

German Acorn Beer

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For this paper, I am using the generally accepted definitions of beer and ale, whereby ale is a malt beverage made with herbs and spices while beer is a malt beverage made with hops, rather than the modern definitions determined by the use of top or bottom fermenting yeasts.

Ale is made of malte and water; and they the which do put any other thyng to ale than is rehersed, except yest, barme, or goddesgood, doth sophysticat there ale. Ale for an Englysshe man is a naturall drinke. Ale muste have these properties, it muste be fresshe and cleare, it muste not be ropy, nor smoky, nor it must have no wefte nor tayle. Ale shulde not be dronke under .v. dayes olde Barly malte maketh better ale than Oten malte or any other corne doth ... Beere is made of malte, of hoppes, and water; it is a naturall drynke for a Doche man, and nowe of late dayes it is moche used in Englande to the detryment of many Englysshe men ... for the drynke is a colde drynke. Yet it doth make a man fatte, and doth inflate the bely, as it doth appere by the Doche mennes faces and belyes.¹

The first English documents cited by the OED in which the term *beer* signifies the hopped beverage are customs records of the 1390's. One of them, interestingly enough, is for Margery Kempe's town of Lynn, where barrels of beer imported by alien merchants from the low countries were taxed. Margery herself records what must be among the earliest instances of hopped beer consumption in English literature.²

The Malt

The process of malting grains for brewing was known for centuries.

...the Greeks ascribed the invention of malt to the Egyptians. The art of malting, the key to successful brewing, is thus one of the most ancient of processes. The art found its way from Egypt to Tyre and Sidon and thence to Carthage, Greece, Rome, Germany, Gaul, the Scandinavian countries and to Britain.³

Essentially, malting consists of allowing grains to germinate to a certain point, followed by the application of heat to halt the growth and kill the sprouts. What was left in the grain was a combination of convertible starches, amino acids, and amylase enzymes which enabled the mashing process – the production of fermentable sugars.⁴ We know that this process was well established by the time of Charlemagne by looking at the plans for construction of the St. Gall Monastery c.820 AD. The plans called for three separate breweries, a granary, a mill, and a kiln for the production of malted grains.⁵

Kilns used for drying the malt were primarily fired by wood, straw, or peat. Depending on the logistics of the kiln itself, the quality of the fire, and the proximity of the grains to the heat source, the individual grains might be lighter or darker. In earlier periods, these grains would not have

¹Boorde, folio Gii-iii

²Hagen

³Brookes, pg 26

⁴Palmer, pg 141-142

⁵Unger, pg 27-29

been separated out by color, but would simply have been used collectively. This would have resulted in a beer of color anywhere from a pale amber to a rich brown. Since beer styles were not defined to the level of detail they are today, color would have been largely dictated by individual kilns within each locale. However, by the mid to late 17th century, recognition of the differences between various roasts of malt was common. "...it then must be put on the Kiln to dry four, six, or twelve Hours according to the nature of the Malt, for the pale sort requires more leisure and less fire than the amber or brown sorts."⁶

"Colored malts resulted from uneven heat control which would have produced pale, amber and brown malts in the same batch, and likely in random distributions. Brown malt was also intentionally produced to reclaim slack malt."⁷

For this recipe, I used 8 pounds of 2-row malted barley produced in the 1:16 scale model malt house that I built for Ice Dragon. The malt was dried in a charcoal kiln that is part of the malt house, and subsequently roasted lightly in a conventional oven at 200 degrees for 2 hours.

The Hops

Hops was a well-known agricultural product in Europe by the 9th century. Records from two French abbeys, St. Germain-des-Pres and St. Remi, both show sizable quantities of hops brought in from a number of estates.⁸ In this case, it was largely used for medicinal purposes, having a mild analgesic effect as well as being purported to induce sleep.

