1984

Wine making in small quantities

P.B. Gherardi

Follow this and additional works at: https://researchlibrary.agric.wa.gov.au/bulletins

Part of the Food Processing Commons

Recommended Citation

IMPORTANT DISCLAIMER

This document has been obtained from DAFWA's research library website (researchlibrary.agric.wa.gov.au) which hosts DAFWA's archival research publications. Although reasonable care was taken to make the information in the document accurate at the time it was first published, DAFWA does not make any representations or warranties about its accuracy, reliability, currency, completeness or suitability for any particular purpose. It may be out of date, inaccurate or misleading or conflict with current laws, polices or practices. DAFWA has not reviewed or revised the information before making the document available from its research library website. Before using the information, you should carefully evaluate its accuracy, currency, completeness and relevance for your purposes. We recommend you also search for more recent information on DAFWA's research library website, DAFWA's main website (https://www.agric.wa.gov.au) and other appropriate websites and sources.

Information in, or referred to in, documents on DAFWA's research library website is not tailored to the circumstances of individual farms, people or businesses, and does not constitute legal, business, scientific, agricultural or farm management advice. We recommend before making any significant decisions, you obtain advice from appropriate professionals who have taken into account your individual circumstances and objectives.

The Chief Executive Officer of the Department of Agriculture and Food and the State of Western Australia and their employees and agents (collectively and individually referred to below as DAFWA) accept no liability whatsoever, by reason of negligence or otherwise, arising from any use or release of information in, or referred to in, this document, or any error, inaccuracy or omission in the information.
Wine making in small quantities

By P. B. Gherardi, Viticulturist, Department of Agriculture

This publication aims to guide the amateur wine maker producing small quantities of wine from fresh grapes. It does not explain the changes that occur when grape juice is fermented into wine, nor does it discuss the technology required to make commercial quantities of wine.

Types of wine

White table wines may be dry, medium dry or sweet, depending on the level of residual sugar, plus contain about 12 per cent by volume of alcohol. They are usually pale yellow with a green tinge, light in body (resulting from less extraction and lower alcohol) and with a delicate flavour. Muscadelle, Chenin Blanc, Muscat Gordo Blanco, Semillon, Verdelho, Riesling and Chardonnay are some grape varieties used for white wine production in Western Australia. Dry red table wines are usually medium to full bodied (more extracted and slightly higher in alcohol), with the colour ranging from dark red with tinges of purple in newly-made wines through to brick red in older wines. The longer the skins are left in contact with the fermenting juice, the darker the resulting wine. The alcohol content of red wines is about 12 per cent by volume, however, some may reach 14 per cent when very ripe fruit is used.

Red wines should be aged in a cask or bottle to soften and mellow before drinking. In Western Australia the grape varieties most commonly used for making red wine are Cabernet Sauvignon, Shiraz, Malbec and Grenache.

Table grape varieties are not recommended for wine making because they lack the intensity of flavour required in wine.

Sugar measurement

The sugar content of grape juice can be easily measured using a Baume hydrometer. This instrument measures the specific gravity of the juice. The higher the specific gravity, the higher the sugar content. Two scales are commonly used: degree Baume and degree Brix.

One degree Baume of sugar when fermented yields about 1 per cent alcohol by volume. Thus a juice of 12° Baume will yield a wine of about 12 per cent alcohol by volume.

One degree Brix represents one gram of sugar per 100 millilitres of juice or 10 grams per litre. Thus a juice measuring 20° Brix contains 200 grams of sugar per litre.

One degree Baume equals 1.8° Brix (Figure 1).

Baume is easily measured by floating the hydrometer in the juice and reading the value at the bottom of the meniscus. This is the easiest method for the amateur wine maker. Brix is usually measured using a refractometer, which is a much more expensive instrument often used by commercial wine makers.

As grapes ripen, the sugar level rises and the acid level falls. Picking time is often determined by the balance of sugar and acid. If the grapes are picked too early, the resulting wine may lack flavour, be light in body and have excessive acidity.

