THE BEVERAGE PEOPLE

We recently asked author, Gianaclis Caldwell to provide us with some of her insights to the succesful production of bloomy rind cheeses. As a commercial cheesemaker from Pholia Farms in Oregon and the author of Mastering Artisan Cheesemaking she has a unique ability to communicate technical information to home cheesemakers. Enjoy.

Secrets of White Mold Surface Ripened Cheese Making

When you think of French cheeses, most of us immediately think of Brie and Camembert. These two surface ripened cheeses are easy to love and are, arguably, the most imitated cheeses in the world. They seem to represent sophistication of palate and are therefore the gateway cheese to a whole new world of taste. Camembert and Brie, however, are just the "edge-of-the-wedge" (that's my cheesy metaphor for tip of the iceberg). There are a myriad of other surface ripened cheeses- and indeed, most of them are French!

In order to make delectable bloomy rind cheeses you must either get lucky OR you need to understand the special needs of this cheese type, as it has the most complex ripening pattern of all. To begin gaining this understanding, let's take a look at the lifecycle of your typical, everyday bloomy rind and then we'll talk about the most common problems you might encounter when making these delicious types of cheese.

Understanding Lifecycle of White Mold Ripened Cheeses

Curd is produced either through a lactic (acid) production over a day or two, or through a quicker-set, rennet coagulation – or a combination of either method. The curd is not cooked or heated much beyond the ripening temperature. Usually it is made with aroma producing and acidifying mesophillic cultures (I like *Flora Danica* or *Aroma B*) along with white molds- *Penicillium camemberti* (same thing as *P. candidum*) and often *Geotrichum candidum*, (a mold that acts more like a yeast) usually at a rate of 3:1 or 4:1. Sometimes yeasts are added as well, we'll talk more about this later.

Molding and draining is done when the correct pH is attained. Lactic set curd is either directly ladled or the curd can be pre-drained in a bag for a couple of hours then ladled into the forms (this is really helpful when making pyramid shaped cheeses and logs - such as Pouligny Saint Pierre and Saint Maure). Rennet set curd is usually ladled without cutting, or after cutting into columns or large curds. Curd is best ladled in thin slices into the forms.

When the curd is put in the molds the pH of lactic curd is quite low, about 4.5. Because rennet curd has a lot of whey at molding, it goes into the forms at about 6.2-6.4 and will continue to drop in pH during draining to reach the goal of about 4.7 – 5.1. Draining usually takes 12-24 hours. The room temperature during draining should drop from 72 – 65 or so degrees by the end of the draining period. During this time, most shapes are turned several times with the exception of pyramid shapes which do not need to be (and really cannot be) turned.

The low pH at the end of draining means that the cheese has a low buffering capacity - due to the loss of calcium in the whey. Low buffering means the pH is easy to change. This is critical to the development of texture later. Low pH (high acid) also means that plenty of lactate will be present (you'll see why all this matters in a moment).

Salting occurs after the forms are unmolded. The right amount of salt (usually 1-2% of the weight of the drained curd) is critical to limit undesired molds and encourage the more salt tolerant white molds. It is also important for flavor. Getting just the right amount of salt on shapes such as pyramids is quite tricky and requires some practice. Over and under salting of this type of cheese is very common.

Drying occurs over a 1-2 day period. Room temperature is usually about 62F and the humidity 80-85%. Turning takes place a couple of times during draining (for pyramids, just lift and reposition). The surface of the cheeses must be dried after salting. Most molds don't like a really wet environment (they like humidity, which is different than actual moisture you can see), but undesirable molds like mucor (aka cats fur) do like moisture.

Ripening is done at 50-55 F and 95 % humidity until a good coverage of white mold exists. Turning takes place daily during this time. Ripening of bloomy rinds is a complex process.

