

## Small-lot fermentation method for smoke-exposed grapes



### Assessing the potential for grapes to produce smoke-affected wine

When vineyards and grapes are exposed to smoke this can result in wines with undesirable 'smoky' sensory characters. The compounds in smoke primarily responsible for these characters are free volatile phenols. These can be absorbed directly by grapes and bind to grape sugars to give glycosides that have no smoky aroma. Aroma assessment of grapes or juice will therefore not give a good indication of the potential impact of smoke exposure on the resultant wine.

During fermentation or wine storage the glycosides can break apart, releasing volatile phenols into the must or wine, allowing the smoky flavour to be perceived. One option that could be useful for winemakers with potentially smoke-affected grapes is to conduct small-lot fermentations, followed by sensory assessment, to gauge the potential risk of smoke characters being

perceived in wine made from grapes that have been exposed to smoke.

If small-lot fermentations are conducted, the AWRI recommends that grapes are also analysed for volatile phenols and glycosides at the same time the fermentation is started. This allows the chemical results and the sensory assessment to be used to make harvest decisions.

This fact sheet sets out all the steps for conducting a small-lot fermentation. A flow chart is also provided on the final page (Figure 1). In addition, there is a [companion video](#) that demonstrates all the steps outlined in this fact sheet.

## When to sample

It is preferable to conduct the ferments about three weeks before harvest, to allow enough time for transport of grapes to a testing facility and for the analytical testing of grapes before harvest. The later this procedure is used, the more reliable the indication of smoke exposure will be. It is best to plan in advance to ensure the small-lot fermentation is conducted in time to be used to support harvest decisions.

## Grape sampling

It is important to ensure that a representative sample is collected from the entire vineyard. Refer to the [AWRI grape sampling fact sheet](#) for more details.

Weigh out approximately 5 kg of berries stripped off grape bunches and transfer them into a clean open container; for example, a 10 L stainless steel bucket, a large pot or a food grade plastic storage container. A loose-fitting lid or cover can be used to allow ferment gas to escape and prevent contaminants or vinegar flies from entering.

## Fermentation on skins

The AWRI recommends that when conducting small-lot ferments to assess smoke risk the fermentation should be conducted on skins, regardless of whether the grapes are red or white. This provides an opportunity for maximum extraction of smoke compounds, if present, and therefore gives a 'worst case scenario' result for white wines. Winemakers may also choose to also conduct a fermentation off skins for white grapes, producing a wine for sensory assessment that reflects a more realistic outcome for a white wine fermentation.

## Must preparation and additions

- Crush the grapes using a potato masher.
- Take a sample for Baume, pH and TA measurement.
- Add SO<sub>2</sub>. Measure out approximately 1.5 mL of the 10% SO<sub>2</sub> solution into about 25 mL of water and then tip the whole lot evenly across the grapes. Mix in thoroughly with potato masher.
- Add pectinase. Measure out approximately 1.5 mL of the 10% pectinase solution and dilute further into 25 mL of water and then tip the whole lot evenly across the grapes. Mix in thoroughly with potato masher.
- Add DAP. Measure out approximately 6 mL of the 10% DAP solution and tip the whole lot evenly across the grapes. Mix in thoroughly with potato masher.

**\*\*\*Important – Do not mix SO<sub>2</sub> and pectinase solutions together prior to addition \*\*\***

- Adjust acidity to around pH 3.4 (if required). For every 0.1 pH decrease required, add 3 g of solid tartaric acid or 30 mL of a 10% tartaric acid solution. For every 0.1 pH increase required, add 1.5 g solid potassium bicarbonate or 15 mL 10% potassium bicarbonate solution. Mix in thoroughly with potato masher.

Note that due to the use of hand crushing, the addition amounts in this procedure are based on a low 600 L/T extraction rate, or around 3 L of juice expected from 5 kg of fruit.

See 'Preparation of solutions' section below for instructions on how to prepare the required solutions.

## Yeast preparation and inoculation

- Add 50 mL of chlorine-free water (such as reverse osmosis treated, distilled or *Milli-Q*) to a clean drinking glass and heat in a microwave to a temperature of 38-40°C. Dissolve 2.5 g of sugar (raw or white) in the warm water. Weigh out 1 g yeast and sprinkle onto the water. Gentle mixing may be required to ensure all the yeast is properly wetted. Leave for 10 minutes to allow the yeast to rehydrate.
- Make sure the must is around 20°C (ideally 20-25°C). Add 50 mL of must to the 50 mL of hydrated yeast and leave for 10 minutes, before adding the entire contents of the yeast culture to the fermenter. This is a yeast addition of 300 mg/L. Yeast inoculation day is considered day 0. The time for the yeast rehydration procedure should not exceed 40 minutes.
- Place fermenter in an area that is between 20 and 25°C (e.g. winery laboratory).