The first documented link between hops and brewing comes from Picardy in Northern France, in 822, where Abbot Adalhard of the Benedictine monastery of Corbie, in the Somme valley near Amiens, wrote a series of statutes on how the abbey should be run. The many rules covered areas such as the duties of the abbey's tenants, which included gathering of firewood and also of hops – implying wild hops, rather than cultivated ones. Adalhard also said that a tithe (or tenth) of all the malt that came in should be given to the porter of the monastery, and the same with the hops. If this did not supply enough hops, the porter should take steps to get more from elsewhere to make sufficient beer for himself.⁹

A German abbess named Hildegard living in the abbey of Rupertsberg near the town of Bingen-am-Rhein documented hops use in beer in *Physica Sacra*, published c.1158. Her treatise is the first indication we have of hops being used for its preservative qualities rather than simply for flavoring.

It is warm and dry, and has a moderate moisture, and is not very useful in benefiting man, because it makes melancholy grow in man and makes the soul of man sad, and weighs down his inner organs. But yet as a result of its own bitterness it keeps some putrefactions from drinks, to which it may be added, so that they may last so much longer.¹⁰

Mascall explains how to prepare the hops for use in the brewery.

When your Hoppes be well tossed and turned on boarded floores, and well dried (as I haue

⁶Fox, pg 11

⁷Hardy

⁸Unger, pg 54

⁹Cornell

¹⁰Von Bingen, Book I, Chapter 61

afore shewed) ye shall put them into great sacks according to the quantitie of your Hoppes, and let them be troden downe hard together, which will kéepe their strength longer, and so yée may reserve them, and take at your pleasure. Some doe use, (which have but small store) to treade them into drie fattes, and so reserve them for their use, which is counted the better way and the lesse portion doth serve, and will longer kéepe their vertue and strength.¹¹

Hops contain two types of acid – alpha and beta. The alpha acids contain the chemical agents Humulone, Cohumulone and Adhumulone and are used to impart bitterness. Alpha resins are not very soluble and must be boiled extensively to impart bitterness in the beer. Beta acids are used to impart flavor and aroma. Unlike the alpha acids, these oils are water soluble and will quickly boil off. Typically, hops will impart flavor if boiled between 5-15 minutes and aroma if boiled for 1-3 minutes.¹²

For this beverage, I used commercially procured Tettnang hops (~6% Alpha) for bittering, and Hallertau hops (~4% Alpha) for flavor. Both strains of hops are cultivated in central Germany.

The Yeast

Although yeast as a microbe was not known until the early 19th century, yeast itself was known earlier than the days of the Roman empire. Recognized as both the froth that rose to the top of the fermenting vat and the sludge that fell to the bottom, its cause may not have been well known but its effect was certainly common knowledge among both brewers and bakers.

The traditions of brewing were carried on and thrived under the Catholic Church. Nearly every major monastery in medieval Europe contained a brewery that served not only the monks but also pilgrims and the surrounding villages (perhaps as an inducement for attending mass). One large monastery in Switzerland had three breweries, each adjacent to a bakery. Brewing and baking, in fact, were closely related activities in ancient and medieval times.¹³

The presence of an agent for fermentation was known at least in France in the 13th century. In a comprehensive law enacted by Louis IX in 1268, numerous strictures to ensure the quality of fermented beverages are laid out, including regarding the sale of yeast barm. “No beer yeast shall be hawked about the streets, but shall be all sold in the brew-houses to bakers and pastry cooks, and to no others. Beer yeast brought by foreigners shall be inspected by a jury before it is exposed to sale.”¹⁴

Spontaneous fermentation was undoubtedly the result of natural yeasts found in the atmosphere, or exigent on the leaves and skins of various ingredients added to provide flavor. Dominant strains of wild yeast in any locale would have been the primary means by which yeast made it into the fermenting vessel.¹⁵ Wild yeasts by their very nature are aggressive, highly tolerant of a hostile brewing environment (able to survive in more extreme temperatures or in a high-alcohol

¹¹Mascall, pg 89

¹²British Brewer, *Hops*

¹³Kiefer

¹⁴Salem, pg 19

¹⁵Meade

beverage), and more likely to produce what we would today call 'off flavors'.

