Recommended Procedures for Wine BIB Shelf-life studies

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Recommended Procedures for Wine BIB Shelf-life studies

Summary

1st Part: Wine Shelf-life
2nd Part: Protocol construction
3rd Part: Check-list

Conclusion

SO₂ mg/L

Total SO₂

Free SO₂

month
1st Part: Wine Shelf-life

1.1) Why this document?

Currently there would appear to be a lack of clear recommended procedures for defining and executing wine shelf-life studies.

Numerous studies conducted on the shelf-life of wines are not scientifically valid, often due to the lack of control of key variables or because the test conditions are not representative of reality.

This document is intended for anyone who would like to order, develop, conduct or evaluate a wine shelf-life study. Although the example of BIB (Bag-in-Box ®) packaging is often cited, the same recommendations apply to all types of packaging.
1.2) Definition of Wine Shelf-life

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

Determination of when a wine exceeds its shelf-life can be based upon both analytical and sensorial criteria.

The judgment of a wine will be more severe if several conditions must be met to “pass” the test, if professional tasters are used rather than typical consumers and if certain benchmarks (for example the same wine in a glass bottle) are used.
The starting point is generally date of fill and the end point when it is to be consumed.

If the chosen end point for the study is when the package is 1st opened (and not completely finished) then this should be stated.

The goal is to reach or exceed a target (example: average of 9 months) while minimizing variance.
1.3) Identify key shelf-life parameters

Those defining an experimental protocol should first understand the key determinates of packaged wine shelf life.

Depending upon study objectives, certain of these parameters are to be controlled (maintained constant) and others may be purposefully manipulated (explanatory variables) to determine the impact on shelf-life (response variables).

In some cases, a parameter may be controlled in beginning but may end up being tracked over time as a response variable.

Examples: Free SO₂, CO₂.
Key parameters may exhibit multiple causal links.

For example higher storage temperatures:
- Increase package $O_2$ permeability
- Diminish free $SO_2$ levels
- Increase microbiological risk, etc.

Sometimes there can be a trade-off between parameters.

If, for example, a producer of organic wines decides to lower levels of $SO_2$:
- Either accept a shorter shelf-life
- Or better master other parameters (such as $O_2$ or temperature) to compensate for the lack of $SO_2$.

If, at time of fill, the level of free $SO_2$ is maintained lower:

For example, 25 mg/L instead of 40 mg/L

It would be necessary to lower:

- Either $O_2$
- Or $SO_2$

In order to maintain the same shelf-life
The main shelf-life parameters are:

1.3.1) Characteristics of the wine before filling
Grape varieties, wine colour, alcohol level, acidity, initial dissolved O₂ and CO₂ levels, prior oxidative reactions, etc..

1.3.2) SO₂ Levels
The ideal initial level of free SO₂ to employ varies with wine pH, type of packaging, shelf-life target, microbiological risks, legislative limits, etc..
1.3.3) Microbiological control
A initially high population of microorganisms, a lack of adequate final filtration or insufficient cleaning (CIP) of the filler can result in off-tastes and bloated boxes as a result of excess CO₂ produced from the metabolism of the micro-organisms.

1.3.4) O₂ pick-up during filling
Because of its obvious role in oxidation, it is fundamental to measure and to minimize the change in dissolved O₂ in the wine as a result of filling as well as headspace O₂

1.3.5) O₂ permeability of the package
= True ingress of O₂ through a package filled with wine during several months of storage.
1.3.6) Use of oxygen scavengers
It is possible to add active molecules to the package intended to remove part of dissolved or headspace O₂.

1.3.7) Damage to the package
This parameter can influence O₂ Transmission Rate (OTR) as well as possible leakage of the liquid.

1.3.8) Temperature
An increase in temperature greatly reduces shelf-life.

1.3.9) Contaminants
Example on natural corks: TCA
➤ Risk of altering sensory characteristics of wine.
1.4) Shelf-life indicators

1.4.1) Chemical analysis

Although many chemical tests can be performed, for many food products, one indicator often stands out over the others.

For beer or soft drinks a key shelf-life indicator is often the loss of CO₂ (> x % loss means that the beverage is no longer acceptable).

For wine the key indicator generally is free SO₂. Free SO₂ is relatively easy to measure and compare and there is a threshold value under which the wine is generally no longer protected against oxidation.
1.4.2) Sensory evaluation

For shelf-life studies, sensory evaluation is essential because products can potentially “pass” the routine oenological tests and still be unsuitable for the market.