## Fermentation management

The ferment will take about five days.

Daily tasks:

- Mix the ferment three to four times per day by plunging with a potato masher or stirring with a long handled wooden spoon – try to break up and submerge the cap.
- Smell the ferment for any hydrogen sulfide (H<sub>2</sub>S) or 'eggy' aroma. If observed, add 3 mL of 10% DAP solution (100 mg/L of DAP).
- On day 2, measure out approximately 6 mL of 10% DAP solution and tip the whole lot evenly across the grapes. Plunge to mix thoroughly.

- After five days of fermentation, take a sample and test for residual sugar using an *AimTab* or *Clinitest*.
- If the *AimTab/Clinitest* reads <2 g/L sugar, then proceed to drain and press, as described below. If the *Clinitest* reads >2 g/L sugar, then ferment for an extra day and recheck residual sugar. Repeat if necessary, then proceed to drain and press.
- Do not exceed seven days on skins post inoculation even if sugar >2 g/L.

## Drain and press

- Weigh an empty sealable container (at least 3 L volume).
- Drain the ferment through a sieve into the container, press the solids against the sieve, then re-weigh the container to determine the wine volume (assuming 1 kg=1 L)

## End of ferment additions

SO<sub>2</sub> addition:

- Using the determined wine volume, add 0.8 mL/L of 10% SO<sub>2</sub> solution to the wine and mix thoroughly.

Copper sulfate addition:

- Using the determined wine volume, add approximately 0.4 mL/L 0.2% CuSO<sub>4</sub> solution. It is ESSENTIAL to add this DROPSWISE to the wine while mixing thoroughly.

Seal the container and place in refrigerator at 4°C for 48 hours to settle out solids.

## Rack, decant and bottle

- Rack or transfer the clear wine using a siphon hose into two 750 mL or four 375 mL clean wine bottles, filling them as

much as possible to decrease headspace.  
Seal with a screwcap.

- Wine can now be subjected to sensory assessment for the presence of any smoke characters. A [smoke sensory evaluation procedure](#) and [demonstration video](#) provide guidance on how to conduct a sensory assessment of potentially smoke-affected wines, including small-lot fermentations.

### Preparation of solutions for additions

Use reverse osmosis (RO) treated water, distilled water or Milli-Q water to prepare the required solutions.

10% SO<sub>2</sub> solution (store at room temperature, expires after 2 weeks)

- Weigh 20 g of potassium metabisulfite (PMS) into a clean bottle (~100 mL).
- Add 80 mL of water and mix until all the crystals dissolve.
- Top up with water to a total volume of 100 mL.

10% pectinase solution (store in refrigerator, expires after 2 weeks)

- Measure 10 mL of liquid pectinase into a clean bottle (~100 mL).
- Top up with water to a total volume of 100 mL.
- If using powdered pectinase, follow manufacturer's instructions then dilute as above.

10% tartaric acid solution (store at room temperature, expires after 3 months)

- Weigh 10 g of tartaric acid into a clean bottle (~100 mL).
- Add 80 mL of water and mix until all the crystals dissolve.

- Top up with water to a total volume of 100 mL.

10% potassium bicarbonate solution (store at room temperature, expires after 3 months)

- Weigh 10 g of potassium bicarbonate into a clean bottle (~100 mL).
- Add 80 mL of water and mix until all the crystals dissolve.
- Top up with water to a total volume of 100 mL.

10% diammonium phosphate (DAP) solution (store at room temperature, expires after 3 months)

- Weigh 10 g DAP into a clean bottle (~100 mL).
- Add 80 mL of warm water and mix until all the crystals dissolve.
- Top up with water to a total volume of 100 mL.

2% copper sulfate – STOCK solution (store in refrigerator, expires after 1 year)

**\*\*\*Do NOT add this stock solution to wine**

- Weigh 2 g copper sulfate into a clean bottle (~100 mL).
- Add 80 mL of water and mix until all the crystals dissolve.
- Top up with water to a total volume of 100 mL.

0.2% copper sulfate – WORKING solution - (store in refrigerator, expires after 3 months)

- Take 10 mL of the stock solution and add to 100 mL of water in a clean bottle (~100 mL).

