"The office of the maltster,
and the several secrets and knowledges
belonging to the making of malt"

-The English Housewife, 1568

The Malt House and the Making of Malt

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The process of malting barley is simple yet as with any perishable goods or product that is deemed by its quality, the details of production are endless. Variable methods are basically the same due to the biology of seed germination dynamics, but the details that have been documented are innumerous! The best recorded documentation of malting that occurred before the year 1600 was written by Gervase Markham in The English Housewife, a synopsis of the duties detailed chapter by chapter covering everything expected of a household woman at the time. [1] Another piece, The Complete English Brewer, written in 1747 also gives a short but concise description of the malting process, see attached. It is a synopsis of the same process outlined in the previous, basically verifying the technique of the time period.[2] Previously, I verified the methods used to prepare malt as detailed by Markham. However, now I have taken this process a step further and explored the manner in which malt was made in this time period by creating a miniature AND functional malt house. In this writing I have reviewed the process of malting while simultaneously describing the rooms and functions of the malt house and my reasoning for designing the structures in certain manners.

A brief description of the malt house, detailed by Markham:

For the general situation of the it would (as near as can be) stand upon firm dry ground, having prospect every way with open windows and lights to let in the wind, sun, and air which way the maltster pleaseth, both to cool and comfort the grain at pleasure, now also close-shuts or draw windows to keep out the frosts and storms, which are the only lets and hindrances for making the malt good and perfect; for the model or form of these houses, some are made round, with a court in the middle, some long, and some square, but the round is the best and the least laborious, for the cisterns or vats being placed (as it were) at the head or beginning of the circle, and the pump or well (but the pump is best) being close adjoining, or at least by conveyance of troughs made as useful as if it were near adjoining, the corn, being steeped, may with one person's labor and a shovel, be cast from the vat or the cistern to the floor and there couched; then the when the couch is broken it may in the turning either with the hand or with the shovel be carried in such a circular house round about from one floor to another, till it come to the kiln, which would also be placed next over against the pump and cisterns and all contained under one roof; and thus you may empty steeping after steeping and carry them with one person's labor from floor to floor, till all the floors be filled; in which circular motion you shall find that ever that which was first steeped shall first come to the kiln, and so consequently one after another in such sort as they were steeped, and your work may ever more be constant and your floors at no time empty but at your own pleasure, and all the labor done only with the hand and shovel without carrying or recarrying or lifting heavy burdens, which is both troublesome and offensive and not without much loss, because in such cases ever some grain scattereth.

My design is very similar to what is described above, rectangular in shape, having windows in each malt floor wall (although the shutters are incomplete at this time, they will be available in the future). An example of a circular malt house is shown on

the attached map of the Sutherland's house at Thentham, Staffordshire. Also included is a reference to an existing malt house at Harvington Hall in the Archdiocese of Birmingham, of which I am trying to obtain photos[3].

The cistern is at one end of the house and the malt is passed from the cistern to the next floor where it is heaped for couching. It is then passed at regular intervals to the other floors until the sprouting is complete, at which point it reaches the kiln (achieving the "full circle" of being passed throughout the malt house). Simultaneously, more grains are steeped and follow suit throughout on the same path. At no time are there any floors unfilled and without production. The upper floor also contains garners for storing unmalted and malted grain.

I. Grain Selection

Determining the proper type of seed needed can be an arduous process