It is best to use a dedicated wine tasting room with well trained assessors and to set up a system of scoring and information processing so that the results can be easily analyzed and presented.

Sensory evaluation for wine is generally based upon appearance (colour, limpidity, etc), aroma and flavour and implies the correct use of wine descriptive terminology.
1.4.3) Microbiological testing

For many food products, this is the key shelf-life indicator (especially relative to Food Safety).

For wine this is also important but it is often takes a back-seat to other indicators because there are far more BIBs rejected because of oxidation than because of microbiological activity.
1.4.4) Physical testing
This could include, for example, weight and volume tests.

In the 2004 INRA Study for Performance BIB it was shown that BIB weight loss (due to water vapour escaping from inside the package) was a function of storage temperature.

At 15°C storage a BIB had a weigh loss of only about 1 g over a 6 month period but for every 1°C increase in storage temperature, the package lost approximately an additional 1 g.

Still this is not very much since even with a storage temperature of 25°C the weight loss was only about 0.3% of initial weight after 6 months.
1.5) “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 no longer safe to eat. For wine, a “Use by” date is never appropriate (wine past its optimal level presents no health risk).

Few countries have mandatory “Best by” dates printed on the BIB package. A few require a fill date on the package but leave a “Best by” date optional. Most countries have no requirements for wine but often require (as a result of labelling laws) to correctly indicate a minimum durability if one is provided and also to provide any special storage conditions (for example temperature) which need to be observed.
Depending upon the country and the product, there can be several shelf-life reference dates used with sanctions if the date has expired.

LEVEL OF THE SUPPLY CHAIN

REFERENCE DATE

NUMBER OF MONTHS AFTER FILLING

EXAMPLES OF SANCTIONS BY RETAILERS IF DATE HAS EXPIRED

Date of filling wine

0

3

6

9 months

Producer/Wholesaler-distributor

Retail stores

Consumer homes

Limit Date to be delivered to the retailer

Limit Date to be sold to the consumer

Best by Date

Delivery refusal, return to supplier

Return to supplier, destruction, sales

1st Part: Wine Shelf-life/ 1.5) “Best by” dates
The history of the wine before filling is an important determinate of shelf-life but this is often not even taken into account when a “Best by” date is fixed. We will take the example of bulk wine transport.

1st Part: Wine Shelf-life/1.5) “Best by” dates

REFERENCE DATE
EXAMPLE OF NUMBER OF MONTHS BEFORE FILLING
OXYDATIVE HISTORY OF THE WINE BEFORE FILLING

LEVEL OF THE SUPPLY CHAIN

Grape Production → Wine making → Wine Storage → Bulk wine Transport → Wine Storage

Date of grape harvest → Date wine is finished → Date wine sent in bulk → Date wine received in bulk

-6 -3 -2 -1 0

sulphiting sulphiting sulphiting sulphiting sulphiting

Oxidation/loss of free SO₂
Flexitank (24000 L) is a large BIB in a 20’ metal container instead of a box.

- As other BIB, it is best to minimise O₂ pickup (HS & DO) and the permeability of the bag.
- The fall of free SO₂ during transport bulk wine can be compensated by adding SO₂ before filling but the magnitude of the fall will affect the quality of the wine, its shelf life and the level of total SO₂.
Once a “Best by” date is set it becomes a contract between the wine supplier and its customer and implies acceptance of having the product rejected after this date. It can also imply that the supplier can justify the shelf-life claimed.

A “Best by” date might be reasonably fixed for a box of industrial pasta made with consistent ingredients and uniform processing but given the highly variable nature of wine and the many parameters that influence shelf-life (before, during and after filling), it is extremely difficult for even trained scientists to estimate wine shelf-life.
1st Part: Wine Shelf-life/ 1.5) “Best by” dates

To avoid discriminatory practices one would expect an indication of minimum durability (if obligatory) to apply to all wine packages.

But what “Best by” date should be given for a 2012 Chateau Lafite and should the wine be thrown away when it has exceeded the recommended date limit?

Because of the waste generated by “Best by” date, some countries are considering retaining only “Use-by” - providing a clear guide to when food is no longer good to eat.

Although some retailers relay on « Best by » dates for traceability and stock management, the date and hour of fill (codified or not) could also serve these purposes.
Would the consumer be any better off with:

- inaccurate BIB shelf-life dates estimates (too high or too low) printed on the box?

or

- a situation where the entire supply chain insures (via good filling, storage and transport practices) that the wine stays fresh until it arrives on the table of the consumer?