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## Resources

Video: Small-lot fermentation method for smoke-exposed grapes. Available from:  
<https://youtu.be/GaM3wXt7AgI>

## Contact

For further information regarding this procedure or assistance with smoke taint please contact the AWRI helpdesk team.

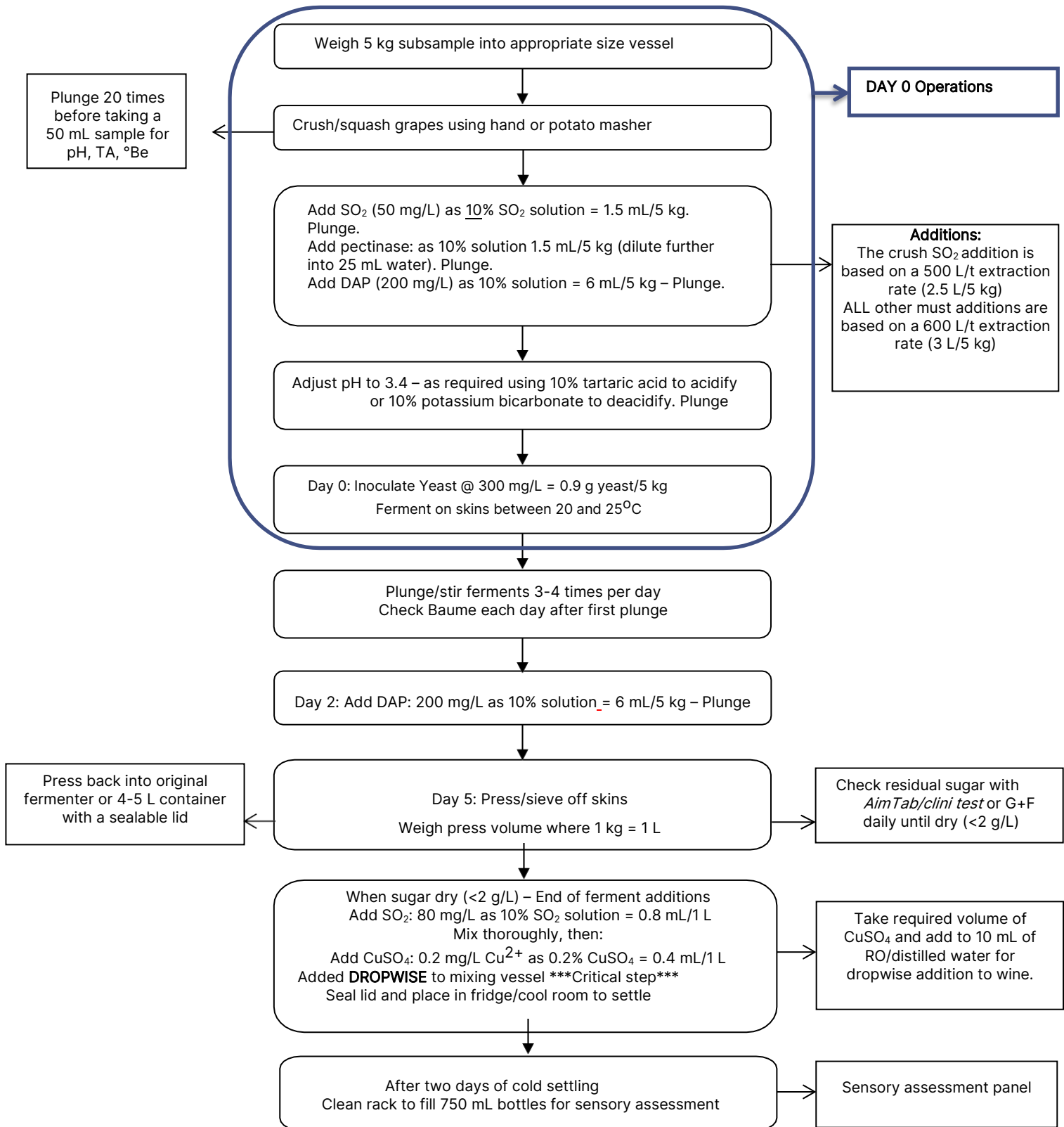
**Phone** 08 8313 6600

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## Website

[https://www.awri.com.au/industry\\_support/winemaking\\_resources/smoke-taint/](https://www.awri.com.au/industry_support/winemaking_resources/smoke-taint/)

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**Figure 1.** Steps in the small-lot fermentation method