and Hárslevelű is sold off as bulk wine while the best lots are bottled. No matter what the variety, dry Tokaji wine can be characterized as full bodied, mineral, with a strong and dry backbone of acidity. Tokaji dry wine is best when consumed young.

Late Harvest

The late harvest category is relatively new in its present form although wines of similar quality and style have always been made in Tokaj. “Főbor” or “main wine” was an ancient sweet wine style that made use of botrytis bunches. These wines were consumed fresh and young as well as after a period of ageing in barrels.

Under the current Hungarian Wine Law, a late harvest wine has to be made from 100% of a stated varietal and there is no requirement for barrel ageing. At the Estates of Pajzos and Megyer, we feel that our late harvest wines reflect the maximum expression of the variety used. This allows the consumer to better appreciate the uniqueness of each Tokaji variety, free of oak influence and blending, while aiding in their comprehension on how these varieties are combined to make Tokaji Aszú

Szamorodni Dry and Sweet

These wines form the first step of the Tokaji Quality Wines of Distinction grading system. Szamorodni is a word of Polish origin that means, “as it comes.” Over ripened grapes that may or may not be botrytis affected are selected to make a dry wine with a high alcohol content. If the must weight is too high to vinify dry, then residual sugar is left and the Szamorodni is sweet. The current wine law only requires aging of this wine in barrel for one year followed by one year of bottle ageing. However, most consumers of Szamorodni prefer a strong oxidative note in their wine that requires several years of ageing in barrel.

Aszú

The basic recipe for aszú winemaking has changed very little over the last 400 years. Dried out raisin-like berries are hand selected, berry-by-berry, starting in early October with the Muscat and continuing into mid November with Furmint and Hárslevelű. These hand picked aszú berries were traditionally collected in wooden baskets that were worn on the backs of the pickers. This basket is known as a puttony. One puttony typically would hold 25 Kg of aszú berries. In order to extract the sugars and flavors out of these very dry aszú berries it is necessary to conduct a maceration. The aszu berries are placed in a tank with fresh must, fermenting must or finished dry wine depending on the wine style desired. The aszú is pressed after a maceration time of between 12 to 48 hours. Traditionally, puttonys of aszú were added to the amount of wine that a gönci barrel holds which is 136 litres. Therefore, the more puttonys used, the sweeter the aszú wine.

3 puttonyos aszu = 75Kg aszu in 136 litres of base wine

4 puttonyos aszu = 100Kg aszu in 136 litres of base wine

5 puttonyos aszu = 125Kg aszu in 136 litres of base wine

6 puttonyos aszu = 150Kg aszu in 136 litres of base wine

Presently, the basic ratio between aszú and base wine is similar despite the fact that we weigh out the portions in much larger quantities without the aid of a puttony or a gönci barrel.

In 1993 the Hungarian Wine Law made two critical changes pertaining to aszú wine production. The old Wine Law stated that Tokaji aszú must be aged for two years plus additional years according to the puttony level. This meant that a 5 Puttonyos aszú would have to be aged for seven years in barrel. Although the best quality aszú wines could handle this extended time in barrel, much of the wonderful aszú fruit flavors were sacrificed. Currently, Tokaji Aszú only requires ageing for a minimum of 2 years in barrels and one year in bottle independent of the puttonyos level. Until 1993 there was no Law

pertaining to the age of the base wine. This meant that a ten year old base wine could be used if available. Although the character of the aszú from a given year definitely dominates the character of the wine, 80% or more of the liquid portion of Tokaji aszú is made up from the base wine. Due to the changes in 1993, it is now Law that the base wine or must used in making Tokaji Aszú has to be the same year as the aszú berries. Both these laws have greatly helped in advancing the quality and integrity of Tokaji Aszú.

Residual Sugar Content

3 puttonyos 60-90g/l

4 puttonyos 90-120g/l

5 puttonyos 120-150g/l

6 puttonyos 150-180g/l

Aszú Esszencia 180g/l and above

Esszencia

It is told that the nobility of the 1700s would measure their wealth by the number of Esszencia casks in their cellars. Like other rarities of the world such as diamonds, gold and caviar, great Tokaji Esszencia is made only in very rare circumstances and only when nature allows it. In most years when aszú berries are harvested, it is possible to collect Esszencia. However, seldom is such a high degree of purity and excellence reached as in the 1993 Pajzos Esszencia. Esszencia is the pure liquid that flows clear and freely from the bins of collected aszú berries. There is no mechanical pressing involved. The weight of between 1000 and 5000 kilograms of aszú berries collected in appropriate sized containers is solely responsible for the minute trickle of Esszencia that flows out. Given the dry nature of high quality aszú berries the aszú can be collected and stored for up to 2 months without any problem provided that the surrounding environment is dry and cool. Daily the small amount of Esszencia is collected from the bottom of the aszú storage containers. Esszencia yields are between 2% and 5 %. This means that from 1000 kg of aszú berries one might get between 20 and 50 litres of Esszencia. Obviously, much of the sugar remains in the aszú berry and is recovered through the maceration techniques used in aszú winemaking. On average, in a good botrytis year one hectare (2.5 acres) will produce between 100 and 300 kilogram of aszú berries. An average worker can pick between 10 and 15 kilograms of aszú berries per day. The Esszencia juice is fermented by wild yeast only since the commercial strains of yeast tend to die in such a concentrated liquid. The current Wine Law in Hungary states that Esszencia must be at least 450 g/l sugar at harvest. The 1993 Pajzos was slightly over 600 g/l when collected and it can happen that certain lots of Esszencia may reach beyond 800 g/l sugar. The 1993 Esszencia fermented for 4 years in a combination of 40% new Hungarian oak barrels and 60% stainless steel. Pajzos is the first company of the

Tokaj Renaissance to produce and bottle successfully an Esszencia. The last Esszencia to be made available to the West was a bottling from the state owned winery, the 1947 Tokaj Kereskedőház Esszencia (\$1200 USD). Traditionally Esszencia has been used in adjusting the Aszú wine and was seldom bottled. By bottling this excellent example of Tokaji Esszencia we have made available a legend that up until now was only the privilege of the aristocracy and royalty.



Château PAJZOS

1999 Chateau Pajzos 5 Puttonyos Aszú - Pajzos Estate Vineyard, Tokaj, Hungary

Base Wine	Aszu Berries	Esszencia
100% Sárga Muskotály	100% Furmint	80% Furmint 20% Hárslevelű
Picked: Oct. 10, 1999	Oct. 15 to Nov. 5 th 1999	Same Picking Window
Brix: 25°	65°	72°
TA: 9 g/l	22 g/l	24 g/l

Bottled: June, 2002

Wine: Alc.11% T.A. 12.2g/l R.S. 160g/l pH 3.4 VA: 1.08 g/l SO₂: 25/183 ppm

Drinkability: best in 2005+, can age Decades

Winemaking

Harvesting

- Strict Hand Harvesting for Muscat Base Wine and Single Berry Furmint Selection
- Sorting was done as best possible in the vineyard
- Only overripe or Szamorodni quality Muscat picked for base wine
- Mostly 1st Class Aszu berries were used with the majority more *passerillé* like
- **THE BEST BOTRYTIS HAS A MOUSTACHE AND NOT A BEARD**

Pressing (Base Wine)

- Destem/Crush/Press 50 ppm SO₂ used in pan to decrease Wild yeasts
- Inoculate with reliable and fast fermenter (EC-1118, K1)

Aszu Collecting

- Individual Aszu berries were picked and stored in large containers holding up to 3 tonnes of berries
- Aszu berries of high quality can stay lumped together for months without spoiling or fermenting
- During the resting period Free Run Esszencia is collected, about 20-50 liters/tonne

Aszu Combination

- When the fermenting Muscat Base wine reached about 11–13% Alc., the formulae of mixing Base Wine to Aszu berry occurred on Oct.30th 1999
- Furmint Aszu berries were blended with Muscat Base wine at a rate of 1 kg to 1 L
- Basically equal to 150 kgs of Aszu in 6 Puttonys to One 136 L Gonci barrel of wine
- Aszu berries are lightly macerated and blended with base wine using a Delta Progressive Cavity Must Pump turning the mixture in Aszu “tészta”
- Aszu “tészta” is left to macerate in Bucher Tank Presses between 12 to 36 hours depending on quality
- 1st pressing yields very sweet juice 4% Alc and 450g/l, later pressings yield lower sugar amounts, Generally only 1st and 2nd pressings used for top Aszu wines
- All base wine fermentation stops because of immense Sugar accumulation
- Blend of pressings are done at this time, separated to tank or barrel for fermentation
- Fermentation resumes with wild “Tokaji” strain, 9.5% Alc., achieved in 2 weeks
- Long fermentation in new Hungraian “Szerdnyei” barrels, 250 liters
- (the last 1.5° Alc. took 6 months to finish), racked after fermentation

Elevage (Aging)

- aged in same new barrels in the Antaloczi cellar for a total of 2.5 years, Cellar Temp.: 42-46 F and 96% humidity, All year round,
- Taste adjusted with 1% Esszencia, Sterile membrane bottled, No Cold Stabilization

HERON HILL
WINERY



2002 Heron Hill Late Harvest Riesling

100% Estate Vineyard – Keuka Lake

Picked: Oct. 15, 2002

Bottled: June 10th 2003

Brix: 31° (at Harvest)

Wine: Alc.11% T.A. 9.7g/l R.S. 115g/l pH 3.16 VA: 0.81 g/l SO2: 27/210 ppm

Drinkability: upon release, best in 2006+, can age 5 to 10 years more

Winemaking

Harvesting

- Strict Hand Harvesting
- Sorting was done as best possible in the vineyard
- Some sour rot was present and the VA on juice was higher than desirable
- 90% of fruit was completely botrytised, large amount of Conidia present
- Most Botrytis fruit was picked out before the fresh harvest started on Oct. 30th

Pressing

- Whole Bunch pressed, 50 ppm SO2 used in pan to decrease Wild yeasts
- Slow pressing at cool temp. (45 F) to preserve fruit flavor
- Dry ice used (1kg/100 L) cools 1°C, Pressed for 24 hours

Fining

- 70 g/hl Polylact used (Caesin/PVPP) to decrease Lacasse and other enzymatic browning
- 50 g/hl Deodorizing Carbon used to absorb VA and off flavors
- 150 g/hl Pure Calcium Granular Bentonite, Let stand for 24 hours then racked

Fermentation

- Steady, neutral fermenting yeast EC-118 was used at 30g/hl, Starter took 36 hours to build up to inoculation strength, Doubling amount each step, done 4 times
- Warm to 68 F, Rack with full aeration when 5 brix depleted
- Fermentation was conducted at 65 to 72°F, Aerated again at 12 brix depletion
- Fermented to 11.5% or 115 g/l RS in **Seven Days Total**
- Stopped fermentation using Dry Ice from 67 F to 28 F in less than 30 mins.

Elevage (Aging)

- Held at 28 F, for 1 week, Racked and SO2 150 ppm
- Stored for 6 months in Stainless Steel at 34 F
- Pad filtered at 4 microns and then Sodium Bentonite at 75g/hl
- Racked and filtered 2.5 micron pad after two weeks on Bentonite
- Pad filtered again to sterile 1.5 to .45 micron
- No Cold Stabilization Needed
- 100 ppm SO2 added the day of bottling, Sterile Membrane Bottled

Flight No. _____ Sample No. _____ Color _____

Fruit derived / varietal flavors: _____

Texture / Mouthfeel: _____

Overall / Balance / Structure: _____

Comments: _____

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Comments: _____

Winter Gift in the Glass

Mira Ananicz, Vincor, Canada

Mira was born and educated in Poland in the field of Analytical Chemistry and Chemical Technology. After completing 2 years at the University in Wroclaw -Poland in the Dep of Chemical and Mechanical engineering, she came to St . Catharines to visit her cousin. Taken in with the beauty of St. Catharines in the heart of Ontario wine region, she decided to continue her studies at Brock University . Mira graduated with Bachelor of Science in Chemistry in 1973.

Dedicated to the pursuit of wine making she completed additional courses at Davis University in California . Mira is currently working at Vincor International in the capacity of Chief Oenologist, and recently celebrated 32 years as wine maker-Canada's longest serving female winemaker, and the first female winemaker in Eastern Canada.

Mira is a member of American Society of Oenology and Viticulture Royal Canadian Legion, Br 418, and International Torch Club. Her hobby is golfing ,skiing and woodworking.

In just over a decade, the Canadian wine industry has grown from primarily producing lower priced wine, and selling it in a protected domestic market to becoming a competitive participant in the international market for premium new world wine (wine produced in Canada, USA, Australia, south Africa and south America) . The regions of Europe such as France, Germany, Italy and Spain are considered 'Old World'

Canadian Wine Facts:

1. Canadian wine making is not a recent phenomenon. Viking explorer Leif Ericson first named Canada, Vineland in 1001 BCE after he found so many vines growing where he landed at L'an Aux Meadows Newfoundland
In 1535 Jacques Cartier also found many grapes growing on the island he named Ile de Bacchus (known now as Ile D'Orleans)
2. Johanne Schillar, a retired German soldier is known as the father of Canadian wine industry. In 1811 he applied his expertise from Rhine wine making ,to a 400 acres of grapes planted in the Niagara region of Ontario, mainly near Grimsby
3. The first commercial winery was VinVilla on Pelee island in 1866.
4. In 1890 there were 41 wineries in Canada, 23 of those were in the corridor between Windsor and Pelee Island.
5. Today we have wineries in Ontario, BC, Quebec, Nova Scotia and Prince Edward island.
6. By 1919 all provinces went dry under Prohibition (except Quebec). Canadian law made it illegal to sell ,but not to manufacture.
7. At the end of prohibition each provincial government decided to regulate the sale of alcohol. The government monopoly in Ontario is the world's largest single purchaser of wine in the world, buying 8.5 million cases annually (or 76.2 million litres)
8. In 1955 Brights Winery produced the first 100% Canadian Chardonnay

9. In the early 1970 Canadian preferred sweet 'pop wines' . 7% alcohol products such as baby Duck
10. In addition to the classical vinifera grapes varieties(Chardonnay, Cabernet Sauvignon), Canada grows several hybrids such as Baco Noir, Marchal Foch and Vidal.
11. Ontario's premier wine regions include Niagara peninsula, Lake Erie North shore and Pelee island.
12. British Columbia is the second largest grape growing region including the Okanagan valley, Similkameen Valley, Fraser Valley and Vancouver island.
13. Canada's wine regions are on the same latitude as Burgundy in France, The Chianti region of Italy and the Rioja region of Spain.
14. In 1988 the Vintners Quality Alliance (VQA) was created to ensure a minimum quality standard in the industry.

VQA has two categories: provincial and geographic:

- The provincial designation allows hybrids or vinifera grapes with 75% minimum of the name of the grape variety.
- Geographic designation refers to specific viticulture area, which will be named on the label. Only Vinifera grapes can be used with 85% minimum of the named variety. Vintage dated wines must have a minimum of 85% of the wine from that vintage.

Greatest success story in the Canadian wine industry:

Ice Wine originated by fluke in 18th century Germany, when a snap freeze caused growers to harvest frozen grapes. Now Ice Wine is made in Germany, Austria Canada and some states in the USA (Ohio, NY).

In Canada, Ontario is the biggest producer of ice wine. In Ontario and Germany ice wine is defined as "naturally frozen".

Walter Hainle made the first Ice Wine in Canada in 1973, and the first commercially available Canadian Ice Wine was made by Hainle Vineyards (Okanagan Valley) in 1978.

In order to make Ice Wine, the grapes are left on the vine until after the first frost hits. These grapes are harvested after being frozen in the vineyard and then while still frozen they are pressed.

Since the grapes are left on the vine well into the winter months, the resulting freezing and thawing of the grapes dehydrates the fruit, and concentrates the sugars, acids, and extracts in the berries, thereby intensifying the flavors and adding complexity to the wine made from it.

The juice from Ice Wine grapes is about one-fifth the amount you would normally get if you pressed unfrozen grapes. To put it another way, a vine will normally produce sufficient grapes to make a bottle of wine; but frozen grapes would produce only one glass of Ice wine

Typical grapes used for ice wine production are: Riesling, Gewürztraminer, Vidal Blanc, and, interestingly, the red grape Cabernet Franc. Cabernet Franc ice wine is a light pink color, like most rosé wines.

During both of those processes: grape picking and pressing, the temperature cannot exceed -8 degrees Celsius (Table 1.)

Table 1:

Temp	Sugar Content
-6	29%
-7	33%
-8	36%
-9	39%
-10	43%
-11	46%
-12	49%
-13	52%
-14	56%

Ideally the temperature should get to between -10 and -13 degrees Celsius before picking. This provides the optimum level of sugar and flavor in the grapes.