Regardless of whether or not a “Best by” date printed on the package it would seem appropriate to add an indication of recommended storage temperature (for example store at less than 23°C) because of the strong reduction of shelf-life due to high storage temperatures.
2nd part: protocol construction

2.1) Why this part?

Not easy to produce a good protocol.

Establish protocol by external or internal scientists.

Rigorous and thoughtful protocol building

⇒ Yields results that will not be doubted

Without offering an exhaustive list, the protocol should take into account the recommendations described in this part.
2.2) Declare study objectives and intended use

Clearly formulate study objectives
Examples: test & evaluate new package or new technology.
Compare relative to the current option (to see if an alternative solution would be worth adopting).

State the intended use: internal or for a wider public
If the study is to be used for marketing purposes ➔ the scientific requirements should be higher so as to meet eventual criticism from the competition.
Example of study objectives:

- Measure impact on shelf-life of various film options.

- Determine influence of headspace volume or % O₂ on shelf life

- Optimize inert gas (such as Nitrogen) flushing settings on a BIB filling machine.
2.3) Explanatory variables to be modified

These are explanatory variables that are to be intentionally manipulated so as to measure their influence on specific response variables chosen to indicate wine quality.

An explanatory variable will be assigned large enough differences in interval levels so as to provoke noticeable differences in the response variables.

Example: For storage temperature, it is better to assign intervals of at least 5°C between levels than 1°C

When the explanatory variable levels are set, the means must then be provided to reach these target levels and reduce variance.
If there are 3 explanatory variables with 2 different levels set for each, this results in 8 distinct tests (= 2 x 2 x 2 = 8)

Table 1: Example of a well balanced experimental plan on a wine to be filled in BIB

Limit the number of tests (example: get rid of tests 3 and 7)
2.4) Keep as constant as possible the other parameters

Parameters other than those to be intentionally modified (the explanatory variables)

- Examples of parameters that may be kept constant:
  - **Packaging materials** (film, tap, box)
  - **Wine** ($O_2$, $CO_2$, $SO_2$, colour, acidity, microbiological stability, etc.)
  - **Filling** ($O_2$, Vol. Headspace & wine, inert gas settings, etc.)
  - **Transport** conditions (duration, temperature, humidity, vibrations, etc.)
  - **Storage conditions** (temperature, humidity, light, etc.)

It is important to know the normal expected variation of these parameters.
2.5) Approach reality

Reproduce as much as possible the reality of the operational steps all along the wine supply chain.

Avoid, for example, to keep samples at 10°C if the wine to be sold is stored at room temperature.

If the wine in the real world is to be subjected to 8 hours road transport and 1 month of maritime transport this should be reflected, if possible, in the protocol.

Even if real transport is to be preferred, often a compromise must be reached, but in this case, any simulated transport conditions should be described and justified.
Avoid high storage temperatures (for example ≥ 35°C) intended to accelerate results and shorten study duration.

⇒ Generally it is difficult to prove that the extrapolated conclusions would have been the same had more realistic conditions been adopted.

To be preferred:

Real supply chain circuits and storage temperatures (example: ≈ 20°C)

The storage position of the BIBs could potentially affect O₂ ingress.
⇒ BIBs are normally stored with the tap on the bottom.
If packaging is to be selected for a future study fill run, preferably:

- use the same packaging production lot numbers
- know the normal variances expected with this packaging.

If the filling has already taken place and this was not done:

- At least make an effort to make sure that the package samples are representative.

Note the lot numbers and other relevant information that may prove to be useful in interpreting study results.
2.7) Filling BIBs for the study

This requires a great deal of preparation

➤ Know and note (prior to the study) the characteristics and performance levels of the filling line (circuits, wine flushing vol., attainable headspace volume, O₂ pick-up, filtration & filling technology, inert gas flushing options, etc.)

Make sure that the wine will not be unintentionally modified during the study run

➤ Particularly levels of O₂, CO₂, SO₂.
2.8) Choice of the wine

A highly oxygen sensitive white wine (for example a young Sauvignon Blanc) is often a good choice
- because its more rapid oxidation tends to generate more clearly delineated differences in less time compared to many red wines.

This choice is not however always possible or desirable.

