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Méthode Cap Classique, Part 4: Aging, riddling, disgorging and corking

Carien Coetzee – 24 February 2017

Aging sur-lie and autolysis

Adequate aging sur-lie is one of the most important MCC production steps and is needed to develop roundness in the body and general flavour and complexity of the wine. The optimum aging time for obtaining a high-quality, stable foam appears to be 18 months after which foam quality starts to decrease. In Champagne, a minimum aging period of nine months is needed per regulations. This aging takes place before disgorgement and dosage to ensure sufficient yeast autolysis. The development of what is commonly referred to as a "yeasty" character also occurs during this stage and result in increased levels of amino acids, esters, fatty acids, amides and terpenoids which alter flavour and complexity and may also enhance bubble formation.

As mentioned, adequate time is needed for this aging process, however producers implement the minimum time necessary to get the product out in the market earlier, thereby reducing production costs. Several methods to speed track the aging process (without compromising the quality) has been investigated. Elevated pH and temperature significantly increases the rate of autolysis, however it might have negative effects on bubble retention and sensory attributes. The optimal temperature for proteolysis has been reported to be between around 12˚C.

The choice of yeast strain has also been shown to influence the autolytic capacity as well as foaming properties and can potentially reduce the sur-lie aging period. The use of mixed cultures containing killer resistant and sensitive yeast strains, the use of yeast autolytic mutants or the addition of selected yeast strains that undergo rapid autolysis has been tested. Other methods include the addition of yeast autosylate and the supplementation with enzymes such as β-glucanase and pectinase.

Wines that are destined for longer aging periods undergo shaking once a year to dislodge sediments from the bottle and avoid crusting. However, excessive shaking should be avoided to prevent the extraction of lipids from the dead yeast cells that can produce marks on the bottle interior.

Riddling (remuage)

After sufficient aging, the riddling process can commence by which gravity conveys the sediment to the neck of the bottle. Proper riddling causes the heavy particles to ride over and bring down the lighter more flocculant particles to the neck of the bottle. The sediment collected during riddling consists of yeast cells, protein material, tartrate deposits and riddling aids. The longer the sur-lie, the more homogenous the sediment will be and less separation of the insoluble particles will take place. In other words, wines that have spent longer periods on the lees are usually easier to riddle. Other factors that affect successful riddling includes yeast strain, sediment volume, fermentation rate, storing conditions, riddling aids and riddling method.

Before the start of the riddling process, the bottles are usually shaken by hand or machine to dislodge the particles. A resting period will then allow for the sediment to settle. Riddling performed at around 18°C (vs a colder temperature) is optimal for efficient riddling. It is important to minimize air movement/currents in the riddling area due to the induction of convection currents in the bottle which can complicate the riddling process.

Riddling may either be performed by hand or automatically. Hand-riddling involves the placement of the bottles onto an A-frame (Figure 1) and is said to have three phases: The bottles are first rotated, then oscillated and finally tilted slightly. This process is repeated daily and may take up to 3 months depending on the nature of the wine and the skill of the remuer.

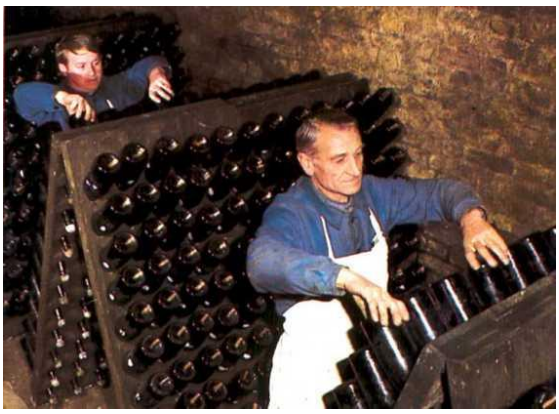

Figure 1. An A-frame used for hand-riddling

In modern winemaking, automated riddling machines are mainly used. A gyropallete (Figure 2), that consists of a pallet basket that holds 504 bottles, are generally used. The basket can shift in all directions, up and down as well as from side to side and stop abruptly. These techniques reduce the riddling time significantly to about 4 days. You also get a rocker system that consists of a metal frame rotated on a pivot. These systems are computerized and can operate different baskets using different regimes.

These type of automated systems have many benefits such as cost savings and the fact that you do not need a skilled remuer to perform the riddling. The floor space of the automized system is also significantly less than what is needed for A-frames. However, in general, hand riddling is believed to still be the most effective riddling action and even big producers still

make use of hand riddling for difficult wines and unusual bottle shapes. The act of hand riddling also adds a certain romanticism to the product which attracts consumers.

Figure 2. Gyropallets used for automated riddling

Scientists have experimented with a recent promising innovation that involves magnetized yeasts for accelerated fermentation and yeast removal. This new method could reduce production time and costs by removing the need for riddling, specialized equipment and the freezing in glycol.

Disgorging (dégorgement)

Disgorging is the removal of the sediment from the bottle. Disgorging should be done at lower temperatures (4-10°C) to reduce CO_2 loss and correct disgorging should not decrease the pressure by more than 2 bar and volume loss is normally about 2%.