The lower the temperature the higher the sugar content in the grapes, but also a lower yield of juice per tone of grapes.

Ice Wine in Canada is produced under the strict rules and regulations set out by the VQA Vintners Quality Alliance.

This includes the following:

1. The finished must (which is the juice, pulp and seeds), must have a Brix level of 35% or higher (Brix is the sugar level).
2. The alcohol must be derived exclusively from the natural sugars of the grapes. All wines that are labeled as ice wine must be produced by VQA registered growers and winemakers.
3. The harvest of ice wine grapes must start after November 15th.
4. Before harvesting the producer must verify in writing (by specified form) the following:
 - a) the temperature of each individual harvest
 - b) the acreage and tonnage of each given crop
 - c) the measured Brix level of each must.
 - d) the harvesting date and time of day
 - e) Ice Wine processing capacity.
5. All VQA ice wine processors are required to attend a VQA ice wine standards seminar each year.
6. VQA authorities randomly sample and analyze must, juice and wine to ensure the standards are being met.

Table 2: Total Grape Purchased in (T) for the last 5 years in Ontario

	2001	2002	2003	2004	2005
Red Hybrids	4775	4224	4229	5828	3275
White Hybrids	14699	13500	12121	16235	6857
White Vinifera	12602	13197	4954	11812	4304
Red Vinifera	9867	13371	5146	12304	3810
Total	41943	44292	26450	46179	18246

- 2003 and 2005 were very poor Vintages due to winter and spring injuries

Table 3: Ice wine Juice (L) production in Ontario from 2000 till 2004

	2000		2001		2002		2003		2004	
	L	T	L	T	L	T	L	T	L	T
White Hybrids	261000	1740	307199	2048	401772	2678	371578	2478	688966	4594
White Vinifera	56437	376	32573	217	140544	937	46230	308	112624	751
Red Vinifera	11242	75	22891	153	82816	552	19863	132	98580	657
Total	328679	2191	362664	2418	625132	4167	737671	2918	900170	6002

*T - Tonnage for ice wine grapes was calculated based on 150L recovery/t of grapes at maturity

*2005 data is not available

Table 4: Some examples of 2005 vintage Ice Wine juices analysis:

	Cabernet Franc	Riesling	Vidal
Brix	40-42	38-39	36.5- 44
TA g/L	8.2- 8.4	9- 9.2	9.0- 10.7
pH	3.4- 3.49	3.08- 3.10	3.28- 3.77
VA g/L	0.15- 0.18	0.06- 0.1	0.06- 0.15

Before we start fermentation of the Ice Wine juice, we must prepare juice in such a way, that after the fermentation is completed, and the ice wine is produced, there is a minimum of adjustment, alteration performed on the finished product.

Any recommended changes as to tannins, astringency, colour, protein stability, total acidity, pH – should be done prior fermentation.

It is recommended addition of approximately 50 ppm of total SO₂ into the juice.

The bisulphate ion binds to aldehydes and ketones preventing oxidation.

SO₂ is protecting highly concentrated juice from microbial spoilage and browning.

The highly concentrated grape must presents a major hurdle for wine yeasts which have to ferment the juice. The ice wine industry all over the world has problems with controlling production of volatile acids in the ice wine by the yeast cells.

Certain strains of wine yeast are more sensitive to osmotic stress from the high concentration of sugars than the others. More stress - means more volatile acids.

Human sensory threshold for volatile acidity is between 0.7 to 1.2 g/L. The challenge for Ice Wine-makers is to keep VA reaching detectable levels. The Canada Food and Drug Act specifies that V.A. in wine cannot exceed 1.3 g/L and for ice wine it is up to 2.1 g/L

Winemakers expecting yeasts to ferment juice with high sugar content of 35 – 45 Brix, high total acidity, high SO₂, so they must do their utmost to provide all the nutrients the wine yeast needs.

The major growth factor for yeast cells is Nitrogen -Yeast Assimilable Nitrogen Cont. (YANC) and target level for healthy fermentation varies by grape sugar content and grape maturity level.

For Brix of 21 YANC level is 200 mg N/L, where at 27 Brix YANC level is 350 mg N/L. Low levels of YANC have been associated with the production of unwanted sulfide compounds as well as sluggish fermentation.

YANC is composed of two elements

1. organic – amino nitrogen
2. inorganic – Nitrogen (ammonia)

To optimize the nitrogen uptake during fermentation of ice wine juice, yeast rehydration nutrient GO-FERM is recommended in the range of 0.3 to 0.4 kg/1000L of juice. The yeast soaks up the valuable bio-available micronutrients as they re-hydrate.

Infusing yeast with these essential nutrients prepare them against alcohol toxicity.

Preparation of yeast starter as well as juice itself before fermentation is very important.

Recommended amount of selected active dry yeast of 0.3 to 0.4 Kg/1000L should be added into yeast rehydration nutrient solution at the temp of 40C and let it stand for 15-25 minute stirring gently a few times during that process.

Recommended yeast for ice wine production:

DV10 *S.serevisiae.bayanus*:

This strains fermentation kinetics are strong over the wide temperature range, and has relatively low Nitrogen demand. Has an ability to ferment in low pH, high total SO₂ and low temperatures. Produces low VA and low H₂S

R2 *S.ceravisiae.bayanus* :

This strain was isolated in the Sauternes region of Bordeaux. It has excellent cold temperature properties, and can ferment as low as at 10 C.

If it does not get proper nutrition, it tends to produce VA. R2 helps create intense, direct fruit style wines.

K1-V1116-*S.serevisiae.cerevisiae*:

This strain can ferment high concentration of sugars at low temperatures. However, it requires proper nutrition. It is a strong floral ester producer. K1 ferments well under stressed conditions.

6-8 hours after inoculation it is recommended to add yeast nutrients such as Fermaid-K or D.A.P. (Diammonium phosphate) into the fermenting juice in the rate of 0.2-0.3kg/1000L.

Yeast cells do not metabolize alpha amino acids equally.

The timing of nutrient addition is important. One large addition of D.A.P. at the beginning of the fermentation may delay the uptake of alpha amino acids.

If needed for YANC supplementations it is recommended to add multiple additions of nutrients.

Length of fermentation of ice wine juice depends on

- Yeast strain and yeast nutrients requirement
- Inoculation rate
- SO₂ level
- Sugar concentration
- Desired alcohol level
- Temperature of fermentation

Although the inoculations rate has no impact on lowering the acidic acid or glycerol concentration in wine, fermentation at lower inoculation rate consumes less sugar -therefore yeast cells convert higher proportion of sugar consumes to acidic acid and glycerol in comparison to yeast cells at higher inoculation rate.

Methods to reduce stress on the fermenting yeast, therefore reducing concentrations of unwanted yeast metabolites, reduction of time required to ferment juice to a desirable alcohol level is the key to the quality of the finished product and its success in the marketplace.

It is by no accident that Ontario's ice wine is among the best in the world. Our summers ensure high sugars in the grapes and our winters ensure a Ice Wine harvest. This combined with the standards set by the industry leave Ontario's ice wine difficult to surpass.

Canada today is the largest producer of this rare, rich and sweet ambrosia, with the lion's share coming from Ontario's Niagara Peninsula. Volume of Ice wine produced in Ontario has risen phenomenally commensurate with demand. Sales in Vintages alone rose from 25,000 bottles in 1992-93 to a 120,000 bottles in 1996-97. Sales continue to grow at a rate of over 50% per annum.

The demand is also evident in the export market - particularly in the Far East where Ontario Ice wines have fetched over three times the domestic price in Japan.

Canada is exporting ice wine into 34 different countries, the biggest importers (2004 stats) are

Taiwan	32,309L
Singapor	6,909L
USA	22,252L
Japan	14,247L
Hong Kong	4,998L
South Korea	7,729L
China	9,164L
UK	1,424L
Malaysia	2,159L

For over 20 Years European banned Canadian Ice Wine from their Markets stating high sugar contents as their reason. The ban was lifted in May 2001.

In June 1991 Inniskillin Winery shocked the world when they won the coveted Grand Prix D'Honneur at Vinexpo (the Olympics for the wine world) in Bordeaux France for their 1989 Ice wine.

Inniskillin Ice wine is now the largest selling wine brand in the International duty free channel, beating out Mum's and Moet et Chandon Champagne.

Flight No. _____ Sample No. _____ Color _____

Fruit derived / varietal flavors: _____

Texture / Mouthfeel: _____

Overall / Balance / Structure: _____

Comments: _____

Flight No. _____ Sample No. _____ Color _____

Fruit derived / varietal flavors: _____

Texture / Mouthfeel: _____

Overall / Balance / Structure: _____

Comments: _____

Flight No. _____ Sample No. _____ Color _____

Fruit derived / varietal flavors: _____

Texture / Mouthfeel: _____

Overall / Balance / Structure: _____

Comments: _____

Flight No. _____ Sample No. _____ Color _____

Fruit derived / varietal flavors: _____

Texture / Mouthfeel: _____

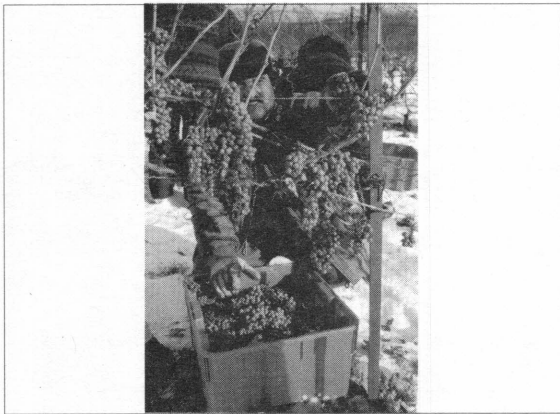
Overall / Balance / Structure: _____

Comments: _____

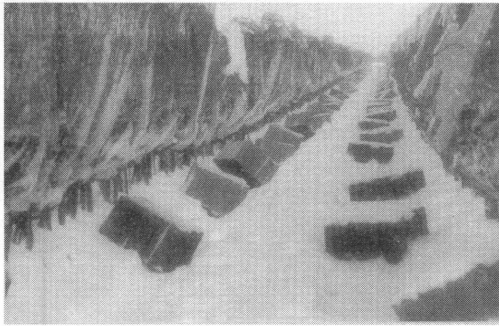


“Winter Gift in the Glass”

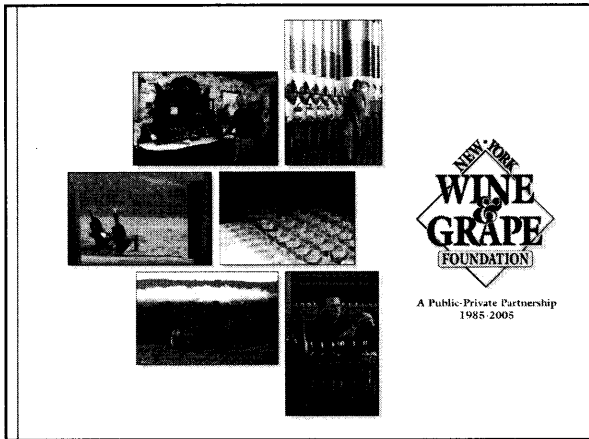
Mira Ananicz, Vincor, Canada











James (Jim) Trevisi has been President of the New York Wine & Grape Foundation since its creation in 1985, and has been involved with the industry since 1982. Jim is also widely recognized for his leadership in the American wine industry, having received the first-ever "Distinguished Service Award" from the American Society for Enology and Viticulture (Eastern Section). He is actively involved with several national and international organizations focusing on key issues affecting the grape and wine industry worldwide. He serves as Director of Communications of the *Federation Internationale des Vins et Spiritueux* (International Federation of Wines and Spirits) based in Paris. He also serves on the Executive Committee and Board of Directors of the WineAmerica, is a co-founder of the American Wine Alliance for Research and Education, and has been active in many other industry organizations. He is a frequent speaker on major issues at conferences throughout the United States, as well as a professional wine judge at several international competitions, and the author of articles which have appeared in The New York Times and other media.

2



Our Goal: "To have the New York grape and wine industry recognized as a world leader in quality, productivity and social responsibility."



www.newyorkwines.org

New York
Grapes
The Rest of the Bunch!



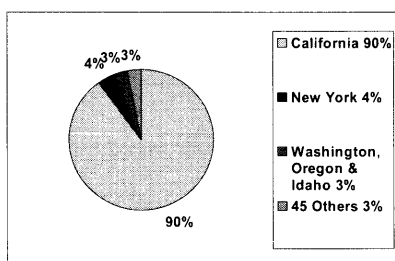
3

20-Year Perspective

- Creation and Operation of Foundation
- Results and Economic Impact
- Challenges and Opportunities
- Secret of Success

4

Wine Production by State



5

New York Wine & Grape Foundation

- Created by 1985 State Legislation
- Public-Private Partnership
- Promotion and Research
- All Grape Products: Juice, Wine, Table Grapes
- All Regions: Long Island, Hudson Valley, Finger Lakes, Niagara Escarpment, Lake Erie and others
- Nationally Recognized for Innovation and Leadership
- From Economic Crisis to Dramatic Success

6

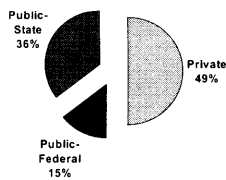
Funding Public-Private Partnership

- State Matching Funds
- Federal Matching Funds
- Program Fees
- Research Grants
- Special Grants
- Promotional Materials Sales
- Dues

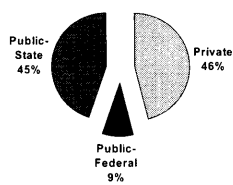
7

Private vs. Public Funding

Funding 2004-2005

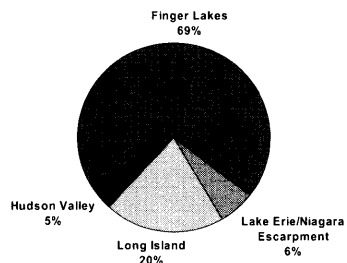


Funding 2005-2006



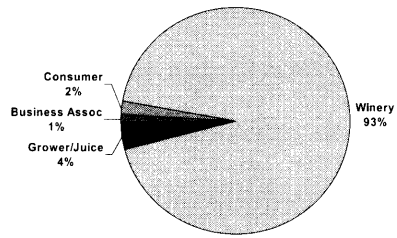
8

Private Funding: Dues by Region



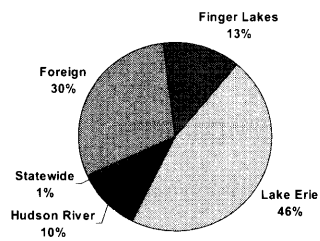
9

Private Funding: Dues by Category



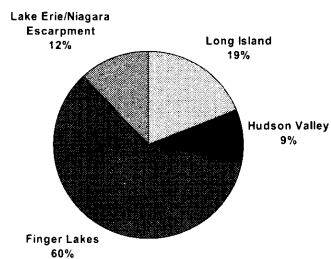
10

Private Funding: Research by Region



11

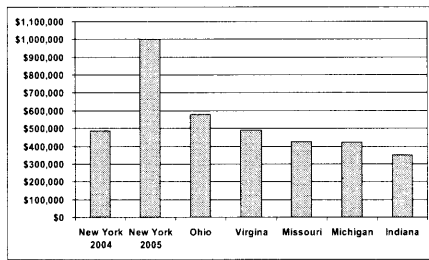
Private Funding: Promotion by Region



12

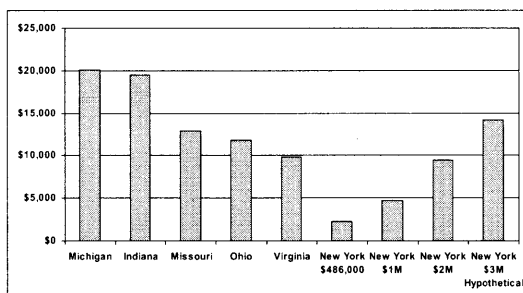
State Investment in Grape & Wine Industry 2004*

*both 2004 and 2005 are shown for New York



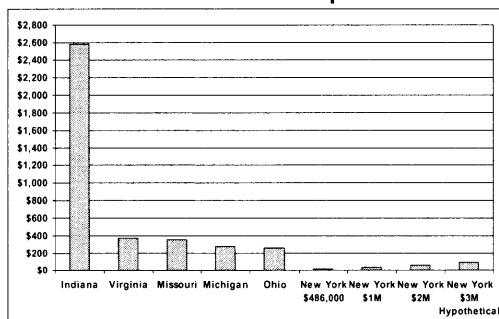
13

State Investment per Winery



14

State Investment per acre



15

Programs

New York
Grapes
The Best of the Bunch!