In any event it is important that the wine selected not already be even somewhat oxidized
- because it would then be difficult to differentiate between those oxidative characteristics already in the wine and those induced by the choice of the packaging or another explanatory variable.
If the wine = an explanatory variable (to be modified)

⇒ Include this in the experimental plan.
1 level = 1 specific wine.

If the wine = a parameter to be kept constant

⇒ 1 wine must remain the same for all the tests.

The great heterogeneity of wines = the principal reason why it is difficult to generalize based upon a given shelf life study.

Grape varieties, appellations, years, winemaking techniques, marketing channels, etc. variations

⇒ Extrapolation to other BIB wines must always proceed with caution.
2.9) Control Total O₂ (headspace and dissolved O₂)

Set target levels for dissolved O₂ and headspace O₂ since this will have an important impact on SO₂, aromas, colour ➔ Shelf-life.

➔ Know the O₂ performances of the filling line, preferably by a preliminary audit.

➔ Determine if the O₂ results of the audit are compatible with study objectives and experimental plan.

Prior to taking samples for the actual study, indicate in the protocol clearly what needs to be done (see checklist in part 3).
Sample preparation, the calibration of instruments and measurements should be performed by experienced technicians (not by novices).

For shelf-life studies, aim at an instrument accuracy of 0.1 mg/L for dissolved $O_2$ and 0.3% for headspace $O_2$.

A knowledge of the uncertainty of the methods is useful for interpretation of discrepancies in the results.

Reminder: maintain the recommended stabilisation time for dissolved $O_2$ when using optical technology.

For a reference document on the methods of measuring total oxygen in filled BIBs, see http://www.b-i-b.com/bib/web/downloads/7O2SheaVidalVialisPerfBIB29nov2010EN2.pdf
When many O$_2$ measurements must be taken with optical instruments (using spots glued inside a transparent tap), it is not always possible to do so sequentially (finish a test before starting another) because it takes at least 15 minutes to stabilize the signal for dissolved O$_2$.

In this case, measure headspace O$_2$ first for each sample, then place the sample in a storage rack (with tap + spot down) with the other samples. Finally measure the dissolved O$_2$ for each sample as it approaches its stabilization time.

This saves time without stopping the filling (frequent stops on the chain being important sources of error).
The important fall of free SO₂ in the 1ˢᵗ month is mainly due to the total amount of oxygen trapped in the packaging.

Subsequently, the amount of O₂ available to the wine will depend very much on the O₂ permeability of the package but often the level of free SO₂ at 1 month correlates well with 9 and 12 months. It is therefore recommended to monitor SO₂ levels at 1 month in the experimental protocol, because it will help better predict how long the wine will remain protected by free SO₂ and thus estimate its shelf life.
Examples of the importance of Total $O_2$:

**Sauvignon Blanc, 75 cL glass bottle** (storage 17 °C) with **6.26 mg/bottle Total $O_2$** (headspace + DO) when bottled, lost 44% of its free $SO_2$ after one month, while for the bottles with only **1.75 mg/bottle of Total $O_2$**, the loss of free $SO_2$ was only 12% \(^{(1)}\).

**Chardonnay, 3L BIB** (storage 20 °C) with **6.30 mg/L Total $O_2$** when packed, lost 35% of its free $SO_2$ after one month, while for BIBs with only **3.14 mg/L of Total $O_2$** lost only 19% of free $SO_2$ \(^{(2)}\).

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Changes in Total O₂ and Free SO₂, Sauvignon Blanc, 75 cl glass bottle

Bottles 1 = Initial Total O₂ (headspace + DO) = 6.26 mg/bottle
Bottles 2 = Initial Total O₂ (headspace + DO) = 1.75 mg/bottle

Wine in Bottles 1 no longer protected after 9 months.
2.10) Set SO₂ levels in the protocol

Initial free SO₂ for BIB wines are often 35 to 55 mg/L.

Levels are a function of the O₂ sensitivity of the wine.

Free SO₂ are often 10 to 15 mg/L higher for BIB than for wine in glass bottles.

Tendency to reduce levels in BIB (thanks to a decrease in total O₂ after filling, lower storage temperatures, etc.) and some day this may reach the same levels as for wine glass bottles but the differences between packages currently exist and should be taken into account in the protocol.

Of course, sometimes initial free SO₂ levels are deliberately set lower in the experimental protocol (organic wines, active packaging alternatives, etc).
2.11) Measure and compare wine quality

Part 1 provided several indicators of wine quality (physicochemical, sensory, microbiological). It is important to define in advance the criteria upon which judgments about the wine will be made.