While still sur point (upside down), the chilled bottles are placed into a brine of calcium chloride or a glycol solution with a temperature of -25°C (be sure to rinse off any glycol/brine before disgorging). This will cause the sediment to freeze together with a small portion of the wine located in the bottle neck, creating an ice plug. The amount of liquid frozen should be kept to a minimum to avoid disgorging problems.

After the freezing of the neck, the bottles are rapidly placed neck up after which the crown cap is removed. The release of pressure will eject the ice plug. This is where the use of a bedule (*MCC Part 3*) is of great value to ensure that the yeast plug will be ejected uniformly.

The dégorgement process (whether by hand or automated) should be evaluated carefully. After the removal of the frozen plug, the wine should be inspected for off-odours and to ensure that all the sediment was successfully removed. Re-fermentation may occur in bottles that has not been disgorged properly.

Dosage (liquer d'expédition) and corking

Dosage is added to the wine before corking to improve the final taste of the wine or to achieve a certain characteristic or style. Each producer has their own recipe for the dosage while zero-dosage (no added sugar) is becoming more popular. There is no standard recipe for the dosage, however mostly it consists of one or more of the following: wine, sugar, brandy (now illegal in Champagne), sulphur dioxide, ascorbic acid, citric acid, tannins, copper sulphate and

stabilization aids. The concentrations of the additives may be customized to the producer's needs. Some recommendations can be found in the *Vinlab manual* on page 139.
Sugar is added for the purpose of balancing the acidity, masking astringency-bitterness and slightly modifying flavour. The presence of carbon dioxide may also influence the perception of sweetness, thus necessitating the addition of some sugar in most cases. It has been suggested that the natural hydrolysis of a 10 g/L sucrose addition to a still wine (pH 3-3.4), devoid of invertase activity, will take 2.5-5.5 months.
The amount of sugar in the final wine will depend on required wine style. The various categories as well as useful dosage calculations can also be found in the *Vinlab manual*. A 600-750 g/L sugar solution is prepared by dissolving sugar in wine, and/or sometimes water (if water is used it should be deionised to ensure it is free of haze forming metals). The use of wine in the dosage is preferred as it limits the attenuations of wine character. The topping wine used may be wine made from the press fractions, wines from younger vintages, older sparkling wines in the cellar or oaked/unoaked still wines (usually Chardonnay). Red wine can be used to brighten and adjust the colour of rosé MCC, while oak aged wines can be used to add depth and complexity.
In years when the alcohol content of the wine is low, brandy can be added to the dosage, however the use of brandy is known to have dramatic effects on the MCC aroma composition. Dosage trials should be performed to determine the ideal concentration of brandy to add. The addition of ascorbic acid should always be in conjunction with sulphur dioxide, however some studies suggest that this addition should only be done for certain cultivars. Citric acid can be added to increase the freshness of older wines.

The dosage should be sterile filtered and brilliantly clear to eliminate any risk of re-fermentation and to reduce gushing (spontaneous and eruptive overfoaming) during filling. The bottles, dosage and topping wine should preferably be at the same (low) temperature to ensure the correct volume and to reduce gushing. Bottles need to be physically mixed after dosage as the dosage has a higher specific gravity than the wine and will settle if not mixed. Many producers will also allow a period of up to 6 months for the dosage and the wine to "marry" prior to release.
The use of quality glass and corks is important for obvious reasons, however, in the case of MCC it is even more critical due to the effect thereof on gushing. Particulate matter in the form of cork dust, fibers, particles from packaging material, particles from the wine or dosage itself (bitartrate crystals and sediment) can cause gushing. The glass bottle itself can also contain imperfections on the inside surface thereby contributing to gushing. Wine constituents like tannins can also add to the gushing effect and the reduction thereof in rosé MCC will help alleviate the problem.
Dissolved gasses within the wine can also be an important contributing factor to gushing. Nitrogen and air have low solubility when under pressure thus causing the gushing effect when opening the bottle. Sparging with nitrogen is thus not advised when producing MCC. Excessive carbon dioxide concentrations and insufficient chilling (lower temperatures leads to higher solubility) will also result in gushing.

The presence of elevated levels of dissolved CO_2 has many beneficial sensorial contributions, however it should be noted that dissolved CO_2 enhance the perception of most aroma compounds including the undesired compounds such as TCA. Care should thus be taken when purchasing corks and *tests* can be done to determine the presence of TCA in cork batches. Dissolved CO_2 (8-10 g/L) will also raise the TA of the wine with 0.75 g/L and should be considered during MCC production.

Jetting is a technique used to reduce oxygen intake during corking and is developed to reduce the flavour and aroma bottle variability induced by the presence of oxygen in the headspace at disgorging. Jetting is the insertion of 100 µL of wine into the bottle neck to induce foaming. The foam acts as a piston, reducing oxygen ingress in the neck space, after which the cork is rapidly inserted while the foam is still high.

The length of time between the disgorging and the release of the consumer-ready MCC is up to the producer, however it is known that the flavour already change from 1 to 3 months in the bottle and continuously thereafter.

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