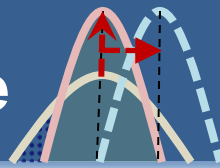




BIB Wine



Shelf Life



BIB Wine Shelf Life



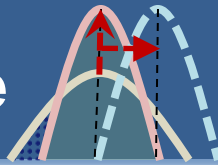
8 May 2012 at
Systembolaget, Stockholm, Sweden

Patrick Shea

vitop 



BIB Wine



Shelf Life



BIB Wine Shelf Life / Summary

1) Principles of BIB Wine Shelf life

Goals

Key Parameters



2) BIB and the wine consumer

World alcohol consumption trends and mortality risk

What is reasonable consumption?

The importance of the occasional wine consumer

Why BIB wine stays fresh after opening?

Why use BIB?

How consumers know how much they have drunk?

Would smaller package size fit requirements?

What about “Best by” dates?

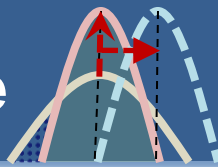


A presentation by Patrick Shea, Vitop, ps@vitop.fr

Acknowledgement to Sophie Vialis (Inter-Rhône) and to Jean-Claude Vidal (INRA) for their scientific contributions to the understanding and improvement of BIB wine shelf life. Several relevant publications are available from the website of the non-profit association Performance BIB: www.b-i-b.com



BIB Wine



Shelf Life



Principles of BIB Wine Shelf life: Goals

Definition of BIB Wine Shelf Life

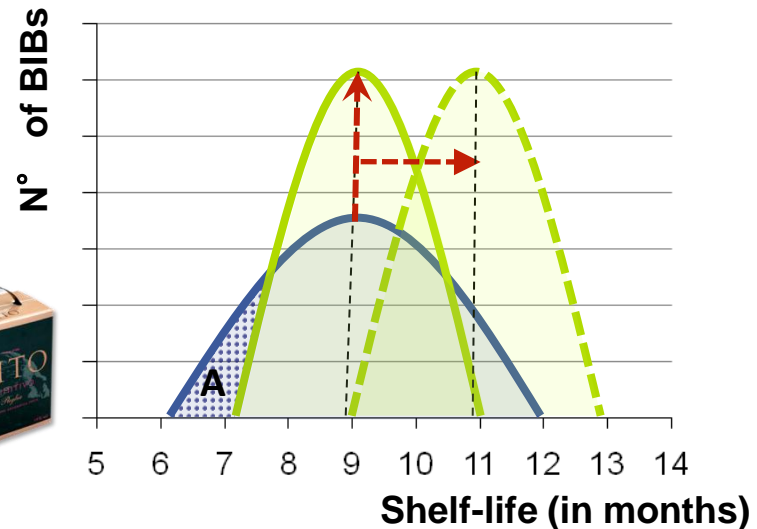
Length of time before the wine is considered unsuitable for consumption.

This is the **interval between the filling of the BIB and the last glass** consumed.

Goal for retailers and fillers: reach or exceed a target (ex: average of 9 months) while minimizing variance - rather than to maximize shelf life since going beyond market requirements has no practical benefits and only adds to costs.

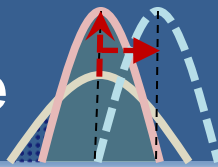
SHELF LIFE GOAL:

Bell curves **tightened**
(less variance) and/or
shifted
to the right





BIB Wine



Shelf Life



Principles of BIB Wine Shelf life: Goals

When is BIB wine unacceptable?

•How long can a BIB wine hold up?

→This depends upon:

- **Changes** that occur in the wine (taste, color, etc.)
- A **judgment** that these changes are unacceptable



The judgment of a BIB wine will be more severe if:

- several **conditions** must be met to “pass” the test (for example: free $\text{SO}_2 > 10 \text{ mg/l}$ *and* taste *and* color acceptable)
- professional tasters** are used rather than typical consumers
- compared** to the same wine in glass bottle with a screw-cap

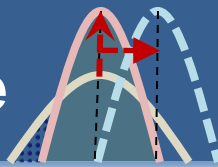


Even when all key shelf-life parameters are mastered:

- a **BIB wine may be judged to not last over 9 months** if evaluated under severe conditions
- the same wine might be considered acceptable for most wine consumers for up to **12 months**



BIB Wine



Shelf Life



Principles of BIB Wine Shelf life: The Goal

A special note to importers and retailers

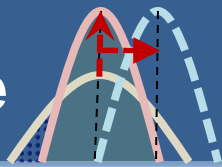
Wine importers and retailers should:

- **Fix realistic shelf life requirements** (for example 9 months max.) that are adjusted to the particular wine.
- **Adopt good practices** (low storage and transport temperatures and quick rotation)
- **Be more concerned about helping suppliers meet overall shelf-life goals rather than fixing performance criteria based upon selected parameters, particularly if measurement issues are highly complex and non-standardized.** Examples of criteria not to include in specifications: requiring that Dissolved Oxygen (DO) pickup be < 0.5 mg/L or that the permeability of the bag should be < 0.5 cm³/m²/day.
- **Refer to the Good of Practices for the filling of wine in BIB**





BIB Wine



Shelf Life



Principles of BIB Wine Shelf life: Key Parameters

Seven Ways to Extend Wine BIB Shelf-Life

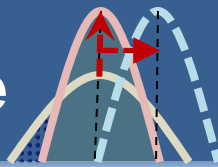
It is possible to push forward the limits of shelf life by:

- 1) Selecting **certain types of wines**
- 2) Adding appropriate amounts of **SO₂**
- 3) Proper **final filtration** and **filling line sterility**
- 4) Minimizing **oxygen pickup** by the filling process
- 5) Selecting a **package** with low gas permeability
- 6) Minimizing **damage** to the barrier film
- 7) Minimizing storage **temperatures**





BIB Wine



Shelf Life



Principles of BIB Wine Shelf life: Key Parameters

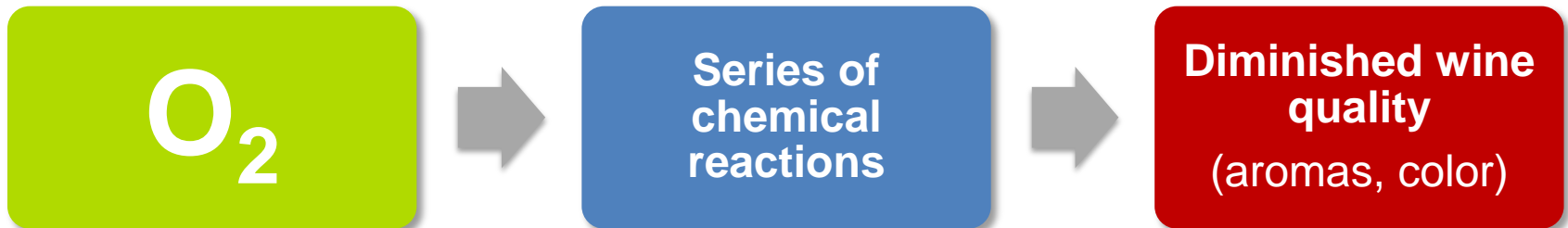
Shelf-Life Factor 1: The Wine

Expected shelf-life depends upon the **specific wine chosen**

On the average BIB wines will **have a longer shelf life** if they:

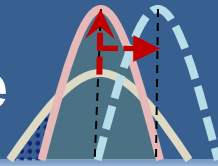
- are **red** rather than white because reds have more anti-oxidative polyphenols
- have **high alcohol** and **high acid** (low pH)
- have a **low level of initial dissolved oxygen** before bottling
- have **not already suffered many oxidative reactions**

A wine that is oxidized is permanently damaged!