In the 1st instance, the experimenter can rely on the commonly accepted threshold of 10 mg/L of free SO₂ below which the wine is insufficiently protected. To this we can add colour ($A_{420}$, $A_{520}$, CIE L*a*b*), and the levels of volatile compounds (esters, higher alcohols, thiols, etc.).
Sensory analysis is also an important evaluation tool. The protocol must identify the objectives and operating conditions (service order, black or white glass, professional or amateur judges, descriptive analysis or tripartite test, etc.).

The definition of a benchmark such as wine in a glass bottle or in BIB stored at 5 °C often lends sensible support to the physicochemical and sensory evaluation.
2.12) Setting the time horizon in the experimental protocol

If several types of package types are to be evaluated, it is advisable to select a time horizon that takes into account the distribution requirements for each type of packaging. For example, for the BIB wine these requirements rarely exceed 8 to 10 months (exceptionally up to 1 year), while for some glass bottles to be stored in a cellar for aging, several years may be necessary.

This implies that several study time horizons might be adopted if several types of packaging are involved. In this case however, a comparison between two packages with different life expectancies should be based only the shortest duration (9 months, for example, if comparing glass bottle to BIB).
2.13) Defining sample size

Normally sample size is dependent upon the expected variance of the underlying population (the bigger the variance the bigger the sample size). Often however this variance is not well known in advance and also for reasons of cost, the sample size will sometimes not be large enough to be entirely statistically valid, but the study can nevertheless produce useful results.

The simplified rule of thumb is to have at least 3 samples for each specific test and for each date of analysis.
2.14) Experimental protocol simulation

To avoid oversights, it is recommended to use a spreadsheet that lists all the explanatory variables, types of analysis and dates to determine the number of samples in the study.

Table 2 (next page) presents an example of a study with five evaluation dates, a need for 3 samples (repetitions) for each analytical test (O₂, CO₂, SO₂, colour) and 2 samples (repetitions) for the sensory evaluation.

From the spreadsheet used to create the experimental design, it is sometimes useful to simulate results to verify that the protocol addresses the right questions.
2\textsuperscript{nd} part: protocol construction/ 2.14) Experimental protocol simulation

Table 2: Example of an experimental plan with the number of BIB required.

<table>
<thead>
<tr>
<th>Experimental plan</th>
<th>BIB (\textsuperscript{1}) Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Film</strong></td>
<td><strong>Total O\textsubscript{2}</strong></td>
</tr>
<tr>
<td>1</td>
<td>High</td>
</tr>
<tr>
<td>1</td>
<td>Low</td>
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<tr>
<td>1</td>
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<tr>
<td>2</td>
<td>Low</td>
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</tbody>
</table>

(\textsuperscript{1}) In this example, when 5 samples are listed, 3 are for the wine analysis and 2 are for the sensorial evaluation.
(\textsuperscript{2}) At T0, the wine has not yet changed and the sensorial and colour evaluation could be performed within the same test unit.
2.15) Human resources in the experimental protocol

It is recommended to clearly indicate the names, qualifications and experience of those who develop the protocol and those who take conduct filling and measurements. A precise definition of tasks by all stakeholders serves to reduce errors and misunderstandings.

It is preferable for the accuracy and reproducibility of measurements that the analyzes are performed by the most qualified people available and whenever possible, always by the same people.
3rd Part: Check-list

Why a check-list?

In the same way that a packing list before leaving on holiday helps you think of everything, this check-list will allow you to begin a shelf-life study without forgetting something important.
3.1) Why do this study?

**What do I want to know?**

- **Objective of this phase**: Develop the goals of the study

- **Method**: Define a short list of questions that the study is to answer

**Examples:**

- What is the impact on shelf-life of changing $O_2$ levels introduced during filling?

- Will packaging choice A provide a longer shelf-life than packaging choice B?

- What is the “normal” shelf life of a BIB merlot wine filled on a manual filling line in a small winery under “typical” conditions of filling and storage?

- Will changing the filling machine settings for $N_2$ injection have an impact on shelf-life?
How am I going to conduct the study? What material do I need? What measurements must be taken?