<table>
<thead>
<tr>
<th>Baume</th>
<th>Brix</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>25.2</td>
</tr>
<tr>
<td>13</td>
<td>23.4</td>
</tr>
<tr>
<td>12</td>
<td>21.6</td>
</tr>
<tr>
<td>11</td>
<td>19.8</td>
</tr>
<tr>
<td>10</td>
<td>18.0</td>
</tr>
<tr>
<td>9</td>
<td>16.2</td>
</tr>
<tr>
<td>8</td>
<td>14.4</td>
</tr>
<tr>
<td>7</td>
<td>12.6</td>
</tr>
<tr>
<td>6</td>
<td>10.8</td>
</tr>
<tr>
<td>5</td>
<td>9.0</td>
</tr>
<tr>
<td>4</td>
<td>7.2</td>
</tr>
<tr>
<td>3</td>
<td>5.4</td>
</tr>
<tr>
<td>2</td>
<td>3.6</td>
</tr>
<tr>
<td>1</td>
<td>1.8</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Figure 1. The relationship between Baume and Brix readings and levels commonly found in grape juice.
If picked too late, the resulting wine will be higher in alcohol and full-bodied, but may lack acidity and fresh flavour.

Picking time greatly affects the style of the wine produced. If a lighter style is desired the grapes should be picked earlier (for example, 11° to 12° Baumé and 7.0g/L of acid). For fuller flavoured wines the grapes should ripen to 12° to 13° Baumé with 6 to 7g/L of acid. In this instance it may be necessary to add acid to achieve this level. Tartaric acid, a natural grape acid, should be used.

The Department of Agriculture’s Viticulture Laboratory in Jarrah Road, South Perth, can test the sugar and acid levels in grape juice. There is a small charge for this service.

Yeast

A vigorous wine yeast is an essential ingredient for producing sound wine. Without yeast, fermentation cannot take place. While it is possible to permit a natural fermentation to occur through the activity of wild yeast found on the fruit, it is preferable to use a specially prepared yeast starter culture.

Wild yeast often produces unwanted flavours and odours, whereas selected wine yeast produces an active fermentation which rarely leads to off flavours or odours. Selected yeast also ensures that the fermentation starts quickly and is maintained through to completion. It is not advisable to use baking yeast for wine making.

Yeast comes in two forms.

Dried yeast

Dried yeast is usually a pure wine yeast culture and is the most convenient form for the amateur wine maker. The yeast is easily reactivated, usually in warm water or juice, and is used at the rate of about 10 to 20g/100L of juice. It is available from most brewing suppliers.

Liquid yeast

Liquid yeast is usually available as an actively fermenting pure culture.

The culture must be made up to a volume representing 3 to 5 per cent of the quantity of the juice to be fermented. Strict quality control is required during this process to prevent contamination by wild yeast, often a problem for the amateur wine maker.

Sulphur dioxide

Sulphur dioxide is used in wine making to prevent the growth of moulds, bacteria and wild yeast; it also inhibits oxidation of wines. The most common source of sulphur dioxide is sodium metabisulphite or potassium metabisulphite. It is available from brewing suppliers, pharmacists and chemical supply houses.

Sodium and potassium metabisulphite are sold as white crystalline powders. They should be stored in airtight containers to retain their sulphur dioxide.

To add 100 parts per million (ppm) of sulphur dioxide to 10 L of juice or wine, the following quantities are required:

- Sodium metabisulphite (S.M.S.): 1.50 g.
- Potassium metabisulphite (P.M.S.): 1.73 g.

Containers, equipment and sanitation

A range of open and closed containers is available to the amateur wine maker. Any equipment made of lead, brass, copper, tin or zinc should be avoided as these materials can result in the formation of hazes (cloudiness) and off flavours in wine.

Containers made from glass, stainless steel, food grade fibreglass or epoxy or wax-lined concrete should be used. Some plastics (such as polypropylene) may be used for the initial fermentation, but few can be used for storage or ageing the finished wine. If the plastic container has any odour, it is likely to be absorbed by the alcohol in the wine and cause a taint.
Clean equipment is essential to prevent contamination of the wine. All equipment used during the wine making process should be cleaned with either hot water (at 80°C), a strong (600 to 800 ppm) metabisulphite solution, or an approved disinfectant. Do not use soaps or detergents.

During the initial stage of fermentation, when the action is vigorous, open containers can be used. In red wine production where the first half of the fermentation occurs in contact with the skins, an open fermenter allows the skins and pulp to be removed easily. These containers may be covered with finely meshed cheesecloth, canvas or a loose-fitting wooden cover to exclude debris or insects.

For white wine production, where the skins are separated from the juice after crushing, it is best to ferment the juice in a closed container with a small opening, for example a small stainless steel tank, glass jar or demijohn. Where possible the opening should be closed with a fermentation lock. This allows the carbon dioxide gas to escape from the fermentation and prevents air from entering. Locks can be purchased at all brewing suppliers. It is possible to make an air lock by passing a plastic tube through a rubber stopper into the container, with the outer end submerged in a metabisulphite solution.