BIB Wine



Shelf Life



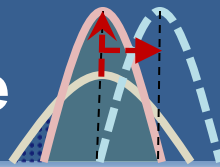
Principles of BIB Wine Shelf life: Key Parameters

Shelf-Life Factor 2: SO_2

- SO_2 added to wine will contribute to **extended shelf-life**
- The level of **free SO_2 upon filling** is often **25 to 50 mg/L** → this will fall over time
- The ideal amount must be **determined by the winemaker** and will depend upon:
 - “burnt match” odor risk
 - cumulative oxygen (measured or expected)
 - shelf life target
 - pH of the wine
 - microbiological risks
 - other factors



BIB Wine



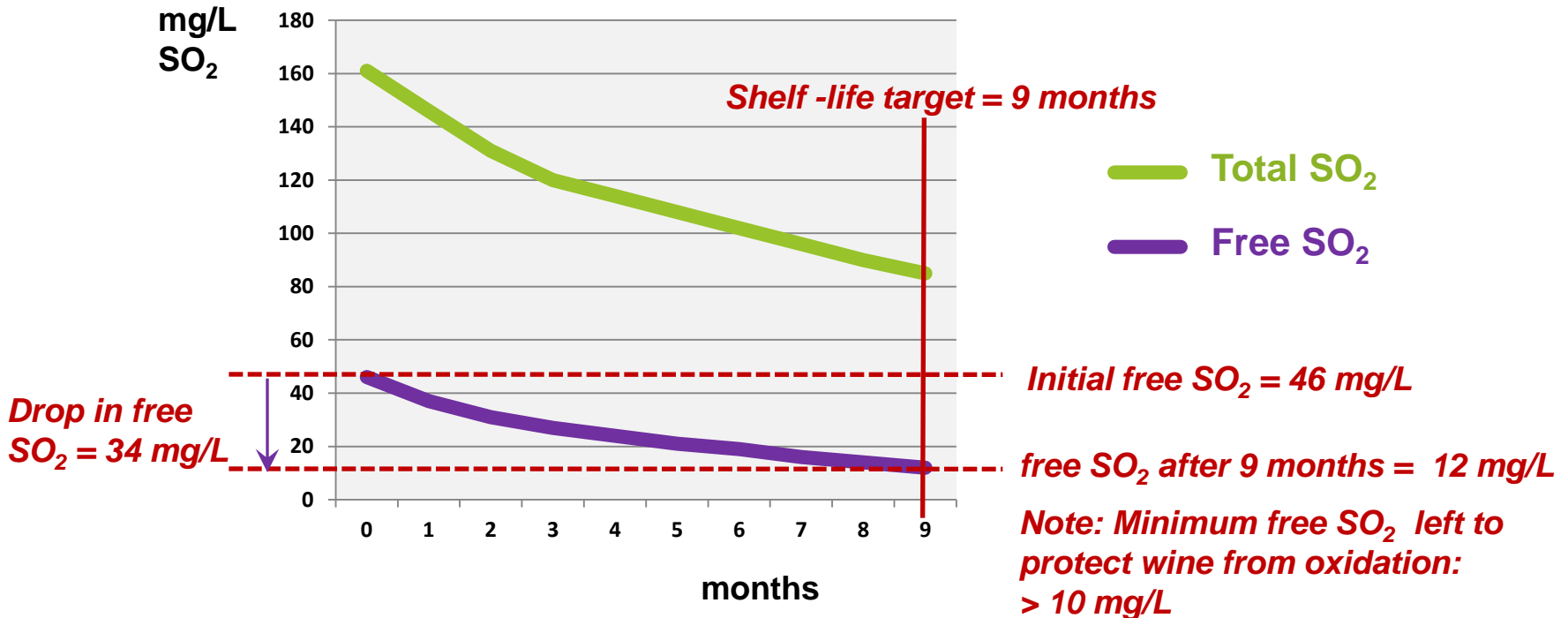
Shelf Life



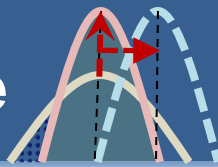
Principles of BIB Wine Shelf life: Key Parameters

Shelf-Life Factor 2: SO₂

Example of the fall of Total and Free SO₂ for a French Chardonnay in BIB at 20 °C



Source: INRA 2004, Study for Performance BIB

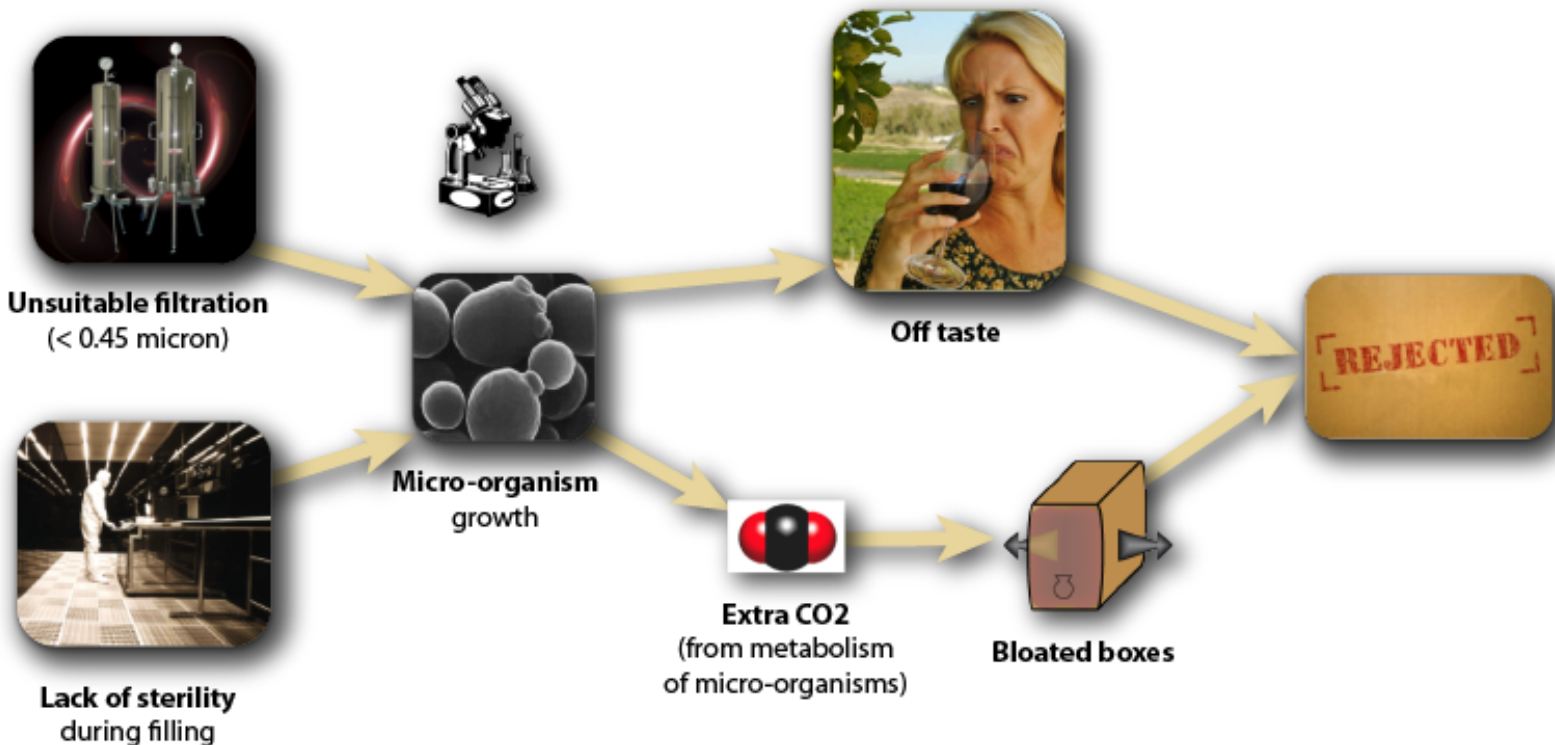


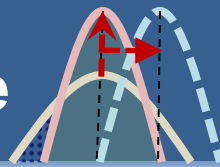
Principles of BIB Wine Shelf life: Key Parameters

Shelf-Life Factor 3: Microbiological Control

Wine BIB shelf-life can be greatly decreased by **inadequate final filtration** or **lack of sterility** during the filling operation

