The art and science of affinage

Cheese maturation is a critical stage in the cheese production process. Nimbin Valley Dairy's Paul Wilson travelled to Lyon, France, to study affinage techniques at the Mons Academie Opus Caseus, supported by the 2014 DIAA Australian Dairy Manufacturing Scholarship.

Affinage, or cheese maturation, requires careful management of temperature, humidity and airflow to help cheese achieve its full potential. Manipulating these three parameters enables the rind of the cheese to be nurtured through its successive stages of growth to direct the maturation of the cheese in the desired direction. Affinage is, in essence, 'farming the rind,' since the growth of surface flora is encouraged, or discouraged, at different stages during the life of the cheese in a process not dissimilar to raising crops on a farm.

Affinage is also about managing stock and marketing. Different cheeses at different stages of maturation will be suitable for different markets. Cheese that can't be aged because of quality defects may need to be sold early or discarded.

No one size fits all with affinage

Milk is a living product and contains a complex microflora consisting of yeasts, moulds and bacteria. This flora comes from the animal and its surrounds. Therefore, the milking environment is very important. A stronger and more diverse milk flora needs diverse herd genetics and a biologically diverse environment.

The Mons Academie Open Caseus course discusses that strict milking and herd hygiene practices mean that milk microflora is becoming diminished. In some cases, it has been noted that the microflora diversity has reduced to the extent that it is not possible to make quality raw milk cheese. The French lament this development, since they believe 'wild' milk allows the cheese to "tell its story," something that modern commercial cheeses cannot do in their opinion.

The development of brands has meant that pasteurisation has become more important in an attempt to achieve consistency and to allow longer supply chains. Greater volumes of milk also require pasteurisation, since factories are pooling milk to achieve efficiency and hence dealing with milk of an unknown origin.

One of the methods to encourage the growth of natural microflora when combining milks from two milkings discussed in the course is to not chill the milk to less than 12°C. At this temperature the microflora can continue to be active.

Cheese being turned and washed. The brick wall allows moisture to pass through to help maintain humidity.

The addition of whey from the previous make also allows this microflora to play a role in the cheesemaking process.

Affinage techniques

Affinage is not a formula, it is a range of techniques that must be modified to achieve an outcome. Cheese is a living product, so the ripening rates of different batches are not always the same and often depend on cheese moisture content.

Affinage practices are often a reflection of available facilities and time restrictions. Routine is important, but it is often modified by time constraints. Affinage at the make facility is logistically easier, but it may be harder from a workload point of view.

Brushing, washing, salting, piercing, smoking, misting, banding and applying wax are all affinage techniques.

Cheeses can be washed with two substances – a wash or a morge. There is not much difference between the two, although a wash tends to be discarded at the end of the day, while a morge may be kept for as long as a week.

When applying a morge or a wash, you start with the older cheeses and work towards the younger cheeses, thereby assisting the transfer of microflora to the new cheeses.

Every time a cheese is brushed, it must also be turned. This encourages flora development and is good for rind management, since the moulds are being compacted together to make the rind.

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It is important not to start brushing too soon. The rind must be allowed to grow and establish before brushing starts. When brushing a natural rind cheese, you should be able to see the tracks of the bush.

Washing cheese is a contamination risk. Pathogens live in water, so it is a critical control point. Water and salt are important at the beginning (usually 2-5%, however older cheeses don't need salt once the rind is established). *Linens* and other bacteria can be naturally present in fresh milk, or they can be added to the wash.

Morges contain rich microflora, either added as commercial cultures to water with salt or with white vinegar (5-15%), or inoculated from the rind of an old cheese as a starter. Simply rubbing a cloth over an old cheese and placing it in a new bucket of water is enough.

The word 'morge' refers to both the biofilm on the surface of the cheese and the liquid that is used to wash the surface of the cheese during affinage to encourage the growth of a particular biofilm.

Applying a morge helps to protect the cheese from undesirable yeasts and moulds and also prevents desiccation. Rind defects can be addressed by morging. As well as helping to ripen the cheese, morge contributes to the colour of the cheese and rind.

Morging is usually done daily for the first week and then reduced to every second or third day. If the rind is growing sufficiently well, morging can be reduced to weekly washes. When washing, the cheese is flipped and the 'new' top surface is washed along with the sides. At the next wash the process is repeated. The rind of the cheese should dry before washing, and if the surface isn't sufficiently dry the washing may be delayed.

Affinage facilities

Four different types of facilities are used to mature cheese in France: haloir (yeasting room), caves, affinage room and sechoir (cold drying room or cheese 'hospital').

The objective of these rooms is to dry out the cheese and lower the available water, or maintain it, at the same time as allowing the flora to develop on the surface of the cheese.

Haloir prepares the surface of the cheese to allow the moulds to grow and to inhibit the growth of undesirable moulds such as black mould and mucor.