✓ **Objective of this phase**: Make a list of everything needed to carry out the study.
3.2.1) Package Specifications

- BIB Volume: 1.5 L, 2 L, 2.25 L, 3 L, 4L, 5L, 10 L
- Type of BIB film (pet met, coex evoh, etc) with indication of OTR (& test method)
- Type of BIB tap with indication of OTR (& test method)
- Type of BIB Box (type of printing, type of cardboard)
- Type of BIB Handle
- Specification of BIB bags (traceability codes, etc.)
- Procedure used to obtain samples for the study.
- Description of other benchmark packages (for example 75 cL bottle with type of closure)
- Other (for example with or without O₂ scavengers)
3.2.2) **Spécifications sur vin au départ dans la cuve de remplissage**

- Description of the preparation of the wine and analysis conducted
- Stability of winemaking parameters & prior oxidative history of wine.
- Appellation and/or grape varieties
- Sensorial evaluation (color, aromas, taste)
- Target level of initial DO
  (for example < 0.5 mg/L)
- Target level of initial CO₂ (for example 400 mg/L)
- Target level of initial SO₂ (for example 45 mg/L free and < 90 mg/L total)
- Target levels of pH, volatile acidity etc.
- Target Microbiological levels, further filtration requirements
- Description of other benchmark solutions if used (for example 14% vol., 3.2 pH, etc.)
3.2.3) **Target Temperatures before and during filling**
- Target temperature of wine filled (for example 8 °C)
- Target temperature of filling plant (for example 23 °C)
- Description of temperature recording process.

3.2.4) **Specification of Filtration technology**
- Model of unit
- Target Level of intermediate filtration (example: tangential filtration at 0.8 µm)
- Target Level of final filtration (example: 0.45 µm)
- Specification relative to O₂ pickup during filtration: is final filtration unit to be flushed with inert gas before start-up?
- Specification relative to the cleaning or changing of filters.
3.2.5) Specification of transport or agitation

✓ Description of agitation during the taking of samples
✓ Transport conditions: including avoiding unwanted movement of samples, type of transport, etc.

3.2.6) Specification of storage conditions for samples

✓ Where are samples to be stored? (at filling centre with sampling conducted on site or at lab conducting the analysis).
✓ How long are samples to be kept after the end of study? (for example end of study + 1 month)
✓ Unless it is a study objective, the samples should not be stored in a contaminated storage area (free from paints, solvents, cleaning products, etc.).
3rd part: Check-list / 3.2) Work methods and materials

- Target temperatures for storage (for example 15°C, 20°C, 25°C)
- Acceptable temperature variations during storage (for example + or – 1°C)
- Description of temperature recording process.
- Target humidity levels. Although this should be recorded, it is often not a parameter kept constant.
- Description of measures taken to protect the samples from theft or tampering.
- Other indications
3.2.7) Specification of damage to bag during filling

✓ BIB bags filled should be visually examined prior to test to make sure that the filling and packing technology does not inflict undue damage that will potentially have an important impact on study results (unless the impact of this damage is an objective of the study).

✓ The filling centre should provide an estimation of the known BIB leaker rate due to the filling and packing process since the leakers will eliminate or damage study samples. Depending upon the anticipated leaker rate the number of samples may have to be modified or else another filling line used to conduct the study.
3.2.8) Specification of Filling technology

- Model of machine & degree of automation
- Vacuum (“on” or “off” + settings if on)
- N₂ flushing of gland (“on” or “off” + settings if “on”)
- N₂ flushing in tap (“on” or “off” + settings if “on”)
- Inert gas in buffer tank & flushing of wine circuits
- Line speed
- Technology used to place the bag in the box
- Description of cleaning (CIP) procedure to be used on filling machine

3.2.9) Spécifications sur le niveau d’homogénéité lors du tirage

- Must the samples be as homogeneous as possible? If so, avoid the beginning and end of the filling run.
- Volume of BIB wine filled (or wine flushing of circuits) before any samples for measurement are taken (for example 100 L)
- Quantity of wine to remain in filling tank (and/or buffer tank) when final samples are taken for measurement.
3.2.10) Target Measurements right after filling

- Target dissolved O$_2$ in wine after filling (for example < 1.5mg/L)
- Target Headspace volume (for example < 60 mL)
- Target Headspace % of O$_2$ (for example < 10%)
- Target Microbiological levels
- Target volume of wine (nominal volume + or – 1.5%)
- Description of how measurements are to be taken
3.2.11) Determination of measurement types and frequency

Types of measurement & methods and materials required
✓ Chemical analysis: O2, SO2, CO2, Acidity, etc.
✓ Sensory evaluation based upon appearance, aroma and flavour
✓ Microbiological testing (identification of types, count, etc.)
✓ Physical testing (weight, volume, etc.)
✓ Measurements of dissolved O2 and headspace O2 (volume and % O2)
✓ Those sampling and conducting measurements should have a minimum of 2 BIB Cone Meters & an optical or electro-chemical O2 measurement instrument (indicate brand and precision).
3rd part: Check-list / 3.2) Work methods and materials

**Frequency of measurements**
✓ For example the day of fill, at 3 days, 7 days, 14 days, 30 days, 60 days, 90 days, 120 days, 180 days, 360 days.