Periodical microbiological analysis + **sound hygiene practices** can greatly reduce the risk





Principles of BIB Wine Shelf life: Key Parameters

Shelf-Life Factor 4: O₂ Pickup During Filling

Important to minimize since **1 extra mg/L of dissolved O₂ reduces shelf life by one month (INRA 2004)!**

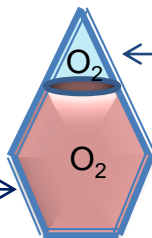
Oxygen pickup during filling = Δ **dissolved O₂** in the wine + **Headspace O₂**

Headspace O₂ is the result of both the **volume** and the **% of oxygen** inside

- **Key factors to control:**
 - filling valve technology
 - vacuum pack to remove air
 - amount of initial O₂ in the empty package
 - filling table adjustments
 - nitrogen flushing of tap and gland to reduce O₂



Measurement with optical instrument **Dissolved Oxygen**



Headspace Oxygen Measurement with optical instrument

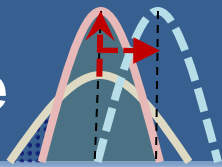


Headspace Volume Measurement with *BIB Cone Meter*





BIB Wine



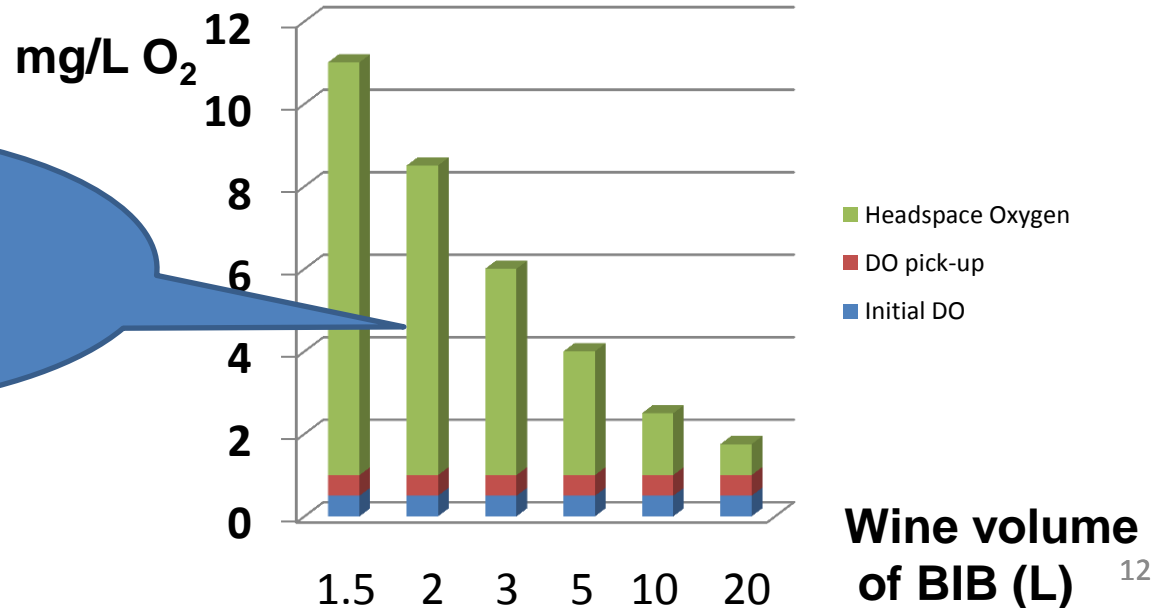
Shelf Life



Principles of BIB Wine Shelf life: Key Parameters

Shelf-Life Factor 4: O₂ Pickup During Filling

Potential Headspace oxygen problems become more acute with smaller BIB sizes. The example below assumes that the size of the air cone (headspace) and DO levels remains constant as the volume of the BIB package changes. The cone generator line is 6.5 cm and 14.9% air inside is O₂. Those packing smaller BIB sizes must manage O₂ even better and retailers pushing for 1.5 L and 2 L BIB should accept that shelf-life is likely to be shortened.

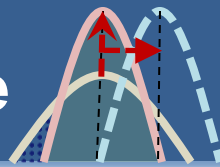


Pay special O₂ Management attention to small capacity BIBs

Wine volume of BIB (L) ¹²



BIB Wine



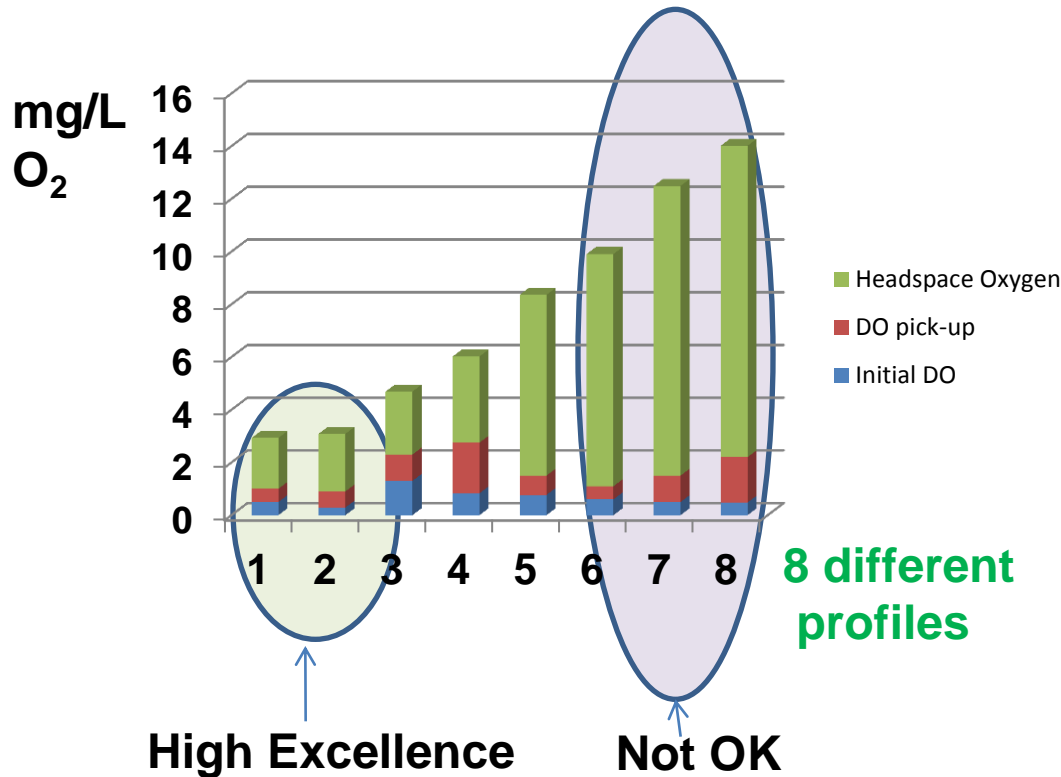
Shelf Life



Principles of BIB Wine Shelf life: Key Parameters

Shelf-Life Factor 4: O₂ Pickup During Filling

A comparison of Total Package Oxygen (TPO) in wine BIBs right after filling, observed at various wineries. The good news is that, since the introduction of a standardized method to measure TPO, results for many wineries have been dramatically improving!