Promotion
Research
Export



16

Promotion: Staff Activities

- Financial Development
- Program Development
- Program Direction & Administration
- Media Relations
- Export Promotion
- National Campaign
- Industry Training & Education

17

Research

Viticulture
Enology
Wine and Health

18

Listing of Viticulture Projects & Special Projects

- Bates Improving Wine Grape Production in Acid Soils
- Bates Response of Concord to Soil pH
- Burr Management of Crown Gall
- Chang Molecular Characterization & Disease Resistance (N)
- Cheng Nitrogen Uptake, Partitioning & Utilization in Concord
- Cousins Evaluation of Rootstocks for Concord Grapes
- English-Loeb Identification of Plant Host Volatiles (GBM)
- Gadoory Epidemiology & Control of Downy Mildew
- Gadoory Investigation of Pathogen Biology & Ecology (PM)
- Goffinet Effects of Crop Load Adjustment on Bud Fruitfulness
- Henick-Kling Completion of Sensory Analysis & Flavor Chemistry
- Henick-Kling Yeast & Lactic Acid Bacteria in New York Wines
- Henick-Kling Winemaking Practices & Occurrence of *Brettanomyces Bruxellensis*
- Henick-Kling Wine Analytical Laboratory and New York Wine Data Bank
- Kumlter Levels of Resveratrol in Concord Grapes
- Lakso Grape Root Growth & Physiology
- Landers Optimizing Spray Penetration & Deposition
- Merwin Managing Vine Vigor & Improving Red Wine Grape Quality
- Morris Total Vineyard Mechanization
- Nyrop Determining whether ERM are Serious Pests of the NE
- Pool Evaluation Adaptation & Wine Quality of Promising Clones
- Reisch Evaluation of New Wine Grape Varieties
- Reisch Expression of Anti-Microbial Genes
- Weigle Addressing Late Season GBM Damage
- Wilcox The Biology and Control of Phomopsis
- Wilcox Biology, Epidemiology & Control of Botrytis
- Wilcox Factors Influencing the Performance of New Fungicides
- Wilcox Regaining Control of Grape Powdery Mildew
- Wise Evaluation of Wine Grape Cultivars & Clones on LI
- Wise Managing Wine Grapes in an Ecological Sensitive Reg

19

Export

Canada
United Kingdom
Generic Program
Branded Program
Promotional Materials

20

New York Wine & Grape Foundation 1985-2005:

Results and Economic Impact

- Phoenix Rising from the Ashes
- International Recognition
- Explosive Growth of wineries
- Rural Renaissance
- Optimism and Confidence
- Shining Star of Agriculture
- Value-Added Agriculture
- Mecca for Tourists
- Locomotive Pulling Train of Economic Development
- Continuing Challenges

21

**Full Economic Impact of Wine, Grapes and Grape Juice
in New York State in 2004
\$3.4 Billion***

NYS Wine, Grapes & Juice Products	Economic Impact
Full-time Equivalent Jobs	23 thousand
Wages Paid	\$786 million
Winery Sales	\$419.8 million
Grape Sales	\$30 million
Grape Bearing Acres	31 thousand
Grape Juice Product Revenues	\$27 million
Wine-Related Tourism Expenditures	\$312 million
Number of Wine Related Tourists	4.14 million
Number of Grape Farms	1384
Taxes Paid (state and local)**	\$372 million

*Does not include \$2.6 billion additional impact from out-of-state wines

**Underestimate as no data available on property taxes paid by wineries or vineyards other than personal property taxes.

22

**New York Winery Survey 2004
Conducted by New York Agricultural Statistics Service
Highlights**

- This survey, similar to previous ones from 2000 and 1998, shows wine industry growth since creation of the New York Wine & Grape Foundation in 1985. Some statistics are derived from other sources like the federal Tax and Trade Bureau and the New York State Liquor Authority.
- In the 30 years since 1975, the number of New York wineries has multiplied over 10-fold from 21 to 212, with 148 established since 1985.
- 63 new wineries were established in the first five years of the 2000 decade, equal to the number for the entire 1990's—essentially doubling the growth rate.
- Wine production has increased by over 50% since 1985 to nearly 200,000,000 bottles annually.
- The number of tourists visiting wineries has multiplied over 10-fold since 1985 from 384,000 to 4,137,000, with a significant share coming from other states.
- Between 2000 and 2003, tourist visits to wineries increased by 54% and per-visitor spending by 49%, meaning total spending (and excise and sales taxes) more than doubled.
- Excise and sales taxes from direct sales at the winery tasting rooms—a small portion of the total—increased from about \$3 million in 2000 to over \$7 million in 2003.
- The average winery invested \$500,000 between 2000 and 2003 in vineyards, wine production, tasting rooms, and other facilities, supporting other economic sectors.

23

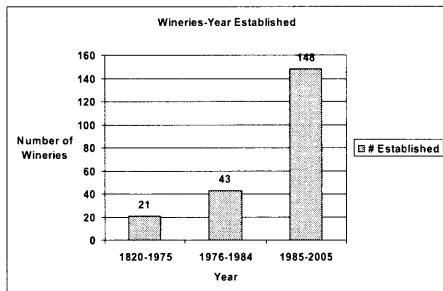
What's in a bottle of wine ?

**\$6 Billion
\$6,000,000,000**

**\$3.4 Billion New York
\$2.6 Billion Other**

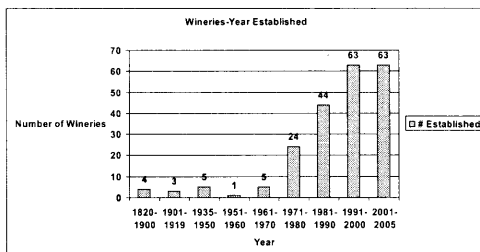
24

The Farm Winery Act of 1976 and creation of the New York Wine & Grape Foundation in 1985 both stimulated wine industry growth.



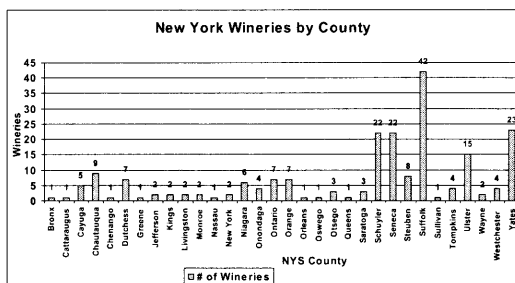
25

The 1990's were the strongest growth period, but the current decade is likely to double that. In just five years the number of new wineries has equaled that of the entire past decade.



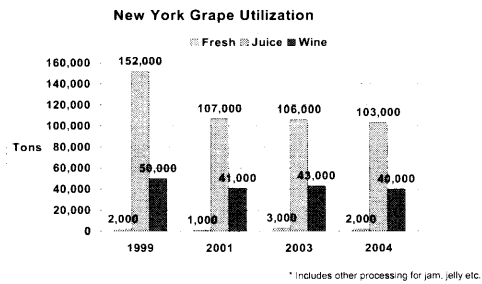
26

32 Counties now have wineries



27

About 3/4^{ths} of all New York grapes are used for grape juice, 1/4th for wine and 1% for table grapes—with total volumes dependant on the size of the harvest.



28

Wineries by Type

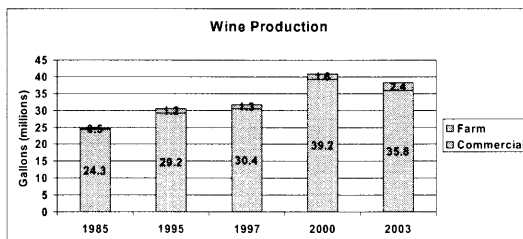
For over a decade, the strong growth of the New York wine industry has been in the establishment of new, small "farm" wineries producing fewer than 150,000 gallons annually—and with most in the range of 10,000 to 50,000 gallons. Today 87% of all wineries are farm wineries and 13% commercial wineries. However, the commercial wineries account for 95% of total production. In short, both types of wineries are very important to the industry and New York's agricultural and tourist economies.



	Licenses	Production
Commercial	13%	95%
Farm	87%	5%

29

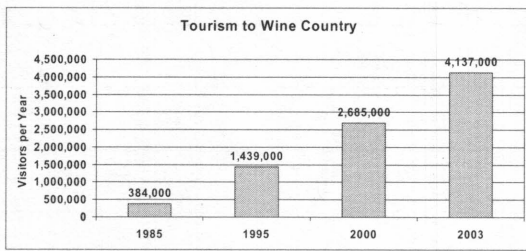
Wine Production has increased significantly since 1985 in both the "commercial"* and "farm" winery sectors.



*Note: The 6% decrease in 2003 reflects the closing of a large production facility and limited grape availability. Virtually all farm wineries reported substantial production increases, ranging from 29% to 44% for various wine trails.

30

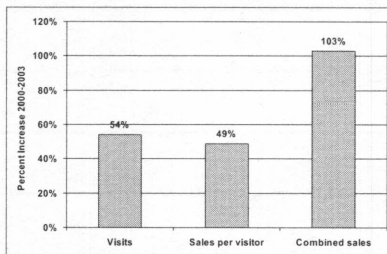
The number of tourist visits to New York's wineries has increased over ten fold-- to over 4 million-- since 1985, bringing major benefits to local economies. The number of visits increased by 54% in three years.



*Note: Since the latest data is from 2003, it is likely that this figure has increased.

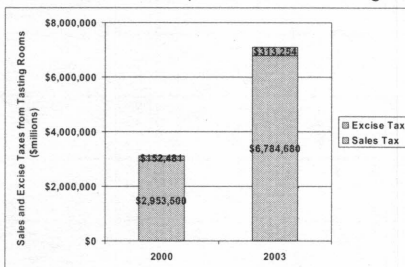
31

Between 2000 and 2003, the number of visits increased by 54% and sales per visitor by 49% -- meaning sales at tasting rooms (and related excise and sales taxes) more than doubled.



32

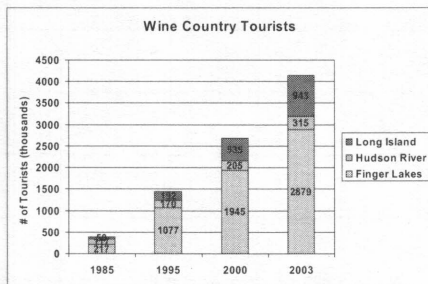
Sales taxes and excise taxes generated by direct sales at winery tasting rooms more than doubled to over \$6 million in 2003. This is a small portion of total taxes generated.



*NOTE: Wine is the only farm product subject to excise taxes and sales taxes.

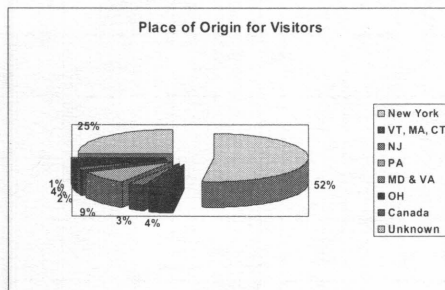
33

All major wine regions have grown in tourism, though the Finger Lakes accounts for a large majority of visitors.



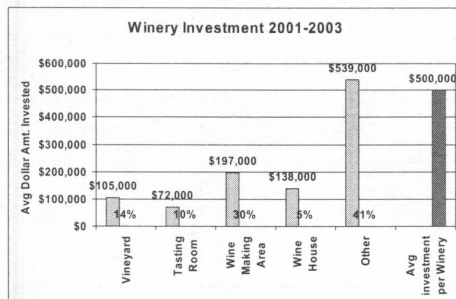
34

Wine Country is important not just for attracting New York residents, but many people from other states and countries who may purchase much more wine than the New Yorkers due to the difficulty in finding New York wines in other states.



35

The average winery invested half a million dollars in three years, stimulating other businesses like construction, equipment supply and transportation.



36

Programs for Growers

- Viticulture 2000, 2003, 2007
- Viticultural Research (2/3rds of all research)
- Wine & Health Research
- Computer Training
- Concord Health Benefits
- Concord Grape Belt Heritage Association
- Crop Insurance Summit
- Situational Analysis Seminars
- New York Grapevine Newsletter
- Research Summaries
- Support of Cornell Co-op Extension
- Financial Management for Growers
- Benefits from All Programs

37

Challenges and Opportunities

- Concord Grape Market
- Imbalance of Supply and Demand
- State Vineyard Acreage
- Weather
- Superb Track Record
- Public Sector Awareness & Support
- NYWCC
- Foundation of Cooperation

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Concord Grape Market 1985-2005

Year	Acreage	Tonnage	Price/Ton
1985	22,963	79,829	\$120
1990	21,006	n/a	\$287
1997	19,948	96,600	\$228
2001	20,584	107,200	\$264
2002	20,584*	107,770	\$266
2003	20,584*	104,000	\$187
2004	20,584*	99,300	\$174

* Year-specific acreage not available, so this is estimated

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Imbalance of Winegrape Supply and Demand 1985-2005

Year	Acreage*	Tonnage*	# of Wineries
1985	12,333	35,000	68
1990	11,000	45,000	85
1997	10,500	46,000	115
2001	10,500	50,000	160
2004	10,333	47,000	208

*Estimate based on one-third of all acreage being devoted to wine production

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Secrets of Success

Diversity = Strength

Unity = Power

Growers...Wineries...Juice Producers...
Researchers...Educators...Wholesalers...
Retailers...Restaurants...Consumers...
Elected Officials

41

Diversity

Unity

Quality

Social
Responsibility



Productivity

42

New Matters at TTB

April 5, 2006

Bioterrorism Act of 2002

- Public Health Security & Bioterrorism Preparedness and Response Act of 2002
- Registration of food facilities
- Prior notice of importation
- Establishment & Maintenance of records
- Administrative detention of food
- <http://www.fda.gov/oc/bioterrorism/bioact.html>

Establishment & Maintenance of Records

- Proposed Rule published May 9, 2003
- Final Rule published December 9, 2004
- Effective February 7, 2005.
- Compliance dates:
 - December 9, 2005
 - Small companies (11-499 FTEs), June 9, 2006
 - Very small companies (1-10 FTEs), December 11, 2006

Miscellaneous Trade & Technical Corrections Act of 2004

- Section 2002
 - Amended section 5382(a) of the Internal Revenue Code of 1986 (relating to cellar treatment of natural wine).
 - Imported wines produced after December 31, 2004 must be certified by the government of the producing country that the practices and procedures used to produce the wine constitute proper cellar treatment in the United States, and accompanied by an affirmed laboratory analysis.

Exception

- Natural wines covered by an international agreement or treaty with the US on winemaking practices and procedures.
 - Argentina, Australia, Canada, Chile and New Zealand signed a MAA covering grape wines (7-22% alcohol)
 - The European Community signed an agreement covering grape wines (7-22% alcohol)

US/EC Wine Agreement

- Initialed on September 14, 2005
- Signed on March 10, 2006
- Winemaking practices
- Protection/recognition of appellations of origin
- Use of semi-generic terms
- Certification
- Labeling of US wines for sale in the EC

Semi-generic names

- Burgundy, Chablis, Champagne, Chianti, Claret, Haut Sauterne, Hock, Madeira, Malaga, Marsala, Moselle, Port, Rhine, Sauterne, Sherry and Tokay
- Retsina
- COLAs issued prior to 3/10/06 are grandfathered
- Brand name or brand name + fanciful name
- Industry Circular 2006-1

SOT

- Special Occupational Tax has been repealed
- Wineries still need to renew their registration, but don't have to pay the tax
- The renewal form is on the TTB website
- TTB F 5630.5R P-No Tax

New treating materials/processes

- The manufacturer must get FDA approval for all materials that come in contact with the wine.
- The winery will write a letter to TTB asking to experiment with the new treating material or process.

Letter to TTB

- Include winery name and BW #
- Gallons and kind of wine you want to treat
- Copy of FDA approval
- What the material or process will do and the use rate
- Statement that the use of the material or process should be considered good commercial practice
- Statement that you will keep records as required in 27 CFR part 24
- Statement that the wine will not be released for commercial sale until approved by TTB

Ice Wine

- Grapes must be partially frozen on the vine prior to harvest.
- Wine made from grapes frozen after harvest may not bear labels containing the term "ice wine" or variations thereof.
- If a wine is made from grapes frozen after harvest, any reference that suggests the wine is made from frozen grapes must be qualified with a phrase such as "made from grapes frozen post-harvest".