Variables That Affect Succesful Ripening

Yeasts and *Geotrichum* arrive first and consume lactic acid (lactate) on the surface of the cheese. (Mold growth requires oxygen, so a good air exchange in the ripening area is critical). As the lactate decreases, the surface pH rises and then *P. candidum*, begins to grow. As it grows it consumes more lactate from deeper inside the cheese, increasing the pH and leading to the softening the cheese (more on that in a moment). The surface microflora produce ammonia (which you can often smell on these cheese types). Ammonia has a high pH (basic) and its presence also increases the pH of the cheese. Ammonia can diffuse toward the core of the cheese over its ripening if the curd is permeable and the cheese isn't too thick. The rate at which lactate is moved from the core to the surface and the rate that ammonia moves from the surface to the core, depends on the permeability of the curd. Some things that effect permeability are humidity and fat content. The right amount of moisture must be present and high fat will impede permeability.

While some softening of the curd occurs due to the breakdown of proteins and fats by the white molds, most of the softening occurs thanks to the pH change and how that affects the behavior of protein. Before milk is made into cheese, the protein clusters in the milk have a negative charge and are bonded to water. During cheesemaking, this charge is removed and the clusters bond with each other and repel water. The low pH of the cheese (thanks to positively charged hydrogen ions) keeps the proteins repelling water. As the pH of the cheese rises, the proteins reach their isoelectric point (at which they have no charge) and begin to attract and bind water (become hydrophilic). As they bind water, the cheese soften and become more creamy (at above 6.0 pH). This softening of the milk proteins is called resolubilization. Without proper humidity, the cheeses cannot soften, since there will be no water for the proteins to bind.

You may find that the cheese needs more time for ripening after it has a good growth of mold. The desired holding temperature for this is lower than that of a normal ripening schedule, usually about 38 F. This slows the mold growth and allows for softening of the paste. Often the cheeses are wrapped with special breathable paper (usually a layered paper) to prevent drying out and to keep the mold from growing too thick.

Eating occurs when you want it too! Some bloomies are best firm, others soft. Start trying them young and decide for yourself.

Common Problems and Solutions

1. **Not enough white mold growth:** Surface of cheese could be too moist, maybe not enough oxygen (or too much carbon dioxide in air, or too much *Geotrichum* growth).
   Solutions: Next time, dry the cheeses better; ensure airflow: spray on additional *P. candidum (camemberti)* during ripening.
2. **Too Firm Texture:** indications that pH was not low enough at draining. The fat content was too high. May be too low of humidity. And/or too low oxygen.
   Solutions: Track pH during make, lower fat content, monitor humidity, increase air exchange.
3. **Too Runny:** Presence of too much *Geotrichum* or other highly proteolytic microorganism (especially when runniness is at the surface only), too low pH (less than 4.5) during draining, too high ripening temperature. Too rapid of initial ripening.
   Solutions: Leave out the *Geotrichum*, heat treat or pasteurize milk to remove wild bacteria and yeast strains, monitor pH better, and/or lower ripening temperature once mold growth is established.
4. ***Toad Skin:*** Too much *Geotrichum*, too high ripening temperature or too long before wrapping.
   Solutions: Be sure to add less *Geotrichum* than penicillium, lower ripening temperature and make sure salt levels are exact (*g. candidum* doesn't like salt).
5. **Mucor** (Cat-Hair) **growth:** Too much moisture, too high pH at end of draining.
   Solutions: Choose mucor resistant penicillium strain, monitor pH at draining, ensure that drying phase is at 60-64 F and 80-85 % relative humidity.
6. **Bitterness:** Breakdown of proteins to bitter peptides by *P. camemberti* or other enzymes such as from rennet. Or too much ammonia build-up in rind.
   Solutions: Encourage things that promote even ripening so that the white mold doesn't breakdown the outer portion of the cheese too quickly. Use geotrichum to balance the proteolysis of penicillium. Use the right amount of culture and the right variety (with less proteolytic activity). Ensure proper air exchange and use a wrapping that is breathable.

Even though these cheeses might seem too persnickety to to work with, there is wiggle room for error in the process and still have a happy outcome. (Much like many relationships…) Just give it a try, document your process, and if you like the resulting cheese, there you go! Do remember, that because the pH goes up in these cheeses (from the safe, pathogen-unfriendly level of 4.7) that they can easily grow some nasty bacteria. This is why our ever-concerned FDA worries about soft-ripened cheeses. And you should too! Become educated about food safety and know if the milk you are working with is bacteriologically safe. Or pasteurize it.