Performance BIB Wine Packaging Seminars Environmental Impact & O₂ Measurements Bordeaux, France 29 November 2010

The measurement of Total Oxygen in filled BIB wine

"There shall be one measure of wine throughout our whole realm"
The Magna Carta, 1215

By: Patrick Shea vitop
Jean-Claude Vidal INRA
Sophie Vialis INTER RHONE

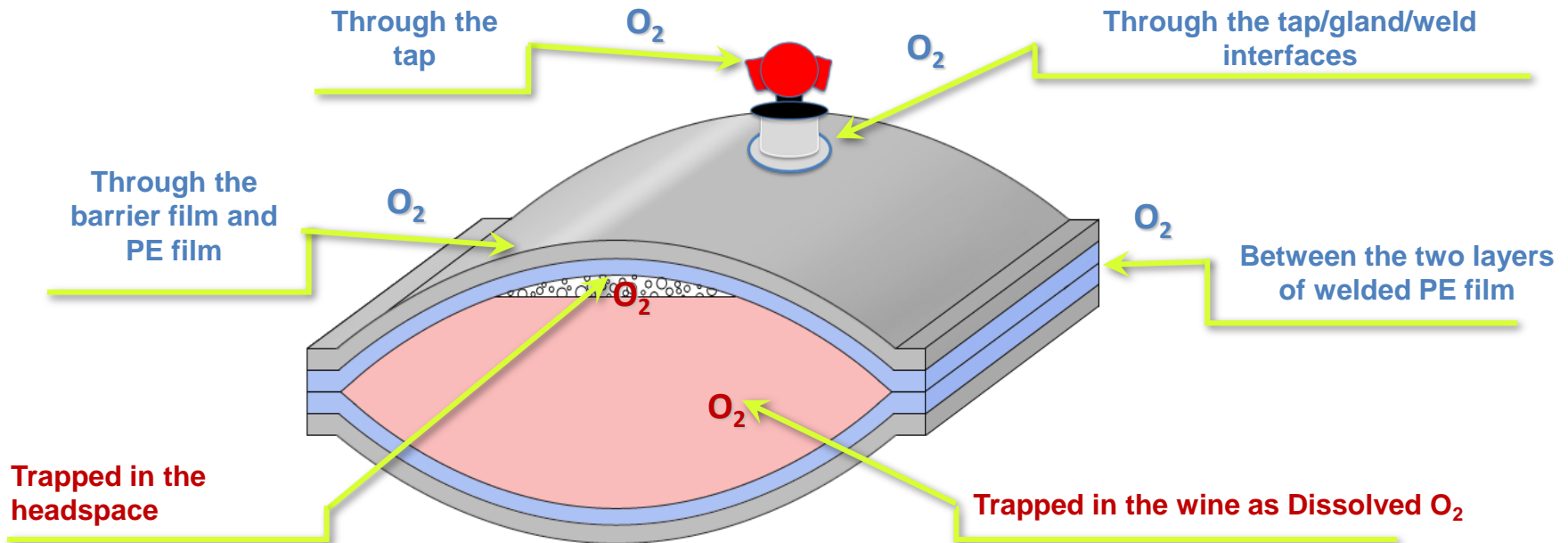


Principles of BIB Wine Shelf life: Key Parameters

Shelf-Life Factor 5: O₂ Permeation of Package

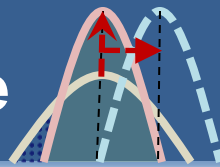
We have seen (factor 4) that the **O₂ trapped in the wine or in the headspace** during filling can be an important source of oxygen available to the wine.

The second source of oxygen is the **O₂ ingress through the package when it is stored after filling**, either via the tap/gland unit or the rest of the bag (film or welds).





BIB Wine



Shelf Life

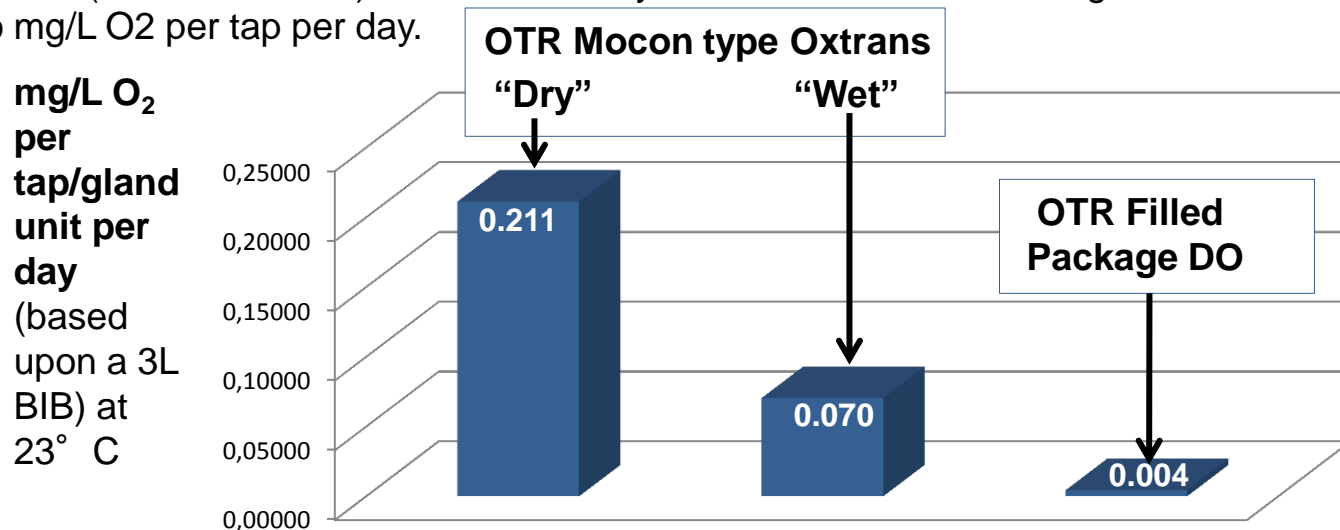


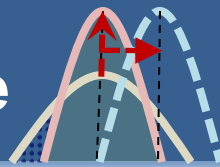
Principles of BIB Wine Shelf life: Key Parameters

Shelf-Life Factor 5: O₂ Permeation of Package

Oxygen Transmission Rate for taps (or film) is often provided based upon “dry” gas/gas Mocon Type Oxtrans measurements of O₂ per day expressed in mL but this can also be expressed in mg/L if the container size is known. If even a few mL of water is added to the tap this is referred to a “wet” measurement and oxygen permeation can drop by a factor of three. Such tests are good for industrial control purposes but not for predicting shelf-life.

Much closer to reality is The Filled Package DO (dissolved oxygen) test conducted measuring the increase in DO (in low initial DO) water over many weeks and then converting the total change over the period into mg/L O₂ per tap per day.





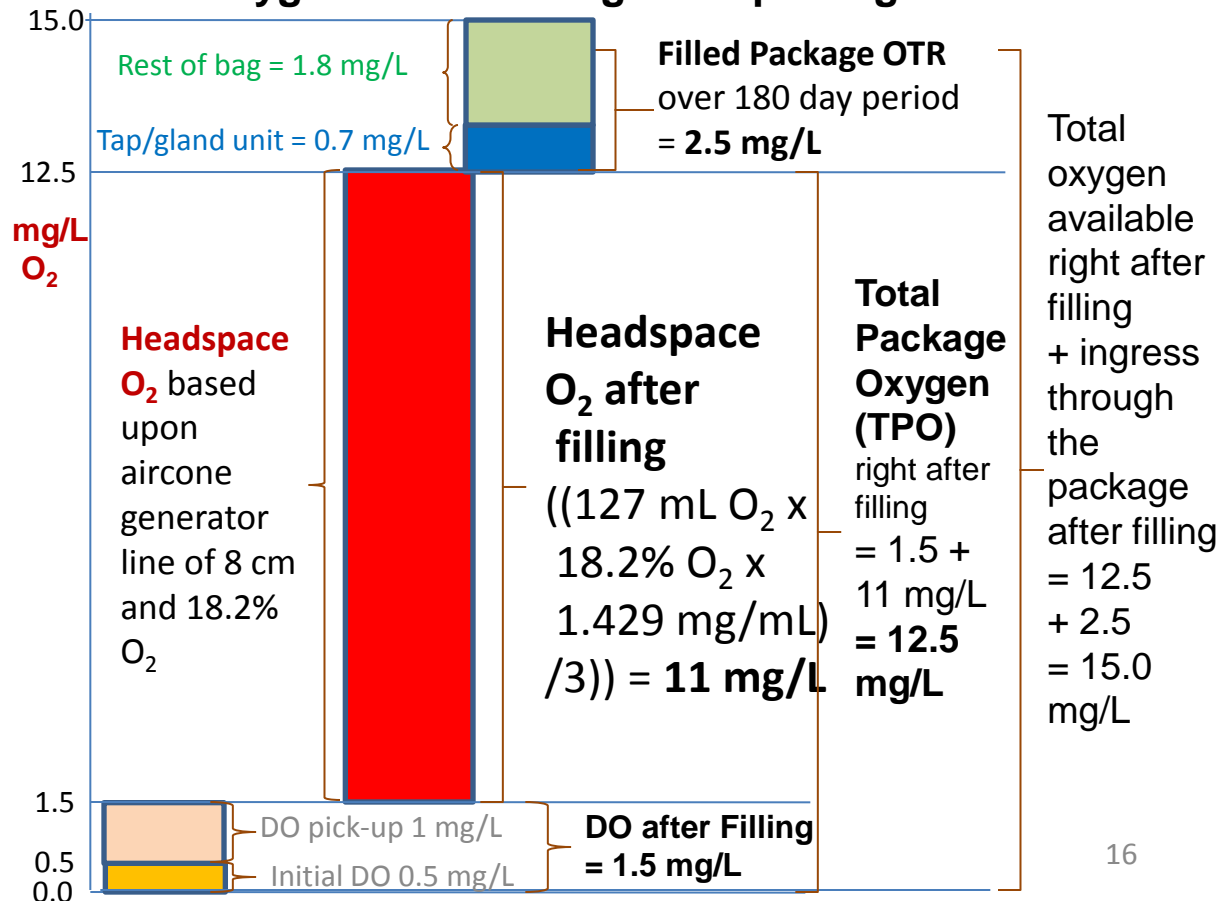
Principles of BIB Wine Shelf life: Key Parameters