✓ **Transport used to get the samples to a laboratory**

**Experimental plan**
✓ List of parameters to modify (explanatory variables)
✓ Target levels for each parameter
✓ Number of repetitions (number of BIBs analysed for each distinct test)
→ From this it is possible to construct the protocol.

✓ Requirements in terms of the number of litres of wine, the number of BIB bags or boxes required, etc.
3.2.12) Labelling of samples

- Samples must be clearly identified with an easy to understand code.
- Food grade adhesive labels should be printed before the study fill run or else use a simple bar code generators and reader.
- Labels placed on the outside of boxes once they have been filled.
- The person conducting the measurements must insure that the bag always goes back into the same box.
- If the bag is also identified a small label can be placed on the outside seam (after the weld) so as to not interfere with the barrier film.
- If a permanent marker is used it should be (NSF or equivalent) food grade and marking are also to be made on the outside seam.
- In all cases, verify that the system of labeling or marking will resist for the entire length of the study.
3.2.13) **Specification of position of tap during storage**
- Tap in bottom of box (full contact of wine with inner part of closure) or top of box (possibility or headspace in contact with inner part of closure).

3.2.14) **Freshly opened BIB or not for each measurement**
- BIBs freshly opened each time or progressively emptying the same BIB
- If progressively emptied, the amount poured each time and the amount remaining

3.2.15) **People**
- Names, Qualifications & Experience of those writing the protocol, those conducting the measurements and those writing the results and conclusions
3rd part: Check-list / 3.2) Work methods and materials

3.2.16) Other equipment and materials that must be supplied for the study

For example, by the filling centre: 2 large, clean tables, 2 chairs, good lighting, 220 V electricity, etc.

Measurement instruments and means of transport to the lab.
3.3) Establish calendar with deliverables

- Agreeing on a final protocol often takes a very long time but it is better than producing study results that are meaningless because the protocol overlooked very important parameters.
- Progress reports may or may not be specified.
- It is best to build in a margin of safety since shelf life studies are notorious for taking longer than originally anticipated.
3.4) Estimate study costs

✓ Costs may include internal costs and external costs but most firms only expect estimated of external costs. This includes the cost of the wine & packaging used as well as all external services. Generally outside lab costs are based upon the specific number and type of tests.

✓ If the firm for who the study is to be performed does not have the resources to manage the shelf life study then an outside manager will have to be brought in.

✓ This outside service provider can, in addition to managing the shelf-life study, train the firm’s own staff so as to develop future in-house shelf life testing and evaluation capacity.
3rd part: Check-list / 3.5) Write up results and conclusions

3.5) Write up results and conclusions

✓ Check that conclusions based up the results.
✓ Provide full protocol details so that experimentation can be repeatable.
✓ Project shortcomings should also be indicated in the study report, including those linked to the protocol or its execution.
✓ If the study is to published and make commercial claims, it should be subject to the critical scrutiny of experts in the specific study area.
✓ Project sponsors should be stated.
✓ If an outside research center/lab is used, normally it should be they who write the conclusions rather than the project sponsor.
Conclusion: Think before you act

To define and conduct tests wine storage, we must first identify the key variables that influence shelf life as well as the primary chemical, sensory, microbiological and physical indicators to be used for the study.

The application of good practices to better satisfy the consumer is always to be encouraged, but it is often difficult to accurately predict the true shelf life of a BIB wine (or other type of package) because of the multitude and complexity of the parameters and especially the heterogeneity of the product. Under these conditions, indicating uniform “Best by...” dates seems difficult to justify on scientific grounds.
Conclusion: Think before you act

Much prior thought must go into the construction and the execution of a good protocol.

With the application of these recommendations, results will be more reliable and can be used to better prepare the wine and improve filling & packaging technology as well as storage and distribution practices.

Long life to wine in BIB!
Thanks!

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