Spontaneous fermentation—what I am hereby referring to as nothing short of “immaculate”—is an age-old practice, first by accident and then by intention, that truly puts Mother Nature at the helm of brewing magic. This type of fermentation takes place when ales are fermented with wild yeasts—from an open window, for instance, or already residing in a barrel...¹⁶

Before the advent of refrigeration and advances in the science of fermentation in the mid-nineteenth century, almost all beer was, to varying degrees, sour. The culprits were pre-modern sanitation and poorly understood, often naturally occurring bacteria including *Lactobacillus* and *Pediococcus*, as well as *Brettanomyces* yeasts, which can contribute a hint of tartness and characteristic 'funky' flavors and aromas, sometimes compared to leather, smoke, and 'horse blanket'.¹⁷

Relying on airborne yeasts, brewers virtually never got a distinctly high or low fermentation variety but rather something mixed. The method worked but was haphazard and raised the risk of infection from unwanted yeast strains which could ruin the beer.¹⁸

However, the same bed of yeast may be cultured from batch to batch in an effort to modify the yeast to recognize and react to the ingredients of a particular recipe. In this rudimentary culturing process, the yeast will evolve slowly with each new batch, producing a predictable set of qualities in the finished beverage. The medieval brewer would facilitate this culturing by scraping the foam layer from a currently fermenting batch or by setting aside the lees from the bottom of the fermenter in order to use it to 'start' the next batch.

When flowers and other leafy herbs or fruits were added to the brew it almost certainly provided necessary yeasts; for yeast, as such, was not an ingredient of itself. The people of the Middle Ages knew that yeast was necessary but didn't quite understand where it came from. The barn (yeast froth) was scraped off the top of the fermenting beer, saved and used to make bread or promote the next batch of brew.¹⁹

Some brewers did, it seems, recognize the possible infection of their brews by airborne yeast, a situation first mentioned at Munich in 1551. The realization was slow in coming, however. As early as the mid-fourteenth century a Flemish recipe book mentions adding yeast to beer, and it seems likely that already by 1300 brewers were using some of the foam skimmed off the top of the fermenting beer of the last brew to start fermentation with the next one. By the sixteenth century, brewers commonly added yeast to wort from cultures which they kept separate and which they controlled and maintained. Regulations in Harlem in 1519 and 1550 leave no doubt that brewers added yeast once the wort was in the fermenting troughs.²⁰

The greatest example of culturing yeast from batch to batch comes to us from the Trappist breweries of Belgium – coincidentally the same regions that provided most of the first hopped beers to be imported to the British Isles. Of the remaining ten Trappist abbeys that produce beer,

¹⁶Herz

¹⁷DeBenedetti

¹⁸Unger, pg 152

¹⁹Westerson

²⁰Unger, pg 152

two date to our period: the Brasserie d'Orval in the Gaume region of Belgium, and the Abbey of Notre Dame de Saint-Remy near Rochefort. The Rochefort beers have been brewed with the same strains of yeast being cultured forward batch-to-batch since 1595.²¹ Although the current Orval brewing facility only dates to 1931, the original brewery dates back to at least 1628, based on writings from the abbot at the time.²²

On a side note, in addition to the boiling of water for the mashing process and the natural contrabacterial qualities of hops, the yeast contributes something to the sanitary nature of beer.

If the beverage contains viable yeast cells these will ensure that anaerobiosis is maintained and so inhibit the growth of aerobic contaminants. Further antiseptic qualities are introduced by many of the supplementary flavouring agents, for example, hops... In historical times, therefore, beer was a useful source of dietary calories, minerals and vitamins but could also be viewed as sanitised water. In medieval times this property was of no small significance when one considers the number of potentially fatal diseases which could be contracted after imbibing polluted water. This is illustrated by the story of Saint Arnold, the patron saint of Belgian brewers, who reportedly saved the inhabitants of a village gripped by a cholera epidemic, by blessing the local brewery and advising them to eschew water and from then on drink only beer.²³

For this particular batch, I pitched yeast that I have been carrying forward from multiple batches. The original strain I used was a Danstar Windsor strain from Lallemend laboratories. I used the lees from the original batch five times, each time in a brown ale, with this project being the sixth batch (fifth carryover.)