Dried Fruit, Honey Wine Production

- TTB Treasury Decision 23 – Affects 27 CFR 24.202-.203
- Effective March 21, 2005
 - Removes 14% alcohol limitation on wine produced from dried fruit
 - Lowers minimum Brix from 22 deg. to 13 deg. for honey wine
 - Clarifies that the addition of sugar to sweeten honey wine is allowed only after fermentation

Direct to Consumer Shipping

- U.S. Supreme Court Hearing Dec 7, 2004
- Ruling in Favor of Direct Shipping Issued May 16, 2005
- ATF Ruling 2000-1 re: Webb-Kenyon Act still in effect
- State-by-State Laws:

Wine Institute's Website
www.wineinstitute.org

Upcoming Rulemaking

- Allergen labeling
- Changes to vintage requirements
- Alcohol facts label

Contact information

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- San Francisco, CA 94105
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Vineyard Variability and Wine Quality – Improving It with Irrigation

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Alan completed his PhD in Plant Physiology in the Viticulture and Enology Department of UC Davis in 1973. His research dealt with temperature effects on malic acid metabolism in winegrapes. In 1973 he moved to Cornell's NY State Agricultural Experiment Station in Geneva, New York to work on apple management and physiology. In the mid-1980's he was able to resume research on grapes. His current research emphasizes integrating vine developmental physiology with environmental and cultural influences as they affect yield and grape quality. Recently more emphasis has been placed on carbon and water relations, root dynamics and modeling of vine physiology. He is currently teaching the vineyard management courses at Cornell.

In viticulture in general and winegrape growing we generally deal with simplified concepts of yield and quality. Often we talk about the relationship of fruit or wine quality to simple vineyard averages such as yield/acre or perhaps average pounds yield per pound of pruning weight.

Effects of Vine-Vine Variability

Is this really a problem? Does it make much difference if vineyards with similar yields of perhaps 4 tons/acre have more or less variability? The answer is not intuitive, but simple spreadsheet calculations can help us.

Although the relationship between wine quality and yield has surprisingly not been well documented and is open to opinion, a reasonable relationship for the NE climate is likely to be high quality at yields up to about 4 tons/acre (assuming good healthy vines that all have the same crop) (Fig. 1). At higher yields the quality drops off. This relationship will be used to estimate how vineyard yield variability affects average wine quality since normally all the fruit of a variety from a vineyard is combined for wine-making.

Using this quality-yield relationship, we can see what the effects on wine quality of different amounts and types of vine-vine-variability. First, it is not of interest to consider a vineyard of very low yield as few can sell wine for high enough prices to sacrifice that much yield. Also, we will ignore the very heavily-cropped vineyards as the wine quality is very poor. So, we will examine vineyards with average yields near the shoulder of the yield-quality relationship as they are attempting to balance yield and quality.

The way of calculating the effects of variability is to develop a scenario of variation in the number of vines/acre that have different yields. The scenarios assume pretty uniform patterns (e.g. bell-shaped

curves) The number of pounds of fruit from each yield category is multiplied by the quality for that yield category. It is important to understand that although there may be equal number of vines with 5 or 30 pounds, the 30-pound vines will have a greater effect on the final crop as they contribute 6 times the fruit to the crop.

In the example, if all the vines were perfectly uniform and had exactly the same yield adding up to 4 tons/acre, the wine quality would be 9 out of 10. A 4-ton vineyard with 90% of the vines having between 3 and 5 tons/acre equivalent gives a wine score of 8.5 due to the few heavily cropped vines reducing total crop quality slightly. Another vineyard with a 4 tons/acre yield, but having only about 70% of the vines having between 3 and 5 tons/acre equivalent gives a wine score dropping to 7.7. Interestingly, many other distributions of yield from flatter bell curves to even bimodal distributions (having most vines either under or over cropped).

The main point is that average yields do not tell the whole story. It is noticeable that when I visited extremely respected producers such as Cheval Blanc in Bordeaux they put tremendous emphasis on making their vines as uniform as possible in both the vigor, canopy, and crop. Their management approach is worth emulating, even if not to the level they can afford. The key is to avoid the over-cropped vines that produce large amounts of poor quality fruit and to avoid the low-cropping vines that may produce good quality, but produce so little fruit.

Sources of Variability in Vineyards

There are several sources of variability within vineyards, especially in the East where we have few if any large consistent tracks of vineyard land. In the Finger Lakes we have additional variability due to the glaciation of the region, the topography and the variably cold winters giving varying cold injury to winegrapes.

Soil/Water Variations. The geology of the glaciation of the Finger Lakes has led to extreme variability in the soils of the region. Soil fertility is variable but tissue analyses can guide appropriate fertilization to overcome these variations. The variations in soil water supply may not be manifested in all years, but in dry years tremendous variation can be seen. Overcoming the variation is not as easy as with nutrition since it is effectively impossible to change the water-holding capacity of soils except with large amounts of organic matter over many years. So irrigation is the logical approach. It is not easy to match the soil variation with variable irrigation but in most cases, irrigation is only applied in dry conditions, so some excessive irrigation is not a major problem except in poorly drained soils.

One of the greatest values of irrigation is to reduce variability in both the year of the drought, but also in many cases in the following year or two. This is especially the case if there are two back-to-back droughts as we experienced in 2001/2002. In a 3 year study at Prejean Vineyards with Lailiang Cheng, Tim Martinson, Thomas Henick-Kling and Terry Acree, we found that irrigation not only maintained Riesling yields over time, but also allowed full ripening, more varietal flavor development and less Atypical Aging.

At Fredonia we have done some long-term studies of irrigation on both newly planted Niagara vines as well as on mature Concord vines with normal and minimal pruning. In the new Niagara vineyard, our results showed that early-life supplemental (i.e. only when needed) irrigation years allowed for rapidly vine development, so that in the third year a full crop could be supported without hurting vine size. The first several crops were sustained at surprisingly high mature levels due to the avoidance of drought reductions on vine pruning weights. Control vines that had no irrigation grew well and produced good initial crops, but when there was a dry year, the vines could not support a full crop and also maintain vine size. The results indicate that the common observation that full crops will strongly inhibit vine size in young vineyards may be a result of drought stress combining with crop stress, not just crop stress alone. In the mature vines, the biggest effects were primarily to even out variations related to soil variations in water-holding capacity and evening out year-to-year variations due to different seasons.

Variability in Environment. In addition to the baseline variation in vineyards due to soil variation, there are also variations in the climate that may be greater than we may think. In the last year Bob Seem of Plant Pathology and I have begun to document small-scale variations in temperature within Finger Lakes vineyards. For example in a small 9-acre vineyard near Seneca Lake, we found up surprising differences in temperatures during ripening. On a sunny warm days, there were up to 9 °F differences in maximum daily temperatures across this small vineyard. Over the last month of ripening, the upper rows of the vineyard had about 18% more degree-hours of heat accumulation than the lower rows. Although this was over only a short distance, it appeared to demonstrate the effects of very local air circulation off the lake. The vineyard owner did not suspect that the environment differed that dramatically.

Another example during the coldest day of the year showed that along a transect down the slope at Hector, NY (a quite steep west-facing slope). The coldest temperature that day across that slope varied by 14°F. The warmest site was closest to the lake, but the coldest site was not due to elevation, but to

topography of air drainage. Such variation is not unexpected, but is critical to understand for site selection and matching of variety to site.

What to Do About Variation. There are basically two approaches to dealing with variation. Both depend on first actually finding out and documenting what variation there actually is. This may be done by yield and/or vine size mapping. Such data can be gained by detailed weighing of vine yields manually or with yield monitors on harvesters. Since this may not be feasible, it may be still very useful to walk the vineyard and make notes of vine size, apparent crop or stress symptoms in dry years by row and panel number. A lot of useful information can be gained by walking the vineyard with a map in hand.

One approach once variation is known, is to attempt to overcome variation by compensatory management such as cover cropping vs mulching, using divided canopies in vigorous sites, installing irrigation in dry sites, etc to make things more uniform. This is more difficult as it requires good information and very flexible management, but it has the advantage of more uniform crop quality and sustainability.

A second approach that is more historic is to identify variation in vineyards and use the variation to produce variable wines. This of course is fine for those few sites that are superior, as grand cru vineyards in Europe. This approach normally takes much experience over many years to identify. In extremely variable climates and limited vineyard sites, it may not be that desirable for most. Additionally, with variations in vineyard water relations from year to year, the superior site may move. In wet years, excessively-drained dry sites may be superior by draining away the water. However, in dry years the deeper soils with more water-holding capacity may be superior.

Ascorbic Acid – Friend or Foe?

Richard Gibson, Director, Scorpex Wine Services, Australia

Richard grew up in an Australian wine producing region and went on to study microbiology and winemaking at university. After starting his career in brewing, he joined Penfolds Wines in 1979. Penfolds became a part of Australia's largest and most successful wine company of the time, Southcorp Wines. Richard held senior management positions within Southcorp at a time when the Australian wine industry became a global leader for innovation and quality. In 2001, Richard left Southcorp Wines to establish Scorpex Wine Services, specialising in technical and strategic consulting to the global wine industry. Scorpex is now involved in a wide range of activities with suppliers, wine companies and wine industry customers around the globe.

Ascorbic acid is a molecule that is naturally present in many foods. It is also known as vitamin C. Ascorbic acid has important properties for human health. Humans cannot synthesize vitamin C. A deficiency of vitamin C in the diet causes scurvy.

Ascorbic acid acts as an antioxidant by reducing oxygen. A relatively stable oxidized form of ascorbic acid, dehydroascorbic acid, is formed by the reaction, along with hydrogen peroxide.

The optical isomer of vitamin C, erythorbic acid, also acts as an antioxidant. However, it has very little vitamin C activity.

Ascorbic acid was first isolated from natural sources in 1928, and first synthesized in 1933. Ascorbic acid is naturally present in grapes, but the levels are low (below 10 mg/L).

Additions of ascorbic acid to wine were first allowed in the USA in 1957. Early studies considered the use of ascorbic acid as a complete or partial substitute for sulfur dioxide. It was soon realized that ascorbic acid could not be used as a complete replacement for SO₂, for the following reasons:

1. Ascorbic acid does not have antimicrobial properties.
2. Ascorbic acid will not bind to residual aldehyde in wine.
3. Ascorbic acid has no impact on oxidative enzymes.
4. The reaction of ascorbic acid with oxygen produces an oxidative species.

After this initial research, most researchers recommended that ascorbic acid be used in conjunction with sulfur dioxide, not as a replacement. Investigations showed that oxygen reacts with ascorbic acid much more rapidly than with SO₂. The oxidative species produced by the reaction between oxygen and ascorbic acid, hydrogen peroxide, can then react quickly with SO₂.

The introduction of ascorbic acid as an intermediate in the reaction between oxygen and SO₂ in wine was considered to be beneficial. Oxygen could be scavenged quickly by ascorbic acid. The by-product of this reaction could then be mopped up by SO₂ present in the wine. It was considered that this gave fresher wines with more fruit character.

Without ascorbic acid, oxygen can react with easily oxidized phenolic compounds. This is not usually an issue with red wines, where some oxidative modification of the phenol content after fermentation is desirable. In white wines, however, phenol oxidation can lead to increased color formation.

Over the years, ascorbic acid has become popular in some countries for use during white wine production. However, use of this material is by no means universal. In Australia, ascorbic acid additions were widely adopted when reductive white winemaking techniques became popular in the 1980s. Use of ascorbic acid was seen to contribute to the production of clean, fresh, fruit-driven wines made from varieties such as Riesling, Semillon and Sauvignon Blanc. Ascorbic acid was also widely used in Chardonnay.

It was also found that ascorbic acid had the valuable property of preventing pinking in white wines. Pinking is an issue that appears sporadically in Australian white wine, apparently associated with seasonal conditions, grape variety, juice expression techniques, the amount of oxygen exposure given to juice prior to fermentation and the amount of oxygen exposure given to finished wine. The bag in box pack popular in Australia (just under 50% of domestic wine sales by volume are sold in this package format) allows oxygen ingress after packaging. Susceptible white wine can form a considerable amount of pink color after a short time in a bag in box pack. Ascorbic acid use in white wine packaged in bag in box, often made from varieties such as Colombard, Thompson's Seedless and Muscat, or pressings of higher value varieties, is almost universal.

More recently, ascorbic acid has been found to delay the formation of atypical aging character (ATA). ATA is as yet unknown in Australia. It is not yet clear if this is due to Australian irrigation practices, climatic conditions (although one of the apparent trigger conditions, drought, is certainly not unknown in Australia) or winemaking techniques. Mechanisms associated with ascorbic acid impact on ATA are not well understood.

While the use of ascorbic acid by Australian winemakers became widespread, there was little published research that confirmed its effectiveness. Older German literature questioned the benefits of its use. To resolve these questions, the Australian Wine Research Institute (AWRI) undertook a study to review the impacts of ascorbic acid usage on the color of white wines and model wine solutions. The results were published in the Australian Journal of Grape and Wine Research in 1998 (Peng et al 1998).

The major findings of this study were:

1. Soon after its addition, ascorbic acid decreased the brown color of white wines.
2. With time, the samples with added ascorbic acid developed more browning than samples without added ascorbic acid.
3. Under a variety of accelerated (45°C, air in the headspace) or prolonged storage conditions, the browning of model wines and white wines was invariably enhanced by ascorbic acid addition.

4. This enhancement took place whether or not SO₂ was present.

The researchers concluded that the addition of SO₂ alone, rather than ascorbic acid alone or SO₂ plus ascorbic acid, appears to be the most effective and least expensive way of protecting white wine from browning during bottle conservation.

The outcomes of this study caused a good deal of discussion in the Australian wine industry. Many winemakers quickly reviewed their use of ascorbic acid. By the 2000 vintage in Australia, ascorbic acid use in many products had ceased.

Unfortunately, this vintage also saw the widespread occurrence of pinking issues in Australian white wines. Winemakers had been lulled into a sense of security by years of ascorbic acid use. Little routine testing of white wines for pinking potential was being carried out prior to packaging. A painful lesson was learned when consumers started to find blush wine in bag in box packs.

Further discussion took place on ascorbic acid use. The results of the AWRI study were reviewed. Some industry members were convinced that ascorbic acid addition was indeed beneficial in preventing the development of darker color in white wines. Further work showed some very interesting conclusions.

In the study reported in 1998, browning was measured by the conventional method of measuring absorbance of clarified samples at 420 nanometres in a spectrophotometer. Measurement of absorbance at other wavelengths and evaluation of the samples by eye had not been carried out.

The AWRI undertook a study after 2000 to review the impacts of added oxygen on white wine color. Quantities of oxygen were accurately added to samples of the same wine in glass bottles. The bottles were sealed and kept in an anaerobic environment. After a period of storage, the color of the wine in the unopened bottles was assessed by measuring absorbance at 420 nm in a specially adapted spectrophotometer. Wine color was also assessed by eye.

In general, it was found that the absorbance at 420 nm correlated well with the apparent “brownness” of wine samples when evaluated by eye. However, an interesting phenomenon was noted. As part of the trial, additions of oxygen had been made to samples of the same wine with and without added ascorbic acid. After 15 months of storage, the absorbance at 420 nm of each sample was measured. 60 panellists were then asked to pick the more brown sample from two bottles of the same wine, one with and one without added ascorbic acid, to which the same amount of oxygen had been added. It was found that the correlation between brown color and absorbance at 420 nm for wines with and without ascorbic acid was not strong.

Evaluation of these samples showed that:

1. Wines perceived as browner by eye did not always have a higher absorbance at 420 nm.
2. Wines with added ascorbic acid were judged to be less brown by eye in all cases.

These results led to a review of the absorption shown by samples of the same wine with and without ascorbic acid at different light wavelengths. It was found that ascorbic acid caused a slight increase in absorbance at 420 nm, associated with yellow color. However, absorbance at light wavelengths between 500 and 600 nm, associated with colors such as orange, was higher for wine without ascorbic acid. The cumulative effects of the absorbance at the higher wavelengths outweighed the effects of the absorbance at 420 nm, making the wines without ascorbic browner to the eye.

This work called into question the findings of Peng et al reported in 1998. Although the absorbance at 420nm of wines with ascorbic acid was higher, the overall color intensity developed in wines with ascorbic acid additions was lower.

No evaluation of the impacts of the presence or absence of ascorbic acid on aroma and flavor had been carried out in this trial. The differences in color behavior between wines with and without ascorbic acid had been unearthed as a sideline finding during the study of the effects of oxidation on samples artificially dosed with oxygen. What effects does ascorbic acid have on flavor and aroma? Do the differences in color happen in real commercial situations? Fortunately, a trial had been started in the late 1990s that would provide samples that could enable these questions to be answered.

The trial involved the bottling and storing of two wines, a Riesling and a wooded Chardonnay, with several variables:

1. With and without ascorbic acid (100 mg/L for the Riesling, 75 mg/L for the Chardonnay).
2. Bottles sealed with different closures – screw cap (with metal liner), natural cork, synthetic closure.
3. Bottle storage orientation – upright and inverted.

Assessments were carried out over five years of storage. Color was estimated by measuring absorbance at 420 nm, determining CIELAB values and by visual inspection.

The overall conclusions from this study concerning the influence of ascorbic acid on the composition, color and flavor properties of the wines were:

1. After three and five years storage, the concentration of SO₂ was either not different or slightly higher in the wines to which ascorbic acid had been added.