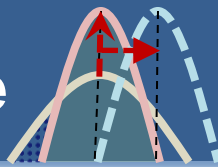
Shelf-Life Factor 5: O₂ Permeation of Package

In many cases the leading source of oxygen is not through the package but that introduced during filling.

In the example to the right (figures for illustration purposes only) so much oxygen enters via the headspace (11 mg/L) that this should be the number 1 priority!

With good filling practices it is entirely possible (with the same package) to reduce this headspace oxygen to only 2 mg/L, DO after filling to 1 mg/L and total oxygen available to 5.5 mg/L - a reduction of 9.5 mg/L! This would **greatly increase shelf-life.**





Principles of BIB Wine Shelf life: Key Parameters

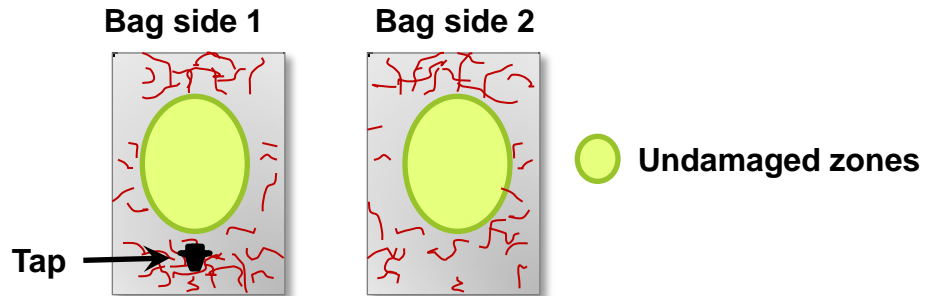
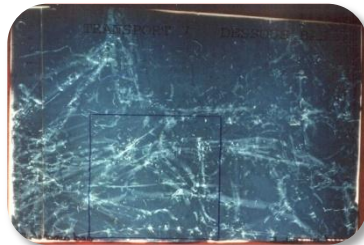
Shelf-Life Factor 6: Damage to Package

Damage to the BIB package, particularly to the barrier film, will shorten shelf-life

BIB bags can be examined periodically after filling and after they have gone through the distribution channels

Flex-cracking is normal but if zones of **excessive damage** are identified, causes should be determined and corrective action taken

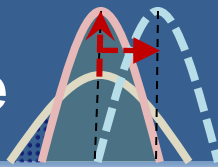
Metalized polyester BIB bag examined with back-light
by Gilles Doyon,
Agriculture Canada



- It is also important to **check the residual space left in the box** (normally + 0.5 litres for a 3 litre box) since this can also have an impact on the jiggling of the filled bag and resulting stress on the film



BIB Wine



Shelf Life



Principles of BIB Wine Shelf life: Key Parameters

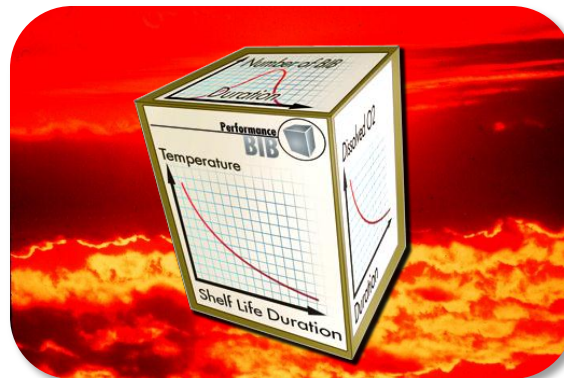
Shelf-Life Factor 7: Temperature

High storage temperatures are the mortal enemy of BIB wines!

Research by the INRA in France has shown that an **increase in storage temperature by 10 °C** (from 20 °C to 30 °C) will reduce wine BIB **shelf-life by half!**

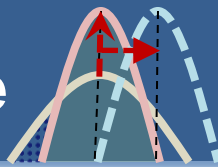
- *This is due to both increased **oxygen transmission rates** of the package and to increased rates of **chemical reaction** in the wine*
- *Storage and transport temperatures should be maintained under 25 °C*

Other research suggests that substantially heating up a filled met-pet BIB bag may permanently diminish the oxygen barrier of the film





BIB Wine Shelf Life



Principles of BIB Wine Shelf life: Key Parameters

Who can guarantee wine BIB shelf life?

Should the BIB bag manufacturer guarantee wine BIB shelf-life?

➔ **No.** Because the bag supplier only controls one of the seven key parameters that determine shelf-life

Parameter	Who is responsible?
The wine	Winery
SO ₂	Filler
Microbiological control	Filler
O ₂ pickup during filling	Filler
Package O ₂ ingress	Bag manufacturer
Package damage	Filler/Distributor
Temperature	Filler/Distributor

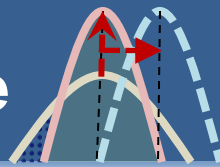
Should the BIB filler guarantee wine BIB shelf-life?

➔ **Partially,** but even if the filler also supplies the wine and buys a quality bag, not all parameters are fully controllable, since damage to the package or high temperatures can also occur after the BIB wines leave the filling centre