The Acorns

As far as nuts go, acorns enjoy an unusual composition. Acorns are largely made up of starches and fiber whereas most other type of nuts (hazelnuts, walnuts, pecans, almonds, etc.) are largely made up of proteins and oils/fats. Because of this structure, acorns have a unique property among nuts – they can actually be malted.

The acorn itself is very similar in content to barley. It is 72 to 80 percent starch, 8 to 12 percent protein, and has a low oil content. One of its major drawbacks is that, like the potato, it contains high concentrations of the enzyme *polyphenol oxidase*. Therefore, the beers made with acorns will not be of the lighter variety. In test mashes the color comes out to be a brown shade along the line of a Vienna or Oktoberfest-style beer.²⁴

Acorns are among one of the more ancient of nuts enjoying not just a nutritional role, but a mythical one as well. “In Greece, the oak too was reckoned the tree from which men first sprang; they called it the ‘first mother’, which fed men, mother-like, with her own acorns.”²⁵ (Ovid)

²¹Fourneau

²²Saint Peters List

²³Boulton, pg 6-7

²⁴ Whistler

²⁵ Watts, pg. 203

“Acorns, too, were a charm against lightning, and ornamental designs used to be made from them and put in cottage windows.”²⁶

Prima Ceres ferro mortalis vertere terram instituit, cum iam glandes atque arbuta sacrae deficerent silvae et victum Dodona negaret. Ceres was the first to instruct mortals how to turn the soil with iron, when once the acorns and the wild strawberries of the sacred forest were failing and Dodona was refusing food.²⁷

Virgil implies that Ceres' grain superseded acorns as the foodstuff of choice. "*Liber et alma Ceres, vestro si munere tellus Chaoniam pingui glandem mutavit arista.*"²⁸ Virgil, 1.7-8, c.30 BC. A loose translation is, “Ancient deity and kind Ceres, who by your bounty aided the Earth in replacing Dodona's acorn with plump grain.” This implies that acorns were the food of choice for mankind prior to the development of agriculture.

In the 15th century, we see acorns mentioned as a principle ingredient in pottage – a hot stew similar to porridge. “Chikeney. Do almond mylke yn a pott. Take cornels of okekornes [acorns] rostydy; grynd hem, draw hem with wyn or ale. Do therto a grete porcyon of sigure, saundres, & safron & othri poudris, & seson hit up with poudres; & take the schelles & set abovyn.”²⁹

Sweet acorns are indeed the best to eat, as they have a lower tannin content. Their low fat and high carbohydrate content make them a suitable food for both humans and animals; pounded and washed in running water, boiled or roasted, they can be quite pleasant. When ground they provide a flour, used in times of hardship, which has given this benign food a bad name.³⁰

“Meanwhile, in an anonymous 16th-century survey (*Descrittione dell'isola di Sicilia*, 1546), listed... as typical of Val Demone [ed. note: a historical and geographical region encompassing the north-eastern third of Sicily], were **acorns**, olives, grapes, chestnuts, almonds, walnuts, pine nuts, hazelnuts, figs, pears, cherries, apples, plums, peaches, and mulberries.”³¹ [bold added for emphasis.]

Acorns in mead are referenced in a kenning within the Ancient Lay of Gudrun, referenced as part of the Volsunga Saga.³² Although brown-burnt acorns are listed here as an ‘ill’, malted or fresh acorns would not be so. Given that ‘blood of all the wood’ [sap] is also listed as an ill when maple and birch sap are not considered so, and that ‘god-doomed dead beasts inwards’ [diseased entrails] is listed as an ill when non-diseased animal innards are part of the daily diet, I contend that the variants listed here are abominations of standard ingestible ingredients. Thus, the inclusion of acorns in the list implies that unburnt acorns are in fact used in food and/or beverage production.