When old wooden casks are to be used for storing wine they must be thoroughly clean. They must not smell acetic (of vinegar), musty or mouldy as these aromas will be readily transferred to the wine. The casks should be thoroughly rinsed with hot washing soda (1 per cent sodium carbonate) and clean water (preferably containing 600 to 800 ppm metabisulphite) before use.

**Making white wines**

**Grapes**

The grapes selected should be sound (that is not damaged by insects, birds or mould) and should contain the desired sugar level for the style of wine to be made.

As a guide, five kilograms of fresh grapes will yield about four 750 ml bottles of wine.

**Crushing**

Roller crushers can be used to crush large quantities of grapes. For small lots the wringer on an old washing machine, or even hands or feet, are satisfactory.

Sulphur dioxide should be added at crushing to prevent the growth of moulds, bacteria and wild yeast.

For sound (undamaged) grapes, add 75 to 100 ppm metabisulphite (about 1.2 to 1.5 g/10kg of grapes); to unsound (damaged) grapes add 120 to 150 ppm metabisulphite (about 1.7 to 2.1 g/10kg of grapes). This will kill the wild yeast and prevent serious oxidation of the juice.

**Draining and pressing**

In white wine production the aim of draining and pressing is to separate the juice from skins, stalks and seeds. If the juice is left in contact with the skins for too long before or during fermentation, the resulting wine may taste coarse or even bitter.

This step is often difficult for the small-scale wine maker owing to a lack of suitable equipment. Small grape presses are available commercially, although stainless steel screens or coarse muslin cloth are suitable.
Juice clarification

The juice from freshly crushed white grapes is cloudy because of the macerated pulp. This juice should be clarified before fermentation otherwise a coarse wine may result.

The most common clarification method is settling, preferably at low temperatures. This can be achieved by leaving the juice in a cold room or refrigerator. The temperature of the juice should be lowered to 5° to 10° C for about 24 hours and the clear juice should be siphoned off into the fermentation vessel. By using a clear plastic hose for siphoning, the juice can be seen, thus avoiding the transfer of any sediment. The container should not be too full, to allow for the vigour of fermentation.

Fermentation

Once the settled juice has warmed to 15° C, fermentation can start. The prepared yeast starter culture is introduced at a rate of 3 to 5 per cent of the volume of the juice. The fermentation temperature should be kept below 25° C. Fermentation has started when bubbles appear on the surface of the juice. Sulphur dioxide should be added once fermentation is complete. Most of the sulphur dioxide previously added would have been lost during fermentation.

Fermentation has stopped when no more gas leaves the wine; the sugar reading on the Baumé hydrometer should measure below zero. Another 50 ppm of sulphur dioxide (0.1 g/L of metabisulphite) should be added. Further small additions of about 15 ppm should be made during storage (usually monthly). The finished wine should contain about 120 to 150 ppm total sulphur dioxide.

Dextro-check tablets or Clinitest strips (available from pharmacists) can be used to assess the “dryness” of the wine. When the tablet turns dark blue, the wine contains less than 0.1 per cent (2 g/L) reducing sugar and can be regarded as being “dry”.

To ensure the wine is protein stable (will not go cloudy on chilling) it should be fined with bentonite powder, which is available from pharmacists. Bentonite can be added either during fermentation (at the halfway stage) or after fermentation is complete. A rate of 1 g/L should be adequate.

Clarification and stabilisation

Newly made wine should not be left on its yeast lees (sediment) for too long after fermentation as it may pick up a leesy character resulting from yeast cell breakdown. Allow the wine to settle for about a week after the completion of fermentation before carrying out the first racking, that is siphoning the clear wine off the sediment into a clean container. The wine may be further clarified by successive rackings or filtering, if a filter is available. Oxidation is the biggest danger during these operations and every attempt should be made to avoid it. The main causes of oxidation are inadequate sulphur dioxide levels in the wine, excessive splashing or aeration of the wine, and part-filled containers into which air can enter.

Stabilisation is the process by which potassium bitartrate crystals are removed. These white harmless crystals of an unstable acid complex can be removed by refrigerating the wine and subsequently racking or filtering. For the small-scale wine maker, this step is often avoided. However, if a cold room is available the wine should be left in it for about 10 days at 0° to 2° C before it is racked from the crystals.

Bottling

The bottling procedure is simple. The rules are:

- use clean sterilised bottles;
- try to avoid oxidation;
- use clean, sterilised corks.