2. The color intensity and brownness of the Chardonnay wines without added ascorbic acid was higher than the wines to which ascorbic acid had been added. There was no significant difference between brownness and overall color intensity for the Riesling wines with and without ascorbic acid, although the Riesling wines with added ascorbic acid were generally higher in yellow color.
3. For both wines, at storage times of three years and more, ascorbic acid additions resulted in either no difference in aroma or wines with less oxidized and/or more fruity and fresh aromas compared with wines without ascorbic acid addition, even if all the added ascorbic acid had been depleted in the samples. When wine had been exposed to relatively high levels of oxygen (e.g. in bottles sealed with the synthetic closure), this effect was more evident.

In this trial, the addition of ascorbic acid at bottling was never detrimental, and in some cases was protective against oxidative spoilage of wines. At no time during the trial were the wines with ascorbic acid addition perceived as more oxidized than those without addition.

The researchers also reported that A420 measurements did not always appear to correlate with the brown scores obtained by visual assessment or color measures obtained by CIELAB when wines with and without ascorbic acid were compared together. In some cases, ascorbic acid addition reduced the score for oxidized aroma. Ascorbic acid addition never caused an increase in oxidized aroma.

Bottles without ascorbic acid scored higher for oxidized character at the same A420 reading. This information reinforces the point that the use of A420 measurement to give an estimate of the degree of oxidation in a wine to which ascorbic acid has been added in comparison with a sample of the same wine to which ascorbic acid has not been added may not give valid results.

Conclusions:

Ascorbic acid is known to be beneficial in protecting white wines against pinking, and may well contribute to the delay of ATA formation. Research has now shown that the addition of ascorbic acid reduces the amount of brown color and oxidized character produced in some wine during bottle maturation. In other wines, there appears to be little positive impact, but no negative impact is likely to occur. This information should give winemakers confidence to use ascorbic acid in white wine.

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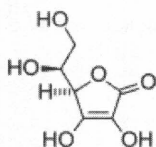
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ASCORBIC ACID FRIEND OR FOE?

Richard Gibson
Scorpex Wine Services
New York Wine Industry Workshop
7 April 2006

Ascorbic Acid:

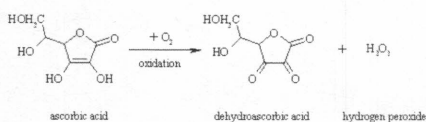
- Ascorbic acid – vitamin C
- Optical isomer – erythorbic acid
- Permitted in wine since the 1950s



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Ascorbic Acid:

- **Reducing agent** – gives up protons (hydrogen) in reaction with oxygen



Reaction produces hydrogen peroxide

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Antioxidant Properties:

- Hydrogen peroxide will react with other oxidizable materials
- Sulfur dioxide can fulfil this role



- End products of the overall reaction between oxygen, ascorbic acid and SO_2 are benign

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Impact On Rate of Reaction:

- Ascorbic acid as an intermediary **enhances the overall rate of reaction** between oxygen and sulfur dioxide
- Rapid reaction minimises interaction of oxygen with other wine components – phenols, aroma molecules
- Ascorbic acid is not a replacement for SO_2

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What Ascorbic Acid Can't Do....

- No antimicrobial properties
- No aldehyde binding properties
- Does not denature oxidative enzymes
- Cannot act alone as a protective antioxidant

Complementary adjunct to sulfur dioxide, not a substitute.....

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Benefits – Ascorbic Acid:

- Used only in white and rosé wines
- Prevents pinking, slows browning
- Converts oxidised phenols e.g. quinones to non-colored forms
- Delays oxidised aroma formation
- Delays formation of ATA characters in some, but not all, susceptible wines.....

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Questions – Ascorbic Acid Use

- Popular in Australia, use not so widespread in other countries
- Some debate in the literature on effectiveness
- Bottled wine oxidation issues in Australia led to a review of ascorbic acid use
- AWRI Oxidation research program



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AWRI Study – Peng et al (1998)

- Compared the effectiveness of combinations of ascorbic acid and SO₂ in preventing browning of white wines and model wines
- Accelerated (high temperature, air in headspace), short term and prolonged storage conditions
- Browning – measured absorbance at 420 nm
- Flavor and aroma impacts not studied

Peng et al (1998) The effect of ascorbic acid on oxidative browning of white wines and model wines AJGWR Vol 4 #3 127-135

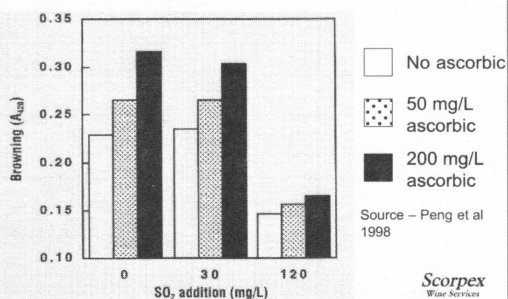
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Peng et al – Conclusions:

1. Soon after its addition, ascorbic acid **decreased** the brown color of white wines
2. With time, browning in the samples **with** added ascorbic acid was **greater** than in samples **without** added ascorbic acid
3. Under accelerated or prolonged storage conditions, the browning of model wines and white wines was invariably **enhanced** by ascorbic acid addition

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Effect of ascorbic acid on browning of a Colombar wine after 5 years of storage



Peng et al – Conclusions:

- The addition of SO₂ alone, rather than ascorbic acid alone or SO₂ plus ascorbic acid, appears to be the most effective way of protecting white wine

Take home message:

Ascorbic acid is a foe, not a friend

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Industry Reaction:

- Ascorbic acid use discontinued by some winemakers
- Pinking issues – 2000 vintage
- Continuing debate
- Further AWRI work started to provide more information.....

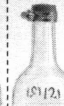
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Further AWRI Study:

- Oxygen added to wine in controlled amounts
- Absorbance at 420 nm measured after 15 months
- Samples also evaluated by eye
- Study included samples of the same wine with and without ascorbic acid addition

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Visual Evaluation and OD 420 nm:

mls/L O ₂	0	0	3.5	3.5	7	7
						
OD 420 nm	0.211	0.192	0.236	0.209	0.245	0.248
	+	+	+	+	+	+
Number of panellists who picked this wine as browner	0	60	14	46	0	60

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New Information:

- Wines perceived as browner by eye did not always have a higher absorbance at 420 nm
- Wines with added ascorbic acid were judged to be less brown by eye in all cases

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Ascorbic Acid Effects:

- Ascorbic acid inhibits the formation of yellow and orange pigments that absorb light at wavelengths higher than 420 nm
- A420 nm is not a reliable measure of browning when comparing the oxidative status of wines with and without added ascorbic acid

Peng et al (1998) conclusions were based on A420 measurements.....

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Further Study.....

- Trial set up to investigate white wine development over five years

Variables:

- **Wine** – Chardonnay (oaked) and Riesling, with and without ascorbic acid (addition to give 100 mg/L)
- **Closures** – screw cap, cork, synthetic
- **Storage orientation** – upright and inverted

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Further Study.....

Wine impacts assessed by:

- A420
- CIELab – values L*, a* and b*, _E
- Evaluation by eye
 - Yellow, orange, brown, green – assisted by Pantone color strips.
 - Overall color intensity
- Wine analysis (SO₂)
- Sensory evaluation - aroma

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Results:

Skouroumounis, G.K., Kwiatkowski, M.J., Francis, I.L., Oakey, H., Capone, D.L., Peng, Z., Duncan, B., Sefton, M.A., Waters, E.J. (2005)

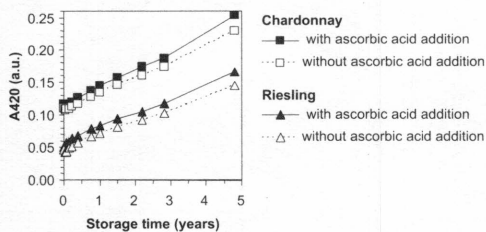
The influence of ascorbic acid on the composition, colour and flavour properties of a Riesling and wooded Chardonnay wine during five years' storage

Australian Journal of Grape and Wine Research, 11, 355-368

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A420 nm:

A420 is higher when ascorbic acid is added



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Skouroumounis et al (2005) AJGWR Vol 11 #3 355-368

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CIELab:

- Wines with ascorbic acid were higher in **yellow** but lower in **red** than wines without ascorbic acid
- **E** values exceeded 1 for all ascorbic/non-ascorbic pairs at 5 years
 - Indicates detectable visual difference

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Visual:

Paired comparison at 2 years:

- Chardonnay without ascorbic acid consistently selected as more brown
- Riesling....no consistent trend

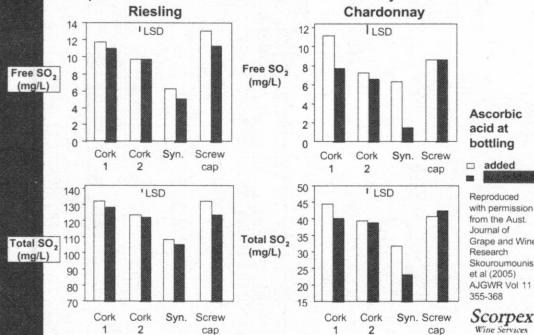
Descriptive analysis at 2.5 years:

- Chardonnay – ascorbic acid gave lower brown, lower orange and higher yellow
- Riesling – ascorbic acid gave higher yellow

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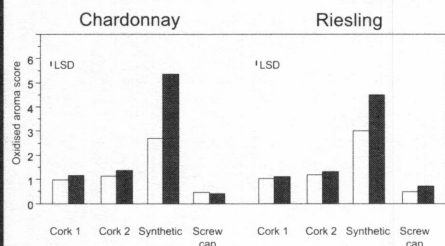
Analysis:

Impact of ascorbic acid on SO₂ after 3 years



Sensory:

Impact of ascorbic acid on oxidized score at 3 years



Ascorbic acid at bottling: ☐ added ☒ not added

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Skourounis et al (2005) AJGWR Vol 11 #3 355-368

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Conclusions:

- The addition of ascorbic acid resulted in wines either **not different** or **less oxidized** than wines with no addition.
- At no time were the wines with ascorbic acid addition found to be more oxidized than those without addition

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Bottom Line:

- Ascorbic acid addition is likely to be beneficial in controlling pinking and ATA
- Ascorbic acid does not promote oxidative change - it either has little effect or inhibits oxidative impact
- **Results of this work indicate that ascorbic acid can be used with confidence**

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Practical Use of Ascorbic Acid

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Grapes and Juice:

Ascorbic acid can be used on grapes and in juice.....

BUT

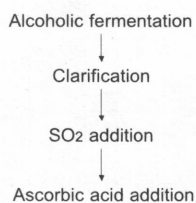
Make sure that free SO₂ is also present when active fermentation is not removing oxygen

Ascorbic acid without SO₂ has been used to promote hyperoxidation of juice....

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After Fermentation:

Ascorbic acid is often added directly after alcoholic fermentation...but make sure that sufficient SO₂ is added first.



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During Storage:

- Monitor ascorbic acid levels – iodine or DCPIP titration sufficient
- Sensitive indicator of oxygen contact
 - if ascorbic acid is depleted, oxygen contact has occurred
- Top up concentration to target level if necessary
- Watch SO₂ levels.....

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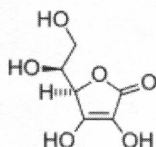
Pre and Post Bottling:

- Top up ascorbic acid concentrations to target levels
- 75-100 ppm standard often used
- Post-bottling ascorbate analysis can be valuable in reviewing
 - Oxygen pick up at bottling
 - Oxygen transfer through the closure or pack e.g. bag in box

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Ascorbic Acid – Friend or Foe?

When used wisely, ascorbic acid can often be a friend.....and not a foe.



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Bottling Solutions

What is right for you

Prepared by Richard Turner

A native of Hammondsport, Richard has worked in the wine industry most of his life. He started working for Taylor Wine Co. out of high school, taking two years off to attend Williamsport College for a degree in mechanical technologies. Upon graduation, he returned to Taylor's as a production line mechanic for the next 16 years. He started with Prospero Equipment in September of 1990, and has become a leading expert on bottling line equipment. Richard now runs the Finger Lakes Branch of Prospero Equipment in Geneva, NY.

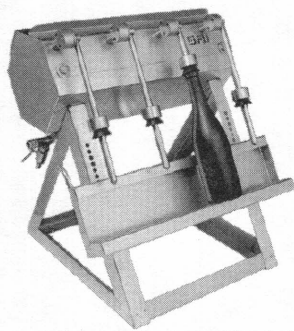
Questions: Size

- What is my production?
- How often do I want to bottle?
- How much labor do I have?
- How much room do I have?
- How much do I want to spend?
- What quality do I want?
- Bells and Whistles?

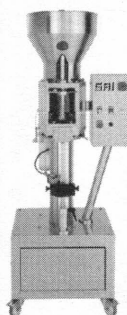
PICKING A VENDOR

- QUALITY OF MACHINES
- EASE OF OPERATION
- ABILITY TO TOTALLY SANITIZE
- TECHNICAL ASSISTANCE
- AVAILABILITY OF SPARE PARTS
- RESALE VALUE OF MACHINES

SEMI-AUTOMATIC SYPHON FILLER



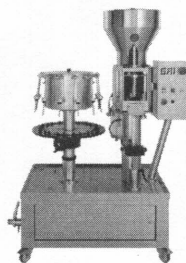
SEMI-AUTOMATIC CORKER WITH HIGH VACUUM



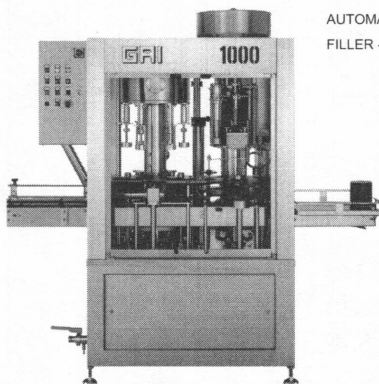
SEMI-AUTOMATIC CORKER

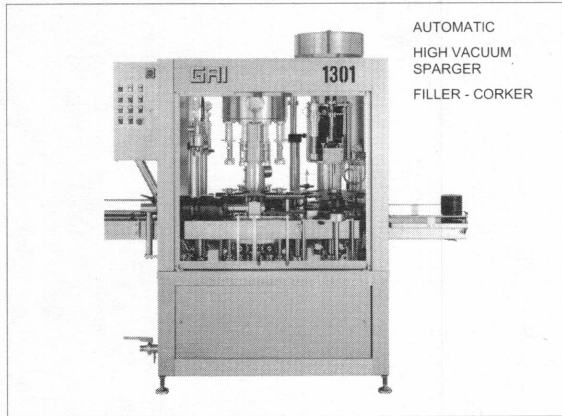


SEMI-AUTOMATIC SYPHON FILLER CORKER

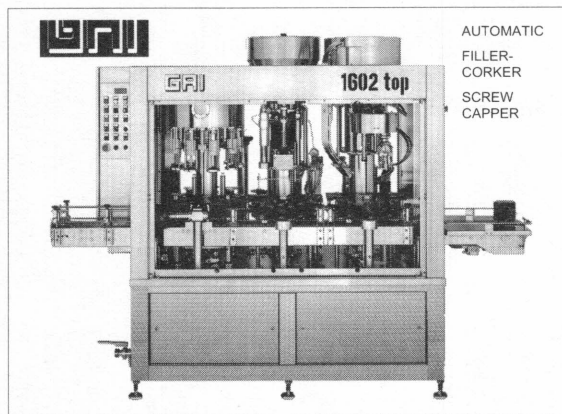


AUTOMATIC
FILLER - CORKER

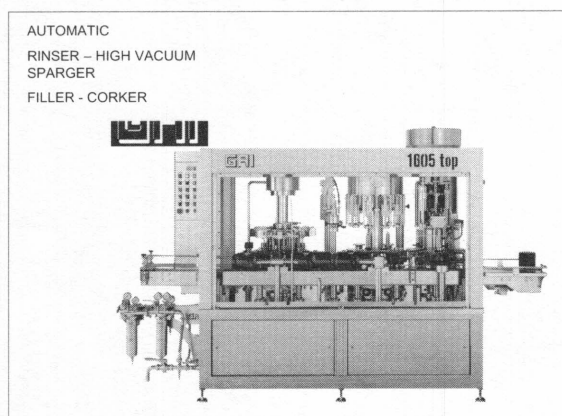




AUTOMATIC
HIGH VACUUM
SPARGER
FILLER - CORKER

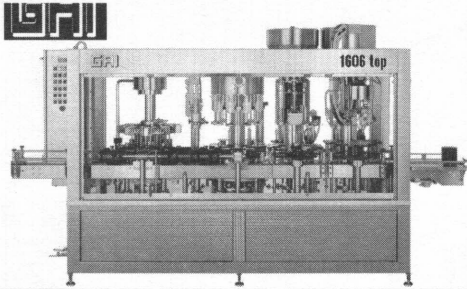


AUTOMATIC
FILLER-
CORKER
SCREW
CAPPER

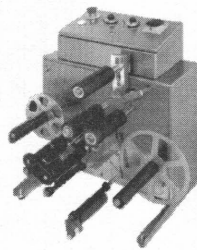


AUTOMATIC
RINSER - HIGH VACUUM
SPARGER
FILLER - CORKER

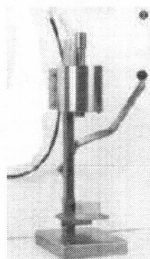
AUTOMATIC
RINSER - HIGH VACUUM
SPARGER
FILLER - CORKER
SCREW CAPPER



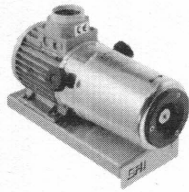
SEMI-AUTOMATIC PRESSURE SENSITIVE LABELER
FRONT LABEL OR FRONT AND BACK ON THE SAME SPOOL