²⁶ Watts, pg. 228

²⁷ Boyd, pp.73-4

²⁸ Maro, 1.7-8

²⁹ Hieatt, pg. 71. The recipe is cited as being from a 15th century source.

³⁰ Riley, pp. 7-8.

³¹ Riley, pp. 498-9.

³² Thorpe, pg. 216

In that mead were mingled
Many ill together,
Blood of all the wood,
And brown-burnt acorns;
The black dew of the hearth,
And god-doomed dead beasts' inwards
And the swine's liver sodden,
For wrongs late done that deadens.

Acorns are mentioned as an ingredient added along with gruit in 16th century Germany. “Ginger, anise, and cumin were used in beer in Germany and various other things including laurel, marjoram, mint, sage, and acorns were used at one time or another in addition to gruit.”³³

The Discovery Channel did a documentary entitled “How Beer Saved the World.” A snippet of transcript describes what is the first use of acorns to make beer in the new world, giving us a gray-area reference circa 1622:³⁴

“Beer was an absolute essential item for their survival.” [Dr. Greg Smith, Historian]

Narrator: When the beer supply ran out, the colony hung in the balance. The settlers had to find a way of making beer. But they had no barley or hops until squirrels came to the rescue. Sounds nuts, but they gave settlers the idea of using acorns, and it worked. Acorn beer kept Plymouth alive.

As stated earlier, acorns can be mashed. However, there are some pre-brewing actions that must occur in order to prepare acorns for brewing. First of all, acorns are very high in tannin. The choice of which species of oak to harvest can assist with the reduction in tannins. In general, acorns from the red and black oak families have more tannins, while those from the white oak family have less.³⁵ If you are unsure of whether the acorns you are harvesting are from the white, red, or black oak families, a simple way to judge is by the size of the acorn cap. The larger the cap, the more tannins contained in the acorn.³⁶ If one is concerned about the authenticity of the specific species of oak, a good choice is the cork oak – a low tannin option that was cultivated throughout southern Europe in the middle ages, and which has migrated to North America. The cork oak produces acorns that are long and slender, shaped similar to a football when the cap is removed.

To harvest the acorns, pick them directly from the tree or soon enough after they fall that they have not yet fallen prey to rodents or insects. They should still be greenish in color, as that ensures they are fresh. In order to ensure that the acorns are suitable for consumption, remove the caps and drop the nut into a bowl of water. If it floats, this is evidence that the core has been hollowed out – generally by a type of larva called an acorn grub or oak weevil.³⁷ You can also do a visual check for small holes, caused by the grub gnawing its way out of the husk.

³³ Unger, pg. 32; referencing Sa Leuven: #11592, fol. 1-14 [1568]; Bing, *Hamburgs Bierbrauerei*, pp. 293-4; Bleyswijck, *Beschryvinge der stad Delft*, pp. 711-13

³⁴ Discovery Communications, Inc.

³⁵ Shaw, 2013.

³⁶ Deane

³⁷ Deane

Once the acorns are harvested, decide whether you want to convert them directly into an adjunct or if you want to mash them as a principle fermentable. If you decide you want to mash them, treat them the same way as raw barley. Allow them to sprout – a sprout of less than an inch is sufficient to indicate that the acorn has begun transforming its starches into convertible sugars.³⁸ *“What I do to prep acorns for consumption is let them germinate, so the starches turn into malt sugar.”*³⁹ Once they have sprouted, you can continue on with the next steps. If you are planning to use them only as an adjunct, you can proceed directly from harvesting to the next step.

