

## Prevention and management of stuck alcoholic fermentations

### Scope

The protocol sets out the steps required for the preparation of a ‘rescue’ culture of yeast for a slow or stuck fermentation. It is based on the collective experience of several winemakers and AWRI staff. Its aim is to acclimatize the yeast to the relatively hostile conditions of the ferment.

There are as many ways to restart a stuck ferment as there are to crush the grapes, and there is no guarantee that any particular protocol will fix a specific problem tank. However, if the key rules of avoiding temperature and alcohol shock, and ensuring that the yeast are always well-supplied with sugar and nitrogen are followed, this protocol should give positive results.

### Procedure

The protocol below is appropriate for the preparation of yeast to reinoculate a 1000 L problem ferment, and may of course be scaled up for larger volumes.

The steps are as follows:

- Step 1. Warm the bulk ferment to 18–22°C.
- Step 2. Prepare the reactivation medium. This can be based on grape juice, if available, or a mixture of grape juice concentrate, water and nutrients. In either case, it should be adjusted to 20 °C before use. The two alternative ‘recipes’ are given below:

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<b>Grape juice reactivation medium</b>	<b>Concentrate/water reactivation medium</b>
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10 L grape juice (free of SO <sub>2</sub> )	15 L clean water (free of chlorine)
5 L clean water	grape juice concentrate (equivalent to ~2 kg sucrose)
15 g DAP	15 g DAP
<i>Cerevit</i> or <i>Maurivit</i> (150 mg)	<i>Cerevit</i> or <i>Maurivit</i> (150 mg)

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- Step 3. Rehydrate 500 g of yeast by suspending in 5 L clean water (free of inhibitory substances such as chlorine) at 40 °C for 15 min. Do not stir in this time, other than to ensure that the yeast is wet when initially added. The most successful culture according to feedback from winemakers is that marketed as *Lalvin EC1118*, *Maurivin PDM*, or *Prise de mousse*.
- Step 4. After this period, add the reactivation medium from Step 2 gradually in several small volumes, to cool the culture (see the table below), each separated by 5 min. Mix carefully after each addition. Leave the culture to stand until approximately 50% of the residual sugar has been metabolized (monitor by hydrometry). This is likely to take approximately 4 hours (see table below).

- Step 5. At this point, add 20 L of the problem ferment, and aerate at a rate of 0.1–0.2 volumes filtered air/volume liquid/min (i.e. if the volume is 40 L, the flow rate should be 4–8 L air/min.). Alternatively, if filtered air is not available, transfer as aerobically as possible from one vessel to another.
- Step 6. Monitor the concentration of residual sugar by hydrometry, hourly. When approximately 50% has been fermented, double the volume again with the problem ferment. Continue aeration.
- Step 7. This step should be repeated at least twice, to ensure that the alcohol concentration is increased gradually, to allow the yeast to acclimatize.
- Step 8. Add the yeast culture to the tank and mix. Approximately 20 mg DAP/L may be added to the bulk ferment when the culture is added, but the addition of further vitamin mixture at this stage is not recommended. Maintain the ferment at 18–22°C, and agitate or pump over at least once a day, to prevent the yeast from settling out. Aeration of the ferment may be risky, as the yeast may not be sufficiently active to prevent oxidation. When fermentation is evident, limited aeration can be beneficial.
- Step 9. Check the residual sugar concentration at least daily; at this stage a more precise measure is required; use an enzymatic analysis method. If the rate of fermentation is very low (less than 1 g/L/day), please contact the AWRI for more assistance. Racking of the ferment, and/or the addition of yeast hulls may be recommended in such cases.

The following table summarizes the size and timing of the additions made:

Stage	Cumul. time (min.)	Temp. (°C)	Vol. added (L)	Cumul. vol. (L)	Comment
Rehydration	0	40	5	5	Do not stir
Cooling	15	~35	2	7	Add rehydration medium and mix
Cooling	20	~30	3	10	as above
Cooling	25	~25	5	15	as above
Cooling	30	~20	5	20	as above
Acclimatization	~240	~20	20	40	Add problem ferment, and aerate continuously
Acclimatization	~600	~20	40	80	as above
Acclimatization	? (when ~50% residual sugar remains)	~20	80	160	May continue with more stages... as above

Note that the duration of this process is variable, and the time elapsed should not be used as a guide to the timing of the addition of more ferment. The rate of sugar usage is far more important. The total time, from rehydration of the yeast to inoculation of the bulk ferment, may be 12–72 h.

The large yeast population present means that the sugar present is likely to be rapidly metabolized, and care must be taken to ensure that the yeast do not ferment all of the residual sugar at any stage. If the culture 'runs dry', a rapid loss of yeast activity can be expected.

In particularly difficult cases, winemakers have had success by adding the bulk ferment to the culture in successive increments, rather than adding the culture to the tank. Under these circumstances, it is necessary to transfer a volume of the warm ferment to the tank containing the culture on a daily or twice-daily basis, ensuring that the residual sugar concentration is determined before and after each addition, so that the rate of fermentation can be monitored.