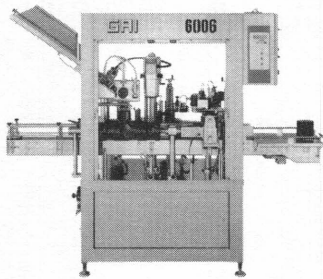


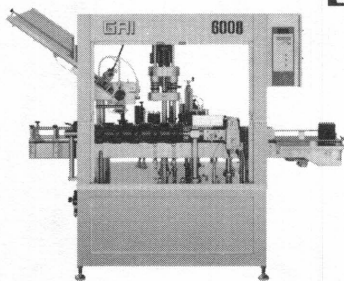
HEAT OVEN FOR PVC CAPSULES

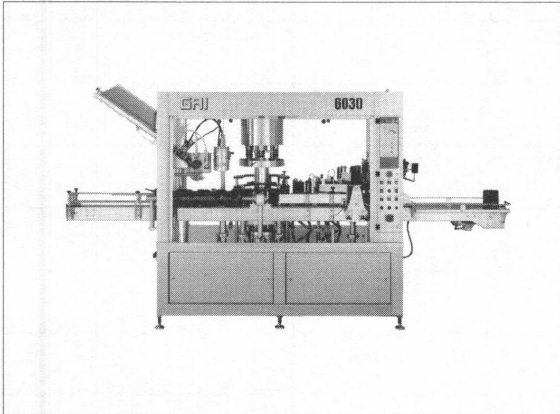


SPINNER FOR POLYLAMINATE OR TIN CAPSULES











Sanitation, ISO 9001:2000 and HACCP Implementation for Wine Bottling Lines: Defined and Measured

Presented by
Scott Marciano - Manager, Quality & Safety
Centerra Wine Company - Canandaigua, New York

35th Annual New York Wine Industry Workshop; April 4-7, 2006
NYS Agricultural Experiment Station, Geneva

1

Objective

- Develop better understanding of ISO 9001:2000, HACCP, and Line Sanitation
- How do they all interrelate and compliment each other?

2

Topics

- What is ISO
- What is HACCP
- How does a sanitation process fit into ISO and HACCP
- Sanitation defined and measured

3

What is ISO 9001:2000

- International Standards Organization – ISO
- An international quality standard against which any firm can measure its quality management system, procedures, and commitment
- Provides a standardized, internationally accepted Quality Management System -- how you do what you do to ensure consistency and high-quality products.
- Scope: From incoming components and materials to customer.
- Providing for
 - Continuous improvement
 - Emphasizing defect prevention
 - Reducing variation and waste in supply chain
 - Employee involvement

4

ISO 9001:2000 Eight Management Principles

- Customer focus
- Leadership
- Involvement of people
- Process approach
- System approach to management
- Continual improvement
- Factual approach to decision making
- Mutually beneficial supplier relationships

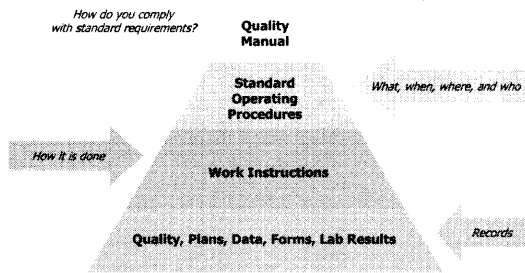
5

ISO 9001:2000

- 0 - Introduction
 - 1 - Scope
 - 2 - Normative Reference
 - 3 - Terms and Definitions
 - 4 - Quality Management System Requirements
 - 5 - Management Responsibility
 - 6 - Resource Management
 - 7 - Product Realization
 - 8 - Measurement, Analysis, and Improvement
- What do you really do and how do you do it?*
- Verification and validation of system... "Say what you do, and do what you say".*

6

The ISO 9000 Quality Pyramid



7

Benefits of ISO 9001:2000

- Increase competitiveness in today's job market
- Provides consistency in work practices and final product
- Gets away from "tribal" knowledge procedures
- Defines responsibilities and accountability
- Strengthen organization/customer confidence

8

What is HACCP?

Hazard Analysis Critical Control Point

- HACCP is a world-recognized approach to the identification, evaluation, and control of potential product safety hazards.
- Providing for
 - Liability control
 - Reduced waste
 - Reduced down time
 - Increased efficiencies

} Increased savings

9

The Seven Principles of HACCP

(1) Conduct a Hazard Analysis

- Process flow: Grapes to finished wines
- Hazards
 - Biological (toxins, fungus, mold, etc.)
 - Chemical (pesticides, cleaning agents, etc.)
 - Physical (glass, dirt, etc.)

10

The Seven Principles of HACCP

(continued)

(2) Determine Critical Control Points

- Any area in the process where there is a high probability of improper contact that may cause, allow, or contribute to hazard or filth in the final product.
- Detailed evaluation

(3) Establish Critical Limits

- A maximum or minimum value to which a biological, chemical, or physical hazard must be controlled at a Critical Control Point in order to prevent, eliminate, or reduce to an acceptable level a product safety level.
- A Critical Control Point will have at least one Critical Limit.

11

The Seven Principles of HACCP

(continued)

- (4) Establish Monitoring Procedures
- (5) Establish Corrective Actions
- (6) Establish Verification Procedures
- (7) Establish Records and Documentation

12

HACCP

(continued)

- Not just microbe free...
 - Employee practices, health, and hygiene
 - Product and container contact areas
 - Environment
 - Product specifications
 - Equipment

13

ISO and HACCP: How They Compliment Each Other

- The Quality Management System (ISO 9001:2000) lays the groundwork for developing a successful process – SOPs, Forms, Work Instructions, Document Control.
- HACCP provides specific guidelines for your food safety program.
- Sanitation is defined in the Quality Management System (ISO 9001:2000) and is one of the tools that can be used to meet the HACCP requirements.
- Today we are focusing on wine production and bottling.

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Sanitation

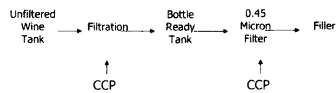
- Successful bottling line sanitation begins in the wine cellar.
 - Dirty tanks and transfer hoses can undo a stellar sanitation of the bottling lines.
 - In our environment, yeast are everywhere because we ferment 52 weeks out of the year
- Minimum, Primary Goal
 - Certainty that the wine in the bottles is free from contamination of micro-organisms that can cause degradation of wine quality.
- Maximum Goal
 - An entire winery that is free of micro-organisms that are harmful to the wine's quality and shelf life.

15

Cellar Sanitation Process Defined

- What process is going to be used (i.e. full chemical, chlorine, or hot water, etc.)
- Define and document the process: who, when, where, how, and limits

Example:



16

Cellar Sanitation Process Measured/Monitored

- Basic tools to monitor sanitation in Cellar:
 - 1) Swabbing after sanitizing equipment
 - 2) Titrations to verify chemical concentrations (i.e. tank rinse)
 - 3) Pre-bottling plating of product in bottle-ready tank
 - 4) Filter sanitation and integrity testing

17

Bottling Sanitation Process Defined

- What process is going to be used (i.e. full chemical, chlorine, or hot water)
 - Canandaigua Winery utilizes a four-step CIP sanitation (wash, rinse, sanitize, rinse)
- All bottling sanitation is documented in SOPs, Work Instructions, and Master Sanitation Schedules – all defined in the Quality Management System.
- Sanitizing is not just cleaning the fillers. There are numerous sources of contamination:
 - Airborne exposure to open, unfilled bottles and filled, unsealed bottles
 - Product contact surfaces, bottles, caps and/or corks
 - Non-product contact surfaces: bottle cleaners, fillers, closure equipment, conveyors
 - Breakage on bottling lines poses a physical hazard.
 - Maintenance work done to areas of product contact should be sanitized appropriately after work has been completed (i.e. filler stems).

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Bottling Sanitation Process Monitored/Measured

- Basic tools to monitor sanitation in Bottling:
 - Chart/document critical temperature and hold times
 - Titration to verify chemical concentrations
 - Swabbing of equipment
 - Microbiology of finished product throughout the run (at start, at end, and at defined intervals between)
 - Set limits on microbiological analysis; need to be defined and realistic

19

Sanitation process defined



Review monitoring actions
(CCPs)



Identify problems



Take action



Validate corrective action
Short/long term

20

Review

- What is ISO 9001:2000
- What is HACCP
- Sanitation on bottling lines defined/measured
- How all three are linked together

21

Guidelines to Success

- A Quality Management System:

ISO 9001:2000

- HACCP (Hazard Analysis Critical Control Point) Program:

ISO 22000:2005

22

Closures - Maximizing Benefits, Minimizing Risks

Richard Gibson, Director, Scorpex Wine Services, Australia

Closures for sealing wine bottles have undergone a revolution in the last ten years. There are now more choices for sealing wine bottles than at any other time in the history of the wine industry. The dominant wine bottle closure for centuries, cork, is fighting for market share as wine producers and wine consumers now use and accept many alternatives.

Wine bottle closure performance is a complex field. Closures must perform well in the following areas to satisfy all members of a winery team – procurement staff, bottling staff, QA, winemakers and marketers:

1. **Cost** – closures that are readily available at a consistent, reasonable cost are preferred by procurement staff.
2. **Consistency** – QA staff favor consistent closures that give uniform performance and require minimal pre-use and post-application checks.
3. **Application** – Bottling staff favor closures that go on or into the bottle with minimal adjustments, product loss and labor input.
4. **Wine Impact** – winemakers favor closures that do not modify the color, aroma and flavor of their wines, while allowing development of the wine at a consistent rate.
5. **Consumer Impact** – marketers favor closures that can be decorated well and enhance product appeal to consumers. They also prefer closures that generate a minimum amount of negative consumer feedback over issues such as closure removal and product modification.

The drivers for change in the wine closure market are based on technical, economic and market factors. The consistency of cork's technical performance has been found wanting as the general standard of quality assurance in the world wine industry has grown. The cost structure of cork, based on appearance, has also led to a review of closure choice by many companies as the world wine market place becomes increasingly competitive. Consumer perceptions of closures are very important in determining closure choice.

The concept of technical risk is an important factor in wine bottle closure choice. All closures introduce technical risk. The technical basis of closure performance in key areas must be understood to enable technical risk to be managed effectively.

For example, the ability of cork to pass contaminant molecules with very low aroma thresholds, such as 2,4,6 trichloroanisole (TCA) to wine, represents a large risk to bottled product quality. Some companies

regard this risk as unmanageable – no matter how many procedures are put in place to detect and remove closures containing TCA, contaminated corks will enter the system and tainted product will result if cork closures are used.

If the risk cannot be effectively managed, it must be removed. To avoid the risk of taint, some wine companies have switched to other closures. However, the technical risks of the use of these other closures must also be recognized and effectively managed. If this is not carried out, producers may simply replace an old problems with new problems – problems that can be even more detrimental to product quality than the old ones.

The experiences of the Australian wine industry as it has embraced closure change have exposed a number of the key areas in which risk management focus must be placed to minimize the emergence of new problems. This presentation will highlight some of the areas of technical risk associated with different closures, and discuss ways in which the risk can be managed.

Cork:

The technical risks associated with the use of cork are well documented. The major risks are wine tainting derived from contamination of cork with halogenated anisoles (HAs), such as TCA and TBA, and inconsistent oxygen barrier properties.

As the consistency and quality of wine has increased, the impact of contamination of cork with HAs on bottled wine quality has become more and more exposed. Despite a large amount of work, the traditional process of cork batch assessment by sampling and testing a representative sub-lot for contamination by sensory or instrumental techniques cannot manage the risk of wine taint to the satisfaction of many wine companies.

To manage the risk of cork contamination and wine taint more effectively, one or more of the following processes must be put in place:

1. Prevention of HA transfer to and/or formation in the cork.
2. Removal of HAs from cork
3. Prevention of the transfer of HAs from the cork to the wine.

The sources of contamination of cork by HAs have not been fully elucidated. Work has shown that TCA may be present in cork bark on the tree in the forest. It can be transferred to cork by aerial migration. It may be formed in cork by chemical and microbial reactions associated with washing processes. While steps have been taken by the cork industry to reduce the potential contamination of cork by HAs during processing, the presence of TCA in cork bark on the tree shows that it may never be possible to

completely eliminate HA contamination. Prevention of HA transfer to and/or formation in the cork cannot give full control of the taint issue.

Several techniques have been proposed over the years to remove HA contamination from cork. These have included removal of parts of the cork structure thought to contain HAs, treatment with microwaves, steam distillation and supercritical carbon dioxide extraction. It now appears that TCA can be removed from some forms of cork (especially granulated cork) by some of these techniques. It remains to be seen whether the treatments can be carried out consistently, at reasonable cost and without affecting other aspects of cork function.

A number of encapsulation and barrier techniques to hold HAs in cork and prevent its migration to wine after bottling have been proposed over the years. None has been entirely successful. However, a development in Australia called ProCork looks more promising. The ProCork process involves the application of a multi-layer membrane to each end of the cork. The membrane prevents the transfer of TCA from the cork to the wine.

Inconsistent oxygen barrier performance has also been a significant risk to wine quality when using cork. So called “random oxidation”, manifested by a percentage of grossly oxidized bottles, or bottles affected by aerobic microorganism growth, caused a large amount of product loss in Australia in the late 1990s, especially in stock stored upright. It has been shown that the oxygen transmission of cork is less consistent when bottles are held upright, and that cork-sealed bottles should be held inverted or laid down. While this simply appears to validate a well-known industry maxim, the technical basis of the difference in performance is not clear.

The risks of cork use have led wine companies to use other closures. The two major categories of closure that are also in use are synthetic polymer insertable closures (often referred to as synthetic corks) and screwcaps.

Synthetic Closures:

Synthetic corks are made from expanded polymer foams. They are made by injecting polymers and a foaming agent into a mould (injection moulding), or extruding a polymer and foaming agent mix from a die (extrusion). Issues with transmission of plastic taint have been overcome by the selection of inert polymers, and synthetic closures produced by reputable suppliers do not taint wine. However, the use of synthetics introduces other technical risks that must be appropriately managed.

All currently available synthetic closures allow reasonably rapid oxygen transmission from the external atmosphere to the product. The oxygen permeates through the plastic matrix and gaseous voids in the body of the closure. The rate of oxygen transmission is the same for inverted and laid down bottles.

There are some differences in oxygen transmission rate depending on the polymers used, the density of the closure and the consistency of cell size in the closure construction.

The impact of this elevated oxygen transmission is restricted shelf life. The stock rotation of wine sealed with synthetics must be closely managed. Old stock will simply become oxidized. Long-term maturation of wine under synthetics is a high-risk exercise. While some short-term benefits may be seen in red wine maturation from the increased oxygen exposure, storage in the bottle for too long will simply result in tired, oxidized wines.

Scalping is another risk that must be managed when synthetics are used. This phenomenon involves the adsorption of volatile aroma compounds by polymers. It has been studied extensively in the food industry. Work with wine shows that, in general, synthetics scalp more than cork and screwcaps. The impact of scalping is difficult to manage. However, not all compounds found in wine are scalped, and not all scalped compounds are odor active. Synthetics may not have any impact on the sensory quality of a number of wine styles. However, it is well known in the food industry that polyethylene, used as a base material in many synthetic closures, will adsorb terpenes, the group of compounds responsible for varietal aroma in Riesling and Gewurztraminer wines. Synthetics based on polyethylene should not be used in these wines.

The consumer must be able to get the closure out of the bottle to enjoy the wine. Synthetics have developed a reputation for difficult extraction. The extraction difficulties appear to be caused by two reasons. In an attempt to minimize oxygen transmission, some producers increased the density of their closures by increasing the polymer content. The higher density closures were more difficult to extract. The behavior of surface treatment compounds on a synthetic surface differed from the behavior of the same compounds when applied to cork. It has taken synthetic closure producers some time to determine the right mix of lubricants to ensure that their products can be inserted and extracted with ease.