In principle, haloir it is a relatively warm room, about 14-15°C, with moving air across the surface of the cheese encouraging the ➤

Top: Brushing Mimolette with a coarse brush. Bottom: The morge is applied to large cheeses using an automated scrubber. As the cheese rotates against the brush, it is kept charged with liquid from the canister above.

Technology is important for monitoring humidity in caves, but staff should also have a feel for humidity based on sensations on the skin.

growth of microflora. Humidity is in the 55-70% range.

It is best to have a haloir for each type and size of cheese, but in practice this is often not possible. When different types and sizes of cheese are housed together, some cheeses may need to be protected in the haloir using curtains, etc.

The haloir should not be too large, since a large volume of air needs to be dehumidified before the cheeses start to be affected. Flooring should be tile or vinyl, and insulation is recommended. A dynamic evaporator is also recommended. Motion detector lights reduce the chance of excess light exposure.

The objective of the cave is to ripen the cheese, usually for cooked and uncooked hard and semi-hard cheeses. A natural site or a modified natural site such as a real cave is best. Underground sites have a large thermal mass and are very stable.

Temperature in the cave should be in the 8-12°C range, with humidity of 85-95%. If it is lower than 85%, the cheeses will lose too much moisture and risk splitting. It is also important not to over-size the room, as maintaining constant conditions is a challenge.

The sechoir or 'cold drying room' with a bank of fans to increase the evaporation rate.

Wet and dry bulb thermometers are best for calculating humidity, since they don't have electronic components that need regular calibration in this difficult environment. Using two different systems is best, since it allows for error checking. Electronic systems require a large amount of maintenance due to mould growth on the receptors. It is also vital for the staff working in the caves to get a feel for room humidity based on sensations on the skin.

A sechoir is simply used for drying cheese, not for flora growth, and is usually used to rectify problems such as rind breakdown.

Affinage 'hardware' and systems

Cooling systems

Static cold systems are best for affinage, since air movement is minimised and since they encourage condensation and increased humidity. Usually these systems circulate water at 4°C through cooling plates to keep a room at a certain temperature, for example at 10°C. This causes a finer condensation and reduces water pooling. Air intakes should be located in a way that draws air into the room over the static cooling system.

Humidity control

Ultrasonic space humidifiers are good and work best in small caves. Leaving a portion of the floor open to the soil beneath, covered in rocks or wood chips, also works well, assuming this meets legal food safety requirements. Misting works well either via pressure or an ultrasonic device. These are common in retail environments, so the cheeses don't have to be wrapped in plastic.

Air extraction

The goal of air extraction is to remove heavy gases such as ammonia from the bottom of the room. To achieve this, a circuit of ventilation pipes connected to an extractor and placed at ground level is required. Air intake should be located high in the room and preferably running over the static cooling plates. An extraction speed of between 0.2 and 0.4 m/s, which equates to approximately 20-40% of total air exchange per hour, is required. At this rate airflow is barely detectable.

Static cooling

Static cooing in an underground vaulted chamber is best, especially if the walls are porous and allow humidity to pass through. If the room is subject to great fluctuations in temperature, static cooling is not the best option. The cool air produced by static cooling systems is more dense so it falls under gravity. The amount of product in the space also affects how well this system works, as does the stock level and cheese arrangement. There must be

A static cooling system that circulates cold water around radiator fins to cool the air. The cool air then falls under gravity. A vaulted ceiling assists in the airflow.

As cheese mircroflora 'cascade,' their growth can be managed to steer the maturation into a desired direction.

space between the shelving and the walls to ensure even airflow around the cheese.

Ventilated systems

Ventilated systems are more reactive and are better suited to environments that need a higher air exchange rate. If there is a large turnover of product, or if the door is being opened and closed regularly, then a ventilated system is better than a static one.

In a ventilated system, cool air is produced by refrigeration and diffused through textile ducts to slow the air to under 60 cm per second. The rate of cooling within the condenser is also important, since if it occurs too quickly moisture will condense and reduce the relative humidity. To work well, this type of system needs to humidify the air within the textile sleeve.

The number of sleeves in a room is important to ensure correct airflow between the rows. The sleeve textile can be perforated in the desired areas, with perforations ranging in size from 5 to 20 mm.

Concluding observations

Affinage is a critical step in the production of quality cheese. Simply placing freshly made cheese into a cool room at 10°C is not enough. Temperature, humidity and airflow need to be managed to ensure that the microflora establish and grow to produce the desired qualities in the cheese. The various mircroflora appear in a 'cascade' that can be managed to steer the maturation into a desired direction.

Technology and service providers can help cheesemakers design and construct facilities that suit the needs of their products and markets. It is vital, however, that the affinage system is designed in reverse order, working back from the cheese – the type and quantity of a desired cheese will determine the type and scale of the affinage facilities required. ■