Shell them. Once the cap is removed, set the acorn in a hard surface and crack it with a hammer. Once the shell is cracked, it should peel away fairly easily. It will be even easier if the acorn is soaked through. If the acorns were harvested green, they can be shelled with a paring knife. Once you have collected the nut meats, choose the leeching method best suited for your final purposes. For making bread or mashing, use the cold water method. For use as an adjunct, you can use the faster boiling method.

To use the boiling method, use two pots of water. Boil the acorn meats in one pot while the second pot heats to boil. The water in the first pot will darken. When it turns brown, pour off the water and immediately place the acorn meats in the second pot. Do not allow them to cool in between, or you risk binding the tannins to the starches. Once the meats are in the second pot, fill the first pot with fresh water and begin heating it back to a boil. Repeat this process until the water no longer changes color.⁴⁰ It should take between 2 and 4 hours, depending on the tannin content of the acorns.

To use the cold water method, crush the shelled acorns, place the ground pieces in cool water and leave sit until the water turns brown. Pour off the water and replace it with clear water. Repeat this process until the water no longer changes color. This could take anywhere from 3 or 4 days to more than a week depending on the level of tannin in the acorns.⁴¹ Bear in mind that Shaw is discussing cold leeching from the perspective of making flour for bread... not adjuncts for beer. You do not want to use cheesecloth to strain the water (since you do not want to preserve the oils or proteins), and you do not want to grind your acorns to flour (as the glutens remaining from cold leeching will cause your mash to gum up and you will be unable to properly sparge.)

Once the leeching produces no change in water color, dry out the nut meat by placing it in the sun, or by placing it in the oven with a heat setting of 200 degrees Fahrenheit for two hours.⁴² You don't want to roast the acorns... you just want to dry them out so they do not mold. At this point, you should have some rather bland-tasting acorn bits. From this point on, if you allowed your acorns to sprout, you can treat the acorn meal just as you would treat malted barley. You can also change out barley pound-for-pound in your beer recipes, although you may find that leaving some barley in the mix will improve the overall flavor. If you used the boiling method of leeching, or you did not allow your acorns to sprout, you can still use the acorns in your brew; but they will not

³⁸ Ocean, pg. 2

³⁹ Deane, a quote from biologist and nutritionist Peter Becker regarding acorns.

⁴⁰ Alden

⁴¹ Shaw, 2013

⁴² Whistler

significantly contribute to fermentation. Treat them as you would rice syrup solids or unmalted barley when formulating your recipe. In this case, if you want a nuttier flavor from the acorns, it is okay to roast them at 350 degrees Fahrenheit for enough time to achieve a desired color.⁴³

I harvested my acorns in late August from a red oak tree. I let the acorns sit until early February, allowing them to sprout in the process. Once sprouted, I performed the water test to glean out the insect infested nuts. I then cracked the shells with a hammer and placed the nut meats in clean water, cold-leeching to get rid of the tannins. I changed the water three to four times a day for two weeks, then twice a day for two more weeks until the water ran clear. I then roasted the nuts in accordance with the instructions above.

On brewing day, I ground the nuts in a grinder designed for coffee beans to get a course meal, which I added directly to the mash tun with the barley. My ratio of grain to acorn was 4:1 – 8 pounds of malted barley to 2 pounds of malted acorns. This was a single-step infusion mash using the “known ratio” of three parts boiling water to one part tap water to achieve the correct mashing temperature. I used a total of 5 gallons of water, and held the mash for 60 minutes. After draining the wort, I sparged with another 4 gallons of water, achieving a total boil volume of just under 7.5 gallons. I boiled the wort for 120 minutes, adding the bittering hops with 45 minutes remaining and the aroma hops with 10 minutes remaining.

Primary fermentation took place in an open plastic bucket covered with a linen towel, and lasted 11 days. The wort was then transferred to a closed glass carboy for the remainder of the fermentation cycle, which last 23 days. Bottling was done in a Cornelius keg. As of the date of Kingdom A&S, the beer will have been aging in the keg for about 5 months.

⁴³ Alden

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