The pressure in the bottle after insertion of closures such as cork and synthetics is an important issue that must be managed correctly. Cork seems to “vent” pressure differences between the bottle and atmosphere – gas transfer takes place around or through the closure to equilibrate pressure differences, and the closure does not move in the bottle neck. The gas transfer may, however, cause rapid oxidation issues. Synthetics do not vent as readily as cork. Both very high and very low internal bottle pressure should be avoided when using synthetics, as closure movement may occur. High pressures can be generated by the technique of injecting CO₂ into the headspace of the bottle prior to closure insertion. Although the CO₂ will soon dissolve into the wine, the transient high pressure may cause closure movement after insertion. Exposure of bottles to high temperatures can also cause high internal pressures, due to wine expansion.

Very low internal pressures can be generated by the use of excessive vacuum at closure insertion. Only sufficient vacuum should be applied to achieve a pressure equivalent to atmospheric pressure in the bottle after closure insertion. Excessively low pressure can lead to inward movement of synthetics and rapid air entry from the atmosphere to the inside of the bottle with corks, both very undesirable effects.

Screw Caps:

Screwcaps are now very popular in Australia and NZ as a bottle seal for wine. The quality of the screwcap seal depends on characteristics of the cap, bottle and application equipment. All of these factors must be managed to obtain satisfactory results. While the screw cap liner that is popular in Australia and New Zealand is inert and does not contribute or remove aromas, the anaerobic conditions that it generates in the bottle can lead to sensory changes.

There are many different grades of screw cap liner available. Only a small number of these are suitable for use with wine. In Australia and NZ, the tin faced liner is widely used. This liner gives low oxygen transmission and is suitable for long-term bottle storage. Liners that use an aluminum layer are also available, but this metal layer is not as flexible as tin and gives a less consistent seal. Pure polymer liners allow more oxygen transmission. Saran is popular for wines in some countries, such as Switzerland, but shelf life may be limited. Liners made from other polymers are not suitable for use with wine.

To ensure consistent application, the outer cap shells must be made of aluminum alloy with consistent malleability. Variation of shell malleability within a batch may give uneven application, even when application equipment is correctly adjusted.

The quality of the bottle rim sealing surface is critical for screw cap performance. Any flaws can prevent a good seal between the cap and the bottle top. The bottle must also be vertical to ensure that the screw thread is applied completely and evenly around the bottle finish. Bottles with a screw cap finish must be inspected closely by the glassmaker to ensure that faulty bottles are culled.

The application of screw caps must be very carefully managed to ensure that product quality is maintained. Poor application can cause leakage, oxygen entry and difficult cap removal. Screw cappers have a number of adjustments that must be set up to give the right head pressures and roller pressures to ensure a good seal. The quality of cap application can be monitored by measuring the torque required to remove caps.

Use of the BVS glass finish on the bottle and matching cap application heads reduce the risk of post-application damage that can reduce the seal integrity of screw capped bottles.

The tin lined screw cap produces a low oxygen environment in the bottle. This is viewed as beneficial in retaining primary fruit characters and freshness in appropriate styles of wine. However, the anaerobic environment has been shown to facilitate the development of sulfide characters in susceptible wines. It is thought that susceptible wines contain relatively high levels of precursors that have a high aroma threshold. They cannot be detected in the sensory profile of wine, and cannot be removed by copper treatment. After bottling, the low oxygen environment in screw capped bottles allows the accumulation of compounds with a very low aroma threshold from these precursors, and the wine takes on sulfidic notes. It is very difficult to treat wines to remove the precursors prior to bottling, and impossible to predict the likely future behavior of wine in an anaerobic environment. Wine making techniques that reduce the generation of sulfide compounds in general, such as adequate yeast nutrition, appear to be helpful in reducing the propensity of wines to develop reductive notes in bottle.

It should be noted that this effect can also be seen with other closures, such as some corks. However, the production of reduced characters is more consistent and intense when susceptible wines are bottled with screw caps with tin liners.

The nature of the headspace gas in the bottle has also been a matter of some interest. Work has been carried out with using a small amount of air and flushing with inert gas. A cap application machine is now available that is designed to draw a vacuum in the headspace prior to cap application. There is no headspace compression when caps are applied, but vacuum may help reduce the oxygen content of the headspace. The use of increased headspace air content does not seem to have an impact on the onset of reduced characters under screwcap. More oxygen at bottling simply causes more oxidation. The reactions that cause reduced characters seem to be linked to the long-term oxygen transmission effects of the closure, rather than oxygen incorporated into the wine at bottling.

Other new closures are being introduced for wine, such as a glass plug with a polymer gasket and a plastic plug that is pressed into a standard bottle finish. Valid testing of these devices is required to ensure that the technical risks associated with their use are known and understood. From this understanding, evaluation of the technical risks of their use can be made and techniques to manage the technical risk can be introduced. If the risks cannot be effectively managed, the closures provide little or no benefit over current closure options, the cost of the closures is too high or consumers do not accept the closures on bottles of wine, it is unlikely that they will succeed.

CLOSURES

MAXIMIZING BENEFITS, MINIMIZING RISKS

Richard Gibson
Scorpex Wine Services
New York Wine Industry Workshop
7 April 2006

CLOSURES FOR WINE:

- There have never been more choices available for wine bottle closures
- Closures have a significant impact on wine style and quality – as perceived by the consumer



Picture reproduced with the permission of the Australian Wine Research Institute

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Closure Choice Factors:

Not all choice factors involve product quality.....

2. **Cost** – Procurement/Finance
 3. **Consistency** – QA
 4. **Application** – Bottling
 5. **Consumer Appeal** – Marketing
- And then....
1. **Product Quality**

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Closure Choice:

- Blend of technical, economic and market factors influences closure choice
- Closures can excel in one area and present considerable risks in others
- Cost, marketing issues – outside the scope of a technical discussion
- ***Understanding and managing technical risks – key closure issue***

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Understanding the Risk Profile:

- Published research
- Internal trials
- QA data
- Customer and consumer feedback
- Supplier review

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Technical Risks - Closures

1. Contamination
2. Taint
3. Oxidation
4. Reduction
5. Leakage
6. Scalping (removal of aroma compounds)
7. Closure movement
8. Ease of removal

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Avoiding Unmanageable Risk:

- Change closure type?
- Technical risk understanding management is critical when closure choice is changed
- New problems may be worse than the old ones.....

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Managing Technical Risk:

Closure:

- Pre-use testing
 - Supplier
 - In-house
- Monitoring
- Specifications

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Managing Technical Risk:

Not just management of the closure.....

- Bottle characteristics
- Closure application
- Wine parameters
- Post-bottling storage conditions

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Technical Risk Profiles:

- Cork
- Insertable synthetic closures
- Screwcaps

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Cork – Major Risks:

- **Taint**
 - Halogenated anisoles – TCA, PCA, TeCA, TBA are the key compounds
 - Formed by mould action on precursor compounds in cork, or in other materials with subsequent transfer to cork
- **Inconsistent oxygen barrier**
 - Permeation, diffusion

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Taint:

- Supplier and pre-use QA widely used
- Sampling often limited
 - Instrumental and sensory techniques used
 - May isolate high taint batches
 - Cannot guarantee closure performance

Pre-use testing cannot manage risk to an acceptable level.....

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Management of Taint:

- Prevent TCA formation in cork
- Prevent TCA transfer to cork
- Remove TCA from cork
- Prevent transfer of TCA from cork to wine

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Prevent TCA Formation in Cork:

- Steps taken to reduce incidence of TCA precursors during cork production e.g. mould, chlorine
- However, TCA is present in cork on the trees in the forest.....

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Prevent TCA Transfer to Cork:

- Suppliers have taken steps to prevent TCA transfer to cork from sources such as wooden products and soil
- Every shipping container, cardboard carton and wooden pallet is a potential source of TCA.....

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Remove TCA from Cork:

Promising developments....

- Supercritical CO₂ extraction
- Steam extraction
- If proven, may remove a major technical risk, but.....
- Post-treatment contamination must be avoided

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Prevent Transfer of TCA to Wine:

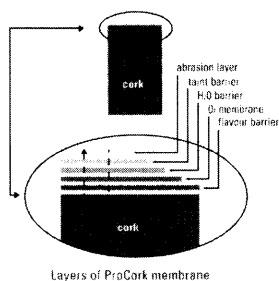
- Encapsulation techniques tried, not successful
- Problems with thick silicon barriers – TCA transfer during transport



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New Technique – Membrane Barrier:

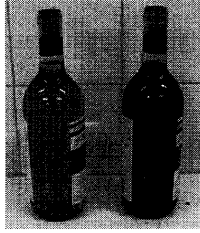
ProCork:
Multilayer
membrane
barrier applied
to each end of
the cork



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Inconsistent Oxygen Barrier:

- “Random oxidation” in upright stored bottles
- Variation in oxidation status



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Inconsistent Oxygen Barrier:

- Trials showed that cork performance is more consistent with laid down or inverted bottles
- Membrane layer also improves oxygen barrier performance

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Oxygen Permeation or Diffusion?

Permeation:

- Transfer through micro channels or pores
- Driven by **pressure** differential

Diffusion:

- Transfer through the molecular matrix of the closure material
- Driven by **concentration** differential

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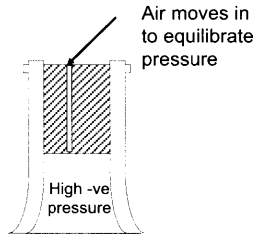
Cork Oxygen Entry:

- Primarily permeation – cork vents
- Exacerbated by pressure differentials between the bottle and the external atmosphere
- Negative bottle pressure causes air entry
- Sources of negative bottle pressure
 - High headspace vacuum at bottling
 - Wine contraction - cooling

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High Headspace Vacuum:

Aim for zero or very slight negative headspace pressure after bottling



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Wine Contraction – Cooling:

- Wine bottled warm – cools and contracts after bottling
- Bottle wine close to likely storage temperature
- Temperature fluctuation during storage
 - Gas exchange can occur if bottles are stored upright

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Synthetics:

- No endemic TCA....but taint is not impossible
 - Acquired TCA
 - Raw materials
- Manufactured product - consistent performance
- **Key Risks:**
 - Oxidation
 - Scalping
 - Closure movement

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Synthetics and Oxidation:

- Oxygen enters by diffusion....same entry rate upright and inverted
- Higher closure density increases oxygen barrier....but may impact extraction force
- Oxygen entry usually consistent within populations of the same closure

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Synthetics and Oxidation:

Solutions:

- Manage bottled product stock age
 - Warehouse
 - Distribution
 - Retailer
 - Consumer
- Manage wine antioxidant levels
 - SO₂
 - Ascorbic acid

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Synthetics and Scalping:

- **Scalping** – removal of aroma compounds from foods and beverages by packaging materials
- AWRI research shows that synthetics scalp some wine aroma compounds
- Limited impact in some styles:
 - Compounds not present or present well below aroma threshold
 - Compounds present in considerable excess of aroma threshold

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Scalping:

- Terpenes – main aroma compounds in Riesling, Gewurz, Muscat
- Food industry literature – terpenes are adsorbed by polyethylene
- Polyethylene based synthetics should not be used with Riesling.....

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Synthetics and Movement:

- Synthetics do not vent
- Large pressure differential between the bottle and the atmosphere may cause closure movement
- Negative bottle pressure – closures move in
- Positive bottle pressure – closures move out

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Synthetics and Movement:

- Headspace pressure critical – neutral
- Temperature change during distribution must be avoided
- Allow sufficient headspace to allow gas compression if liquid volume change occurs

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Screwcaps:

- Now the standard closure for white wine in Australia and NZ
- Technical performance is good – no taint, no scalping
- However, risks can occur and must be managed
 - Oxidation.....
 - Reduction.....



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Screwcaps and Oxidation:

- Screw cap liner determines oxygen barrier characteristics
- High barrier liner is used in Aust/NZ
- Tin layer prevents oxygen entry



- Other liners allow more oxygen entry and may not be suited for long term use

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Screwcaps and Oxidation:

Liner Material	cc oxygen/m ² /day
Polyethylene	5000 - 10000
PET	100 - 200
PVDC (Saran)	10 - 60
Tin	< 10

Liner Type:	PE	PVC	PVDC	FOIL
Oxtrans:	0.09	0.004	0.001	0.0002
(cc/closure/day)				

Data reproduced with permission of Esvin and Jim Peck G3 Enterprises

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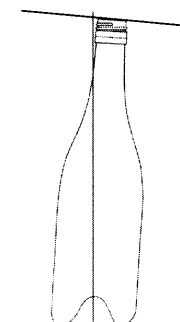
Screwcap Application:

- Good application is essential for avoiding oxidation with screw caps
- Good application requires:
 - Good bottles
 - Well maintained and adjusted capping equipment
 - Consistent caps

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Glass Quality:

- Quality of sealing surface – flat, with no splits, barbs, channels or cracks
- Quality of thread moulding
- Sealing plane must be horizontal

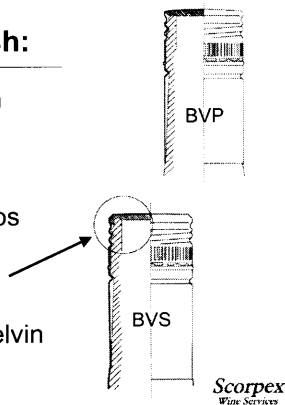


Reproduced with the permission of Esvin Wine Resources

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BVS Bottle Finish:

- BVS bottle finish and matching capping head should be used
- Rolled edge helps to prevent post-bottling impact damage to seal
- Bague Verre Stelvin

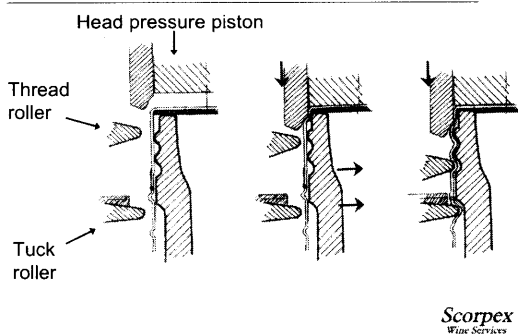


Capping Equipment:

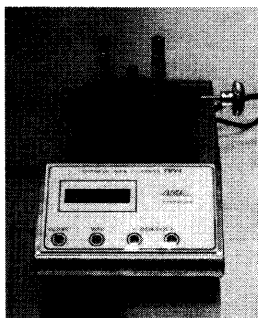
- Cap application is carried out in a three stage process
 - Head pressure
 - Rollers – thread, tuck
 - Release of head pressure
- Head pressure and roller springs must be adjusted to correct specification

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Capping Head:



Capping Equipment:



- Monitor capper performance by testing torque to turn the cap on sealed bottles

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Cap Consistency:

- If the malleability of the metal shell varies within cap batches, problems may occur.
- Cap consistency depends on raw material quality and manufacturing processes
- Some suppliers are more consistent than others.....