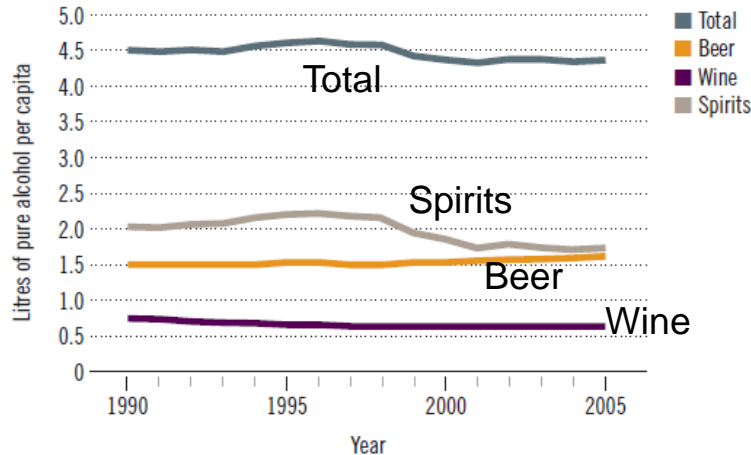


BIB Wine Shelf Life



BIB and the wine consumer: World alcohol consumption trends and mortality risk

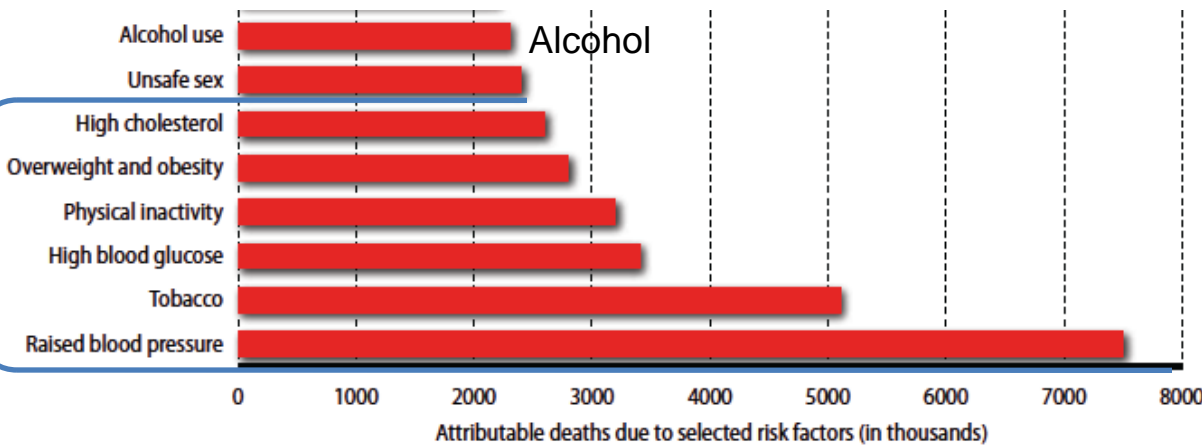
World per-capita consumption of alcoholic beverages



Per capita world consumption of alcohol can best be described as flat or slightly decreasing.

Attributed yearly deaths worldwide due to selected risk factors

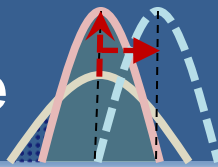
Major cardio-vascular risks



Most deaths worldwide are due to risk factors associated with cardiovascular disease (the Number 1 killer) and other chronic illnesses - although alcohol also takes its toll.



BIB Wine



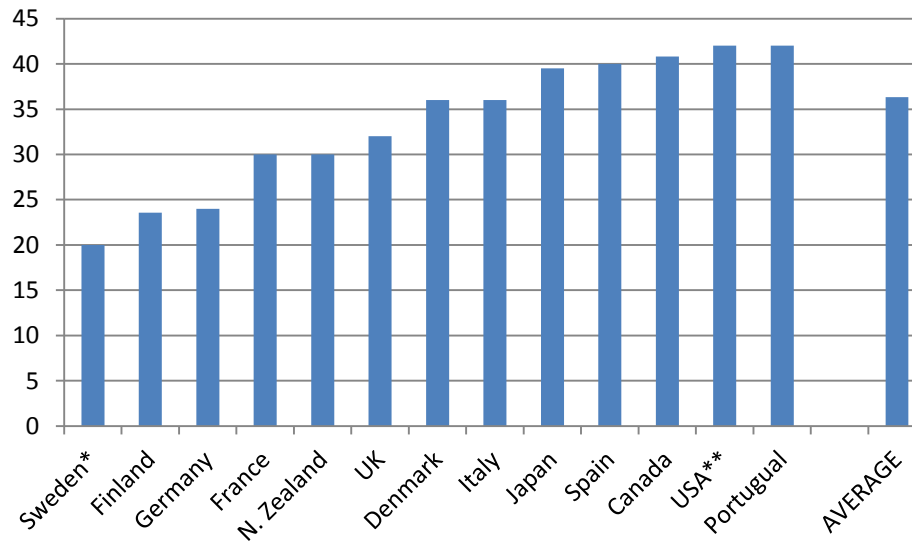
Shelf Life



BIB and the wine consumer: What is reasonable consumption?

Official guidelines for maximum low risk alcohol consumption varies considerably. The average of the 13 countries depicted below is about 37 g/alcohol per day.

Recommended maximum alcohol for adult men 'low risk' consumption expressed in g of pure alcohol per day.



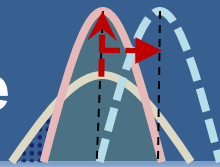
* Guidelines from Swedish Research Council

** For USA, 2010 Dietary Guidelines for Americans recommends max per day of 4 drinks for men but average during year should be 2 drinks per day. Because of ambiguity and taking into account other guidelines in the USA, 3 drinks a day were used for the calculation.

Source: "Recommended international guidelines for adult 'low risk' consumption", Alcohol in Moderation (AIM), 2012. The figures in the chart are only for men. The reference document also provides recommendations for women (usually lower limits than for men). An individualized medical approach should also take into account body weight and personal medical condition before providing any specific recommendation.



BIB Wine



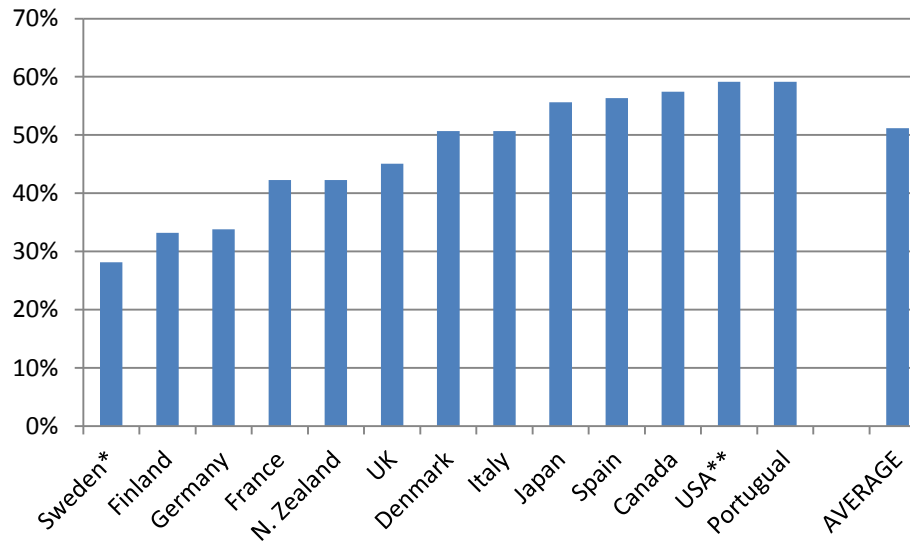
Shelf Life



BIB and the wine consumer: What is reasonable consumption?

The graph below simply converts the maximum low risk alcohol consumption figures from the previous graph from g per day to the equivalent of the % of a 75 cL bottle of 12% alc. wine. The average of the 13 countries depicted below is a little more than half a 75 cL bottle per day.

Recommended maximum alcohol for adult men 'low risk' consumption expressed in % of a 75 cL 12% alc. bottle of wine per day.