Bottles may be sterilised by rinsing with water containing 1 g/L of metabisulphite.

The bottles can be filled by gentle siphoning. Leave a one-centimetre gap below the inserted cork for possible expansion of the wine.

Good quality corks are available from brewing suppliers. They should be soaked for about an hour in water containing 450 ppm of sulphur dioxide (1 g metabisulphite

Draining and pressing.

A small press.
per one litre of water) and drained before use. This will soften them, making corking easier.

The bottled wine should be stored on its side in a cool, dark place to prevent the corks from drying out.

**Making red wines**

**Grapes**

With red wines, fermentation of the juice takes place in contact with the skins and pulp. The skins impart the red colour and flavour to the wine.

There are two major red wine styles—light bodied and full bodied. Light bodied styles display obvious acidity and tannin while full bodied styles are softer on the palate and less firm on the finish.

Normally red grapes are picked between 12° and 13° Baumé. Only sound (undamaged) fruit should be used for making red wine as much of the fermentation is carried out in contact with the skins.

**Crushing**

Crushing involves breaking the berries and removing the stalks. Any stalks left in the juice can lead to an unpleasant stalkly, green character in the wine. The stalks can also be removed by rubbing the berries through a screen or mesh or by picking them from the bunches before crushing.

About 75 to 100 ppm of metabisulphite (1.2 to 1.5 g/10kg of grapes) should be added at crushing to suppress wild yeast activity. Yeast starter culture should be added as soon after crushing as possible at a rate of 3 to 5 per cent of the total volume of must (crushed grapes including juice and skins). Fermentation can be carried out in an open container filled to two-thirds of its volume to allow for expansion.

**Fermentation**

Fermentation of the juice and skins has a major effect on the style of the final wine. The aim should be to obtain flavour and colour from the skins without extracting too much tannin. The longer the juice is on skins, the greater the extraction. Red juice is normally allowed to ferment for about three to five days on skins depending on the rate of fermentation. By this time about half the sugar should have been converted to alcohol.

The favoured temperature for fermentation is between 20° to 25°C. Hot fermentation can give a “cooked” character to the wine. During fermentation the skins will rise to the top of the juice and form a “cap”. This can result in heat being trapped in the juice. The cap should be plunged under the surface of the juice at least three times a day to allow heat to dissipate and more flavour and colour to be extracted from the skins.

During fermentation the alcohol level increases as the sugar level decreases. Alcohol acts to break down the cells in the grape skins, thereby releasing the colour pigment and tannins. Do not allow fermentation to proceed to completion on skins as other bitter compounds will be extracted due to the high alcohol level.

When the juice has been drained from the skins it can be placed in another vessel to allow fermentation to finish.

**Pressing**

The skins are pressed to obtain the remaining wine. The pressings wine is either added to the bulk or kept separate. Pressings wine is usually darker and more tannic.

**Clarification**

One to two weeks after completion of fermentation the wine should be racked off its lees. The usual precautions to avoid oxidation should be taken.

At this stage the sulphur dioxide level should be raised to about 100 ppm. Adding 50 ppm of sulphur dioxide (0.1 g/L of metabisulphite) is usually adequate.

Further rackings will improve the clarity of the wine. A second racking is advisable after about two months and another four months later.

**Small-scale fermentation with air-lock.**
Maturation
Red wines are usually aged for some time before bottling. Ageing may take place in bulk or in wood, preferably oak. This step is often difficult for the small-scale wine maker. European or American oak is preferred for storing wine. The cask should be checked for leaks before filling with wine. Soaking with water for a couple of days will allow the wood to swell and overcome leakage.

If a small oak cask is used care must be taken to avoid excessive wood character in the wine. The wine should be regularly tasted to assess the pick-up of wood flavour. When the wine has reached the desired character the cask should be emptied. It is most important to keep storage containers full at all times to avoid spoilage and oxidation. This may require regular topping up.

Bottling
The rules that apply to white wines also apply to red wines.

Microbial spoilage
The main yeast and bacteria which spoil wine are widely distributed in nature and are present in almost every wine making situation. The wine must be stored in a condition unfavourable for microbial growth. The conditions which restrict the growth of micro-organisms in table wines are: low pH; low levels of fermentable sugar; adequate sulphur dioxide; early cleaning up of wine to a bright condition; no oxygen.

The most common bacterium is *Aerococcus* which converts alcohol to acetic acid (vinaigre). Oxygen encourages its growth, again highlighting the importance of excluding oxygen at all times during the wine making process.