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Post - Bottling Reduction:

- Results from published trials show the development of **sulfide like odours** (SLOs) in wine in bottles sealed with low oxtrans closures
- Same wine in bottles sealed with closures with higher oxtrans do not develop SLOs

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Reduction in Bottle:

In several of these trials, the low oxtrans closure is a screw cap with a foil lined wad

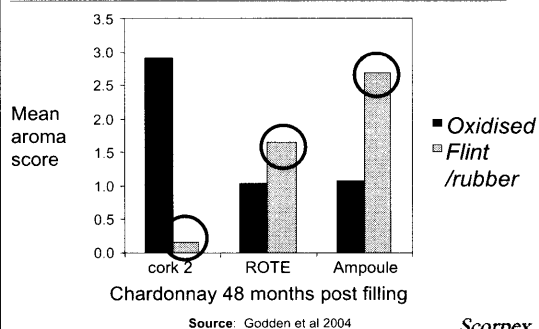
In the other trials, the closures used to create a low oxygen environment are:

- Bark cork with a sealing compound applied to prevent gas exchange*.
- Fused glass (AWRI ampoule trial)

* Pers. Comm. Catherine Chassignou, Agriculture Gironde. See www.bordeauxprof.com/St/Secure/Technique/Domines/recherche/CA33_bouchons_synthetiques.pdf

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AWRI Ampoule Trial:



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Closure Trial – Zork:

- Semillon wine bottled under Screw cap and Zork



Months	1	3	5	12	18
Oxidized	-	-	-	**Z	***Z
Flint/rubber	-	-	*S	**S	***S

* Low significance ** moderate significance *** high significance

Zork oxtrans: 0.0078 cc/closure/day

Screw cap oxtrans: 0.0005 cc/day/closure

Source: <http://www.zork.com.au/pdfs/18MonthTestResults.pdf>

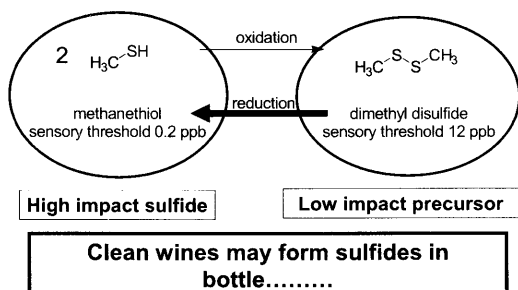
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Current Theory:

- Precursors are present in wine from yeast metabolism during fermentation - disulfides
- Precursors cannot be removed by copper treatment or permanently changed by oxidation
- Low impact precursors can change to compounds with higher sensory impact e.g. thiols
- Equilibrium between low impact and high impact form depends on access to oxygen

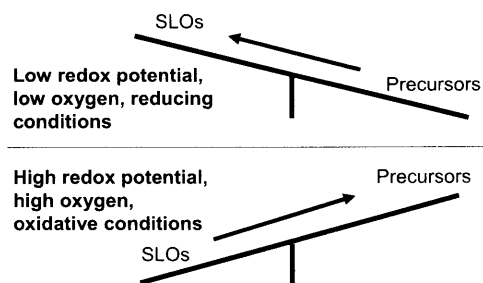
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Sulfide Compound Equilibrium:



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Equilibrium Balance:



Source: Vince O'Brien Winetech 2005

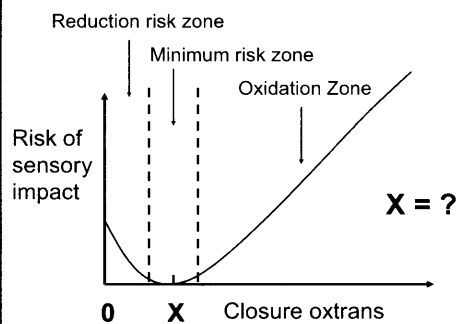
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Managing Reductive Risk:

- Manage the concentration of precursors
 - limit production, remove from wine
- Manage the concentration of high impact compounds once formed – residual copper at bottling
- Manage the redox potential of the bottle environment – closure choice

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Optimum Closure Oxtans:



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Closure Risks:

- Know and understand the basis of closure performance
- Understand closure strengths and limitations
- Manage risk by managing factors such as:
 - Wine
 - Closure application
 - Post bottling conditions

As well as the closure.....

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Acknowledgements:

- Esvin Wine Resources NZ
- Australian Wine Research Institute
- Vince O'Brien, Provisor Australia
- Gregor Christie, Procork Australia
- Jim Peck, G3 Enterprises USA
- Catherine Chassagnou, Agriculture Gironde France
- Alan Limmer, Stonecroft Wines NZ

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CLOSURES

MAXIMIZING BENEFITS, MINIMIZING RISKS

Richard Gibson
Scorpex Wine Services
New York Wine Industry Workshop
7 April 2006

FDA Bioterrorism

Doug Campbell
eSkye Software

Doug Campbell is VP of Winery Systems at eSkye Software and has been involved in developing software solutions to the wine industry since 1989. From the dark days of DOS, he created a software program called PC Blend that is still in operation today. That long-lived product led to the development of the Blend Suite of software that eSkye offers today which tracks not only tracks wine production, but also vineyard operations, case good inventory, sales, marketing and distribution. Considering himself lucky to have had a software company that was successful even through the dot com burst in 2000-2001, he decided to sell his previous company, Blend Winery Software, to eSkye Software in February 2004 and is now working towards expanding eSkye's software offerings to a global market.



FDA Bioterrorism

New regulations for the wine industry

Doug Campbell, VP Winery Systems
eSkye Software



Bioterrorism Reporting

What is it?

- Q The FDA has the responsibility of protecting the food supply of the US
- Q To protect that food supply, they have passed new regulations to require detail trace-through of all elements of food production and transportation
- Q Because wine (along with distilled spirits and bottled water) has been declared a food product, we must comply



Bioterrorism Reporting

What is it (in FDA-speak)?

- Q You must have the ability to trace all ingredients used in your production from all IPS (Immediate Previous Source) and the transportation of those ingredients
- Q You must have the ability to trace all products produced and their ISR (Immediate Subsequent Recipient) and the transportation of those foods



Bioterrorism Reporting

What does it mean?

- Q A new level of compliance tracking must be added to the already existing tracking that you are already doing for the TTB
- Q As a food producer, you must provide a complete list of all ingredients involved in wine production
- Q You must be able to respond to the FDA within 24 hours with a full product trace if they find a contaminated product or ingredient
- Q You must be able to trace 2 years from the date of the release of your product all the way back to the origin of the product



Bioterrorism Reporting

Who must comply?

- Q Any producer who has more than 11 FTE's (full time equivalent employees)
- Q Any producer who has less than 11 FTE's who also sells more than 50% of their product direct to consumers (in other words, the FDA considers them a farm)



Bioterrorism Reporting

When do you have to comply by?

- Q Largest wineries (> 500 FTE's) must be in compliance by December 9, 2005
- Q Medium size wineries (> 11 FTE's) must be in compliance by June 9, 2006
- Q Small wineries (< 11 FTE's) must be in compliance by December 9, 2006



Bioterrorism Reporting

What does it cover?

- ☞ Sale and transportation of juice, bulk wine and finished goods
- ☞ Purchase and transportation of grapes, juice and bulk wine
- ☞ Transportation and detail tracking (by lot number IF there is a lot number on the item) of anything added during wine production and any part of the packaging that touches the final product



Bioterrorism Reporting

What does it cover?

- ☞ Transportation and detail tracking of anything you use that technically impacts your product in production (i.e. Barrels)
- ☞ Transportation and detail tracking of samples drawn and received



Bioterrorism Reporting

What does it exclude?

- ☞ Additions in the vineyard
- ☞ Packaging materials that *don't* touch the final product
- ☞ Financial and Pricing data
- ☞ Recipes for food production (which means that they don't care how much of an ingredient you use, 1 gram or 1 kg - there is no threshold for reporting)

Bioterrorism Reporting

What are the details?

- Additions (Yeast, enzymes, acids, sugar)
- Filtration and fining agents
- Bottles and corks (or screwtop closures)
- Barrels
- Gasses
- Bulk wine
- Samples

Bioterrorism Reporting

Requirements for Production

- Detailed transporter, supplier and bonded winery information to include contact names, phone numbers and addresses
- Collect transporter information when receiving Weigh Tags, shipping Juice/Wine, receiving Juice/Wine, and receiving Additions, Glass, Corks and Barrels
- Using lot tracking when doing additions to wine and using glass and corks

Bioterrorism Reporting

Requirements for Finished Goods

- Track all finished goods by lot number of the wine, the bottle and the cork.
- Determining how to individually identify multiple bottling dates or separate blends that are bottled differently
- Tracking transporter and recipient information for each shipment



Bioterrorism Reporting

Wine Industry Specific Problems

- ❏ Blending
- ❏ Barrel Topping
- ❏ Multiple bottling dates for one product
- ❏ Changing cork lot or glass lot within one bottling run
- ❏ Borrowing materials to make up a short-fall
- ❏ Custom Crush
- ❏ The art of winemaking



Bioterrorism Reporting

Dates to Remember

- ❏ Largest wineries (> 500 FTE's) must be in compliance by December 9, 2005
- ❏ Medium size wineries (> 11 FTE's) must be in compliance by June 9, 2006
- ❏ Small wineries (< 11 FTE's) must be in compliance by December 9, 2006



Bioterrorism Reporting

Recommendations to the Industry

- ❏ Order larger quantities of additives less often and request suppliers to ship same lot number when possible
- ❏ Track receipt of all dry goods by lot number
- ❏ When making additions, record the lot number of the specific ingredient (if there are lot numbers)
- ❏ If there are not lot numbers on an ingredient, make sure that the staff identifies the specific ingredient



Bioterrorism Reporting

Recommendations to the Industry

- ❏ Track receipt and issues of glass and corks by lot number
- ❏ Make copies of every Bill of Lading and keep in the Production office
- ❏ Do periodic physical inventories of all additives and packaging materials
- ❏ Centralize data storage of production records for quick retrieval



Bioterrorism Reporting

Potential ideas for the future

- ❏ Use barcoding to identify all additives, glass and corks to reduce data entry time and help prevent errors
- ❏ Mark cases with wine lot number, cork lot number and glass lot number
- ❏ Laser code bottles with lot identifiers
- ❏ Utilize RFID technology to uniquely identify each case



U.S. Department of Health and Human Services
Food and Drug Administration

Overview of Bioterrorism Act Establishment and Maintenance of Records Final Rule



**Selected slides from a seminar given by the FDA in
Seattle in January 2005**

Examples of FDA-Regulated Food

Definitions (cont.)



- ❧ **Recipe:** means the formula, including ingredients, quantities, and instructions, necessary to manufacture a food product
- ❧ **Because a recipe must have all three elements, a list of the ingredients used to manufacture a product without quantity information and manufacturing instructions is not a recipe**



- ❖ **Recipe:** means the formula, including ingredients, quantities, and instructions, necessary to manufacture a food product
- ❖ **Because a recipe must have all three elements, a list of the ingredients used to manufacture a product without quantity information and manufacturing instructions is not a recipe**

Record Retention Periods		
Food having significant risk of spoilage, loss of value, or loss of palatability within ...	Non-transporter Records	Transporter Records
60 days	6 months	6 months
> 60 days but within 6 months	1 year	1 year
> 6 months	2 years	1 year
All animal feed, including pet feed	1 year	1 year

Food having significant risk of spoilage, loss of value, or loss of palatability within ...	Non-transporter Records	Transporter Records
60 days	6 months	6 months
> 60 days but within 6 months	1 year	1 year
> 6 months	2 years	1 year
All animal food, including pet food	1 year	1 year



Consequences: New Prohibited Acts

It is a prohibited act to:

- Fail to establish or maintain records
- Refuse access to or verification or copying of any such required record
- Fail to make records available to FDA as required by section 414 or 704(a) of the act and this regulation

What are the record availability requirements?

- When FDA has a reasonable belief that an article of food is adulterated and presents a threat of serious adverse health consequences or death to humans or animals (SAHCODHA)...
- ...Any records and other information accessible to FDA under section 414 or 704(a) of the act must be made readily available for inspection and photocopying or other means of reproduction as soon as possible, not to exceed 24 hours from the time of receipt of the official request.



Economic Impact of Final Rule

- Approximately 707,672 total facilities covered

597,172 domestic facilities that manufacture, process, pack, transport, distribute, receive, hold, or import food in the U.S.

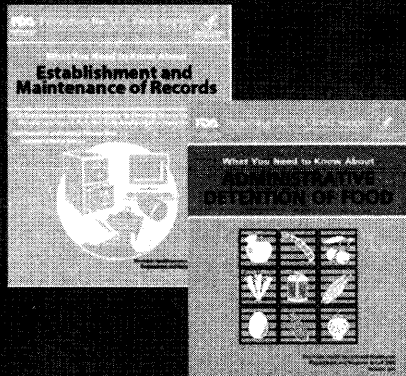
110,500 foreign facilities that transport food in the U.S.

Economic Impact of Final Rule

Estimated per facility recordkeeping costs:

Learning costs:	\$120.00
Records redesign:	\$411.00
Additional records maintenance:	\$219.00

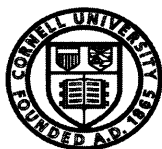
Guides
available
on the
FDA
website



Bioterrorism Reporting

Contact Information

- FDA Web Site
<http://www.fda.gov/oc/bioterrorism/bioact.html>
see section 306 – Records Maintenance
- eSkye Software Web Site
<http://www.eskyesoftware.com>
- My e-mail
dcampbell@eskyesoftware.com



Cornell University
New York State
Agricultural Experiment Station



35th Annual New York Wine Industry Workshop Trade Show Exhibitor List

Thursday, April 6, 2006

Location: NYS Agricultural Experiment Station

PP = Pilot Plant; V&B = Winery & Brewing Lab

Company Name	Booth #
AFTEK, Inc. & Begerow USA	PP-11
Christian CARL Ing. GmbH	V&B-25
Cork Supply USA/Newpak USA	PP-4
Eastern Wine & Grape Archive – Cornell University Library	PP-18
Euro Machines	V&B-29
FOSS North America	PP-22
Goodnature Products	PP-21
Gusmer	PP-16
Hanna Instruments	PP-17
Hauser Packaging	PP-5
Kepner Equipment	PP-20
IDL Process Solutions	PP-9
Megazyme Int'l	PP-7
MRB Group	PP-13
NYSAES-Environmental Health	V&B-34
Parker Hannifin	V&B-24
Prospero Equipment	V&B-31
Pulsair Systems	PP-8
RT Solutions	PP-15
Saxco Canada	PP-19
Scholle Packaging	PP-14
Scott Labs	V&B-30
Spider Graphics	V&B-26
Star Filters	PP-6
StaVin	PP-12
Systea Scientific	V&B-27
United Bottles	PP-3
US Dept. of Labor / OSHA	PP-1
Vance Metal Fabricators	V&B-33
Vinideanet	V&B-28
Waterloo Container	V&B-32
Weir Fluid Conditioning	PP-2

<http://www.nysaes.cornell.edu/fst/faculty/henick/wiw/index.html>

Exhibitors Seminar Schedule

Location: NYS Agricultural Experiment Station, Geneva
Food Science and Technology Building

Room 251 – Conference Room

Room 157 – Lunch Room

Room 150 – Small Conference Room

Exhibitor	Seminar Title	Room 251 / Time	Room 157 / Time	Room 150 / Time
StaVin Inc.	Innovation Using Oak and Oxygenation for Winemaking – <i>Dr. Jeff McCord</i>	8:30 – 9:15 13:45 – 14:30		
Megazyme Int'l	Advanced Wine Test Kits – <i>Barry McCleary and Simon Charnock</i>			8:30 – 9:15 13:45 – 14:30
Scott Labs	Taste the Tannins and Wine Tasting Session – <i>Jeff Heacock</i>		8:30 – 9:30 13:15 – 14:15	
FOSS North America	FOSS FIAstar – <i>S. Anderson</i>			14:45 – 15:05
FOSS North America	WineScan – <i>Maceo Cobb</i>			15:15 – 15:45
Begerow USA	Filter Cartridges for Wine Filtration – Different Types, Application & User – <i>Witte Alfons</i>		10:45 – 11:15	16:00 – 16:30
Begerow USA	Biotechnology Products in Winemaking – Enzyme and Filtration – A Look Behind! <i>Dr. Ilona Schneider</i>	10:30 – 11:15		
AFTEK	Oak Alternatives – Oak Solutions – <i>Paul Abbott</i>	9:30 – 10:15	14:40 – 15:25	
Star Filters	Media Filtration and Crossflow Microfiltration Clarification Options – <i>Jim Smith</i>	11:30 – 12:00	16:30 – 17:00	
Systea Scientific	Improved Analytical Performance with Discrete Analysis – <i>Craig Chinchilla</i>			10:15 – 10:45
US Dept. of Labor/OSHA	All About OSHA – OSHA Partnerships – <i>Michael Casler</i>		15:40 – 16:20	
Scholle Packaging	Let us Show you How – Intro. To Bag-in-Box Packaging – <i>Eunice Reynolds</i>	16:30 – 17:00	11:30 – 12:00	

Exhibitor	Seminar Title	Room 251 / Time	Room 157 / Time	Room 150 / Time
Christian CARL Ing. GmbH	Introduction to Artisan Distilling – <i>N. Haas and A. Plank</i>			11:20 – 12:00
Pulsair Systems	Advantages of Pneumatic Mixing & Blending – Cap Management – <i>John Voorhies</i>	15:45 – 16:15		9:30 – 10:00
Eastern Wine & Grape Archive/Cornell University Library	Basic Records Management & Archiving for the Wine & Grape Industries – <i>Kari R. Smith</i>			13:00 – 13:30
Hanna Instruments	Titration and Measuring Multiple Parameters for Winemaking – <i>Paul Ripka</i>	13:00 – 13:20		16:40 – 17:00
Spider Graphics	Building Customer Relationships Through Integration of Online Marketing and E-Commerce Tools – <i>Michael Meador</i>		9:45 – 10:30	
FDA	Bioterrorism Act – Debbie Rahston	14:40 – 15:30		
Cornell Agriculture & Food Technology Park	The Technology Farm Dedication – <i>Dan Fessenden</i>	12:15 – 12:45		

DOES YOUR MASTERPIECE LACK BODY?



TAN'COR GRAND CRU

and

BIOLEES



help build body
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