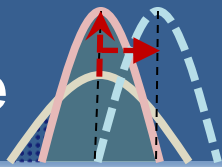
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BIB Wine



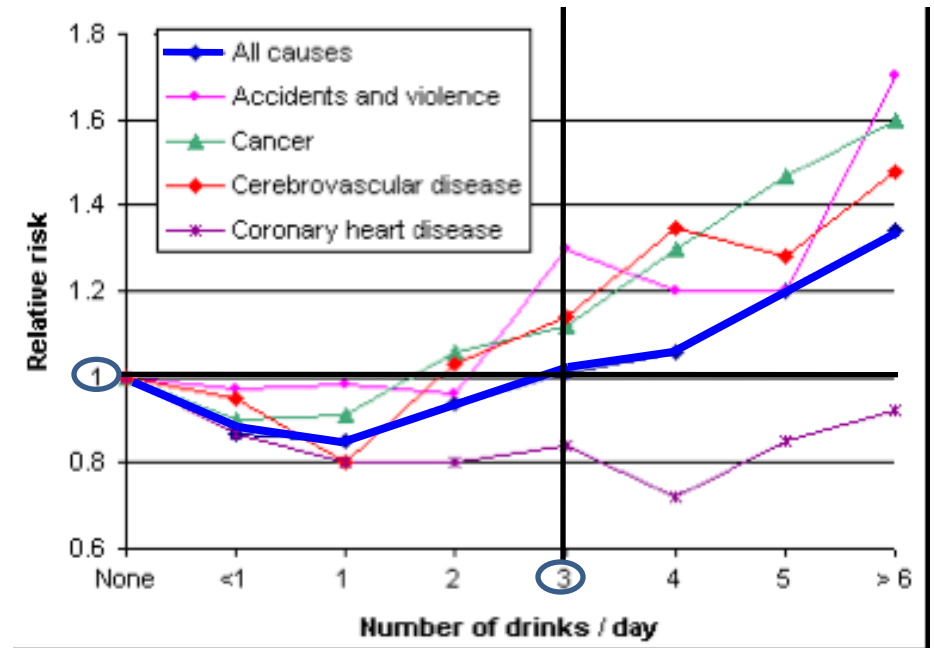
Shelf Life



BIB and the wine consumer: What is reasonable consumption?

Official recommendations are generally based upon studies examining the relationship between alcohol consumption and health indicators such as mortality. Although there are many studies available and all do not reach the same conclusions, there is generally a “J” shaped curve with overall mortality decreasing with moderate consumption and then increasing at some point above the abstinence mortality rate. Below is one “classic” study.

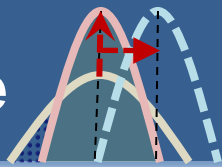
We see in the study to the right that a modest consumption of alcohol by men can be beneficial to lowering the risk of coronary heart disease and cerebrovascular disease (stroke) but after 3 drinks/day for the average man (this would be less for the average woman), the additional risks from accidents and violence and some forms of cancer begin to outweigh the benefits. In the USA a standard drink is 14 g. (17.7 mL) of alcohol and 3 drinks is not so far from the equivalent of a half a bottle of 12% wine.



Source: American Cancer Society 1991 study of 276,802 American men aged 40 to 59 years followed for 12 years.

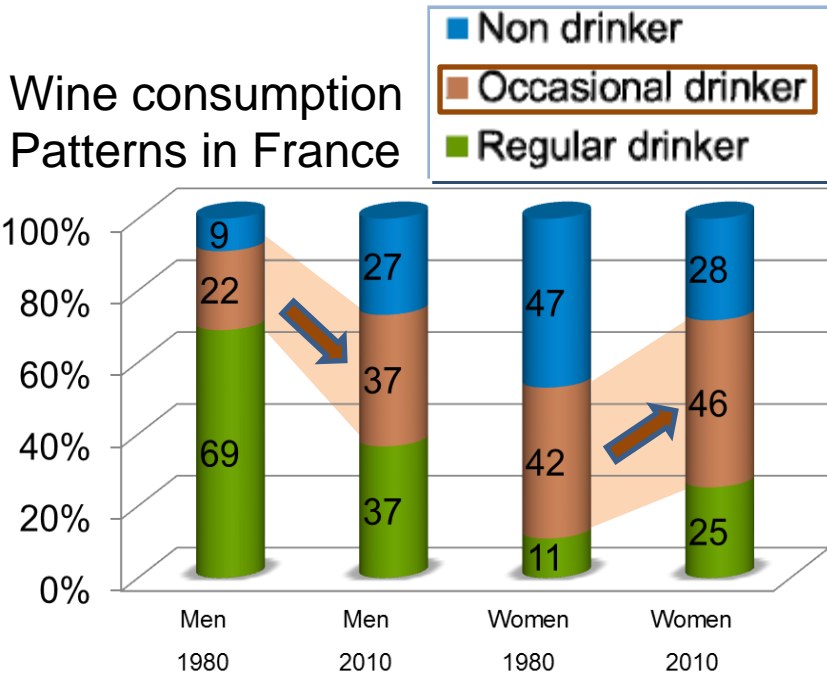


BIB Wine Shelf Life



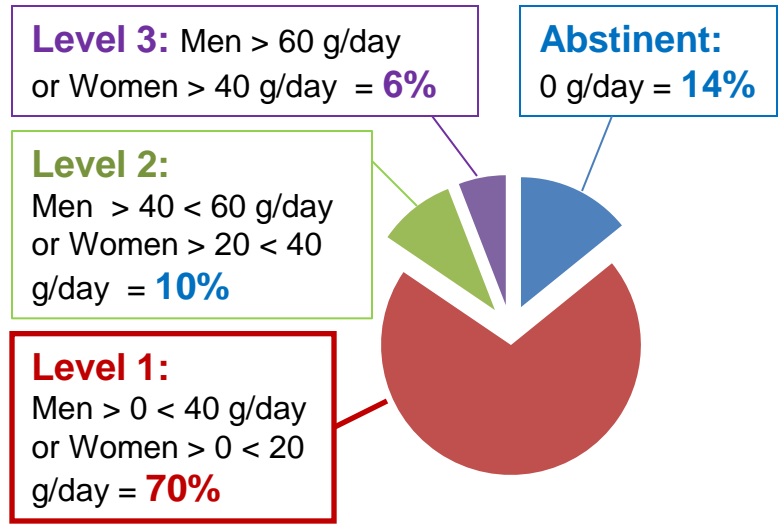
BIB and the wine consumer: The importance of the occasional wine consumer

In many countries we see a rise in the occasional wine consumer. In France, for example, we observe that although more women than men are occasional wine consumers, there is a rise in both as well as a tendency towards male/female consumption pattern convergence. In the European Union, 70% of adults can be described as drinking within Who (World Health Organization) category “Level 1”. This is the lowest level (beyond abstinence) for alcohol consumption.



Source: France Agrimer, 2011

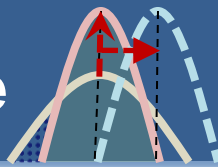
The % of adults (16+) at different drinking levels in the European Union (25 countries)



Source: “Alcohol in Europe”, P. Anderson & B. Baumberg, Institute of Alcohol Studies, European Commission, 2006



BIB Wine Shelf Life



BIB and the wine consumer: Why BIB wine stays fresh after opening?

As wine is poured from a filled BIB the flexible film collapses around the wine and **no air enters during the pouring process**. For most BIB taps, closure after use is automatic and the wine inside will **stay fresh for several weeks after opening**.

For this **unique feature** to work, it is necessary to have **Gravity** and a highly **flexible film**.

A BIB bag will work in a no-gravity environment but some pressure must be created for the wine to flow (for example by squeezing the bag) and this flow must be directed into the mouth. If the package is rigid (stiff) air must fill the void left as the wine pours out.

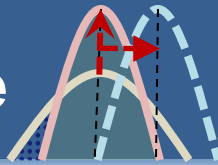


Force of gravity
pulling down on
flexible film





BIB Wine Shelf Life



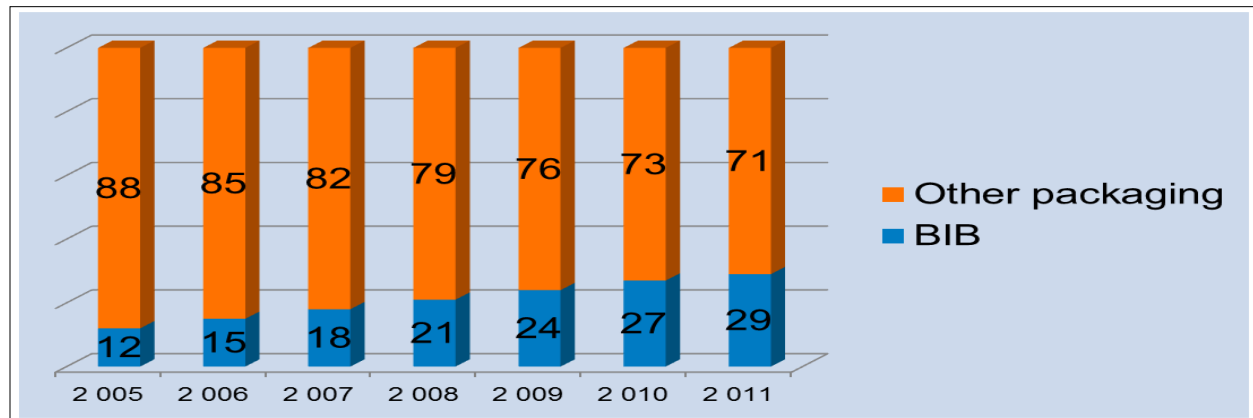
BIB and the wine consumer: Why use BIB?