A surface-growing yeast, *Mycoderma*, grows strongly in the presence of air and low sulphur dioxide levels, forming a compound called acetaldehyde which imparts a green-apple-like taste and smell to the wine. This is a common form of spoilage in small wine making situations, particularly in partly filled containers.

Non-microbial disorders
Metals, particularly copper and iron, cause cloudiness in the wine if present at high levels. Stainless steel and glass containers are recommended for this reason.

Oxidation has been mentioned many times. It causes the wine to turn brown and leads to the formation of acetaldehyde in oxidised wines.

Protein also causes a haze in white wines. It is easily removed by fining with bentonite.

Hydrogen sulphide (rotten egg smell) is a problem usually resulting from fermentations by wild yeast. It can be removed by adding minute quantities of copper sulphate.

Proper advice should be obtained should this disorder occur.
The Wine Making Process

1. Fresh grapes (100 kg)
2. Crush grapes
3. Drain and press
4. Chill, settle and rack (60 L juice)
5. Add 3 g metabisulphite
6. Fermentation to dryness
7. Add 6 g metabisulphite
8. Rack off sediment
9. Open fermentation with skins (Press)
10. Fermentation completed without skins
11. Cold stabilise and clarify (fining)
12. Add Tartaric acid if required
13. 12-15 g metabisulphite
14. Red wine
15. Crush grapes
16. Mature in wood
17. Bottle (80-85 bottles)
18. Warm wine
19. Cold stabilise and clarify (fining)
20. Bottle (70-75 bottles)
21. Store
<table>
<thead>
<tr>
<th>Glossary</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACETIC ACID</td>
<td>The acid from the production of vinegar. It is brought about by the oxidation (by bacteria) of alcohol in wine.</td>
</tr>
<tr>
<td>ACIDITY OF WINE</td>
<td>Related to the presence of acids found in grapes and wine. Adds liveliness to the taste of wine.</td>
</tr>
<tr>
<td>ALCOHOL</td>
<td>Ethyl alcohol. A product of the fermentation of sugar.</td>
</tr>
<tr>
<td>AROMA</td>
<td>The smell attributed to the grape.</td>
</tr>
<tr>
<td>ASTRINGENCY</td>
<td>A character of wine which causes the mouth to pucker. It is due to the acid and tannin content of the wine.</td>
</tr>
<tr>
<td>BITTERNESS</td>
<td>A character resulting from excessive extraction from the skins, stems, stalks and seeds of grapes during crushing, fermentation and pressing.</td>
</tr>
<tr>
<td>BOUQUET</td>
<td>The fragrance of wine resulting from maturation.</td>
</tr>
<tr>
<td>BRIX HYDROMETER</td>
<td>An instrument for estimating the soluble solids (mainly sugar) of juice or wine.</td>
</tr>
<tr>
<td>CARBON DIOXIDE</td>
<td>The gas produced by yeast during fermentation.</td>
</tr>
<tr>
<td>CLOUDY</td>
<td>The suspension of tiny particles in wine.</td>
</tr>
<tr>
<td>COARSE</td>
<td>A character often resulting from the use of mouldy fruit, excessive extraction or poor wine balance.</td>
</tr>
<tr>
<td>DRY</td>
<td>The absence of sweetness. A “dry” wine lacks sugar.</td>
</tr>
<tr>
<td>FLOWERY, FRUIT</td>
<td>The fresh aroma of grapes found in young wines.</td>
</tr>
<tr>
<td>HYDROGEN SULPHIDE</td>
<td>Rotten egg smell resulting from the reduction of sulphur dioxide or elemental sulphur to hydrogen sulphide.</td>
</tr>
<tr>
<td>OXIDATION</td>
<td>A chemical change which takes place when wine or juice comes in contact with oxygen. It causes wines to turn brown and encourages microbial spoilage.</td>
</tr>
<tr>
<td>TANNIN</td>
<td>A component of grapes which is found in wines. It causes an astringent character.</td>
</tr>
<tr>
<td>TARTARIC ACID</td>
<td>A naturally occurring acid found in grapes and wines.</td>
</tr>
<tr>
<td>WOODY</td>
<td>The flavour and astringency found in wines stored in oak barrels or casks.</td>
</tr>
<tr>
<td>YEAST</td>
<td>Micro-organisms found on the skins of grapes. Selected yeasts are used to ensure a more satisfactory fermentation.</td>
</tr>
</tbody>
</table>