Worldwide, there are over 2.4 billion litres of wine (> 650 million packages) filled in BIB each year. In many markets this is growing very rapidly. The average world growth is over 7% and BIB has already exceeded 10% of the world wine market.

The reasons for this success are multiple but generally it can be said that BIB:

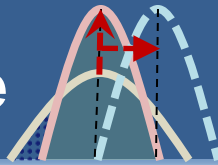
- has a very **low environmental impact** compared to many of the leading alternatives
- is **lightweight, practical, unbreakable, and easy to store and use.**
- increasingly offers a **wide range of wines** including many high quality appellation and varietal wines
- **keeps wine fresh for several weeks after opening the package and thus appeals to the occasional wine consumer that may seek to stay within reasonable limits.**

The graph to the right illustrate the growth of the sales of BIB wine in French supermarkets (Source: France Agrimer)





BIB Wine



Shelf Life



BIB and the wine consumer: How consumers know how much they have drunk?

Wine consumers may decide (for health or other reasons) that they wish to know how much they have drunk and not consume over a certain limit. This may be less than a glass a day or a half a bottle a day but in any case the **question arises as to how to measure this?**

The simplest answer would be to know how many cL is poured into the wine glass and use this as the measurement unit. This will vary but a medium size wine glass may be filled to about 12.5 cL and, in this case, a 75 cL bottle contains 6 glasses. The number of glasses consumed can be counted and drinking stopped at a pre-determined limit.

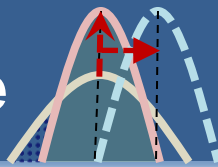
Other options for Bag-in-Box wine include:

- obtaining an estimation of volume consumed based upon **weighing the package** initially and stopping when the weight drops by a set number of g.
- having a **“window”** built into the side of the box with a measurement scale indicating volume consumed or a gauge built into the handle or elsewhere on the package.
- a high-tech **connector based direct flow meter or electronic pressure sensor** linked to the tap mechanism that indirectly calculates volume consumed. This could also estimate Blood Alcohol Concentration levels (based on volume, % alc., weight and sex).

We can expect that in the future better options will emerge for those consumers that are interested in knowing how much they have drunk.



BIB Wine

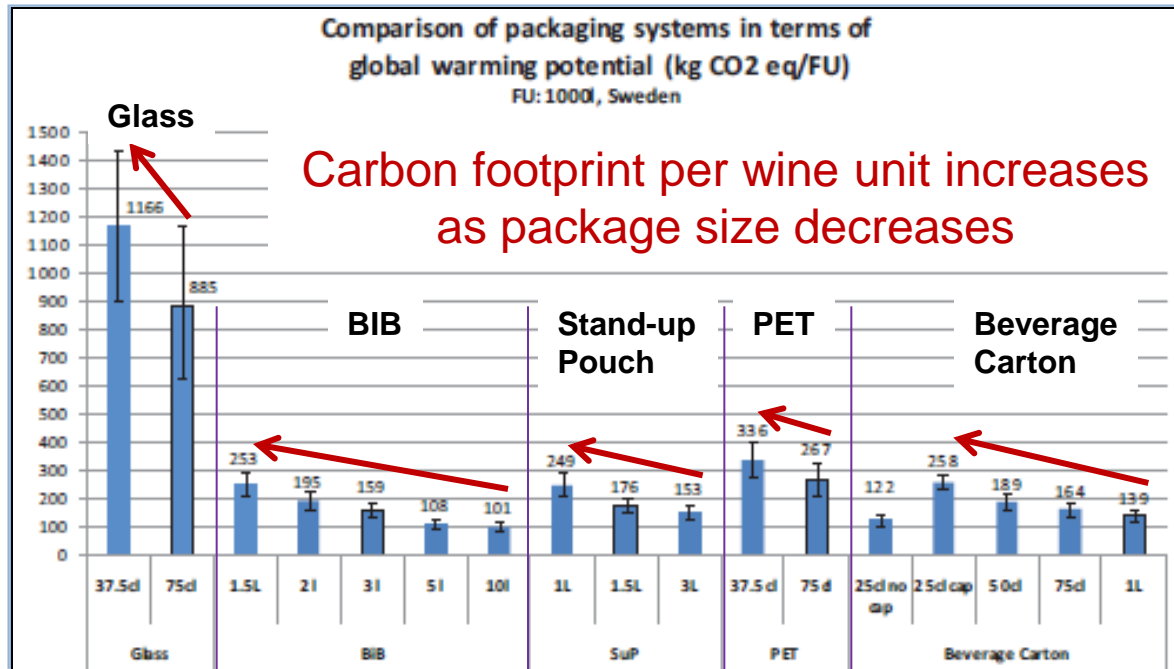


Shelf Life



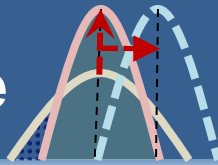
BIB and the wine consumer: Would smaller package size fit requirements?

We have seen that Bag-in-Box is well suited to the occasional wine consumer since drinking only a half a glass or few glasses a day will still keep the remaining wine fresh for a long time. It is also possible to promote **smaller package sizes** to meet per day or per use consumption requirements but this **adds to cost and environmental impact**. **Smaller packages also have a shorter total shelf-life** because per wine unit package oxygen ingress and headspace volume are greater.





BIB Wine



Shelf Life



BIB and the wine consumer: What about “Best by” dates?

A “Best by” (or “Best Before”) date indicates when a product is optimal to consume rather than a “Use by” date, which indicates when a product is safe to eat. For wine, a “Use by” date is never appropriate but the issue of “Best by” dates sometimes rises to the surface.

Is it reasonable to expect the typical filler to possess highly accurate shelf-life predictions at time of fill when trained scientists still currently cannot do this based upon the 7 key parameters described (regardless of the package) ?

Would the consumer be any better off with inaccurate shelf-life estimates (too high or too low) printed on the box versus simply having the entire supply chain insure (via good filling, storage, transport and traceability practices) that the wine stays fresh during its required shelf-life? As the “best by” date approaches would the wine consumer be stressed to finish the package and possibly drinking more than intended?

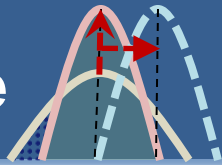
What other information could be printed on the BIB box to promote extended shelf-life (for example: “store at less than 23 °C”)?

What about the waste additional environmental impact generated by “Best by” dates? In the UK, the tendency is to move away from “Best by” dates to reduce the over 5 million tons of food that Britons throw away each year. “Use-by” dates will of course be kept, providing a clear guide to when food is no longer safe to eat and should be thrown away.





BIB Wine



Shelf Life



Conclusion

We have reviewed:

- BIB wine shelf life **goals** and **key parameters**.
- **alcohol consumption** and the **guidelines** for reasonable consumption
- the importance of the **occasional wine consumer** and how well the **BIB package is well adapted** to this group because the wine keep's fresh for a long time after opening.
- how consumers can **know how much they have drunk**
- the increased environmental impact and reduced shelf-life with **smaller package sizes**.
- the issue of about “**Best by**” **dates** relative to the quality of information, waste, environmental impact and other options.

No wine package is perfect and all offer some unique benefits. Fortunately for the consumer there are a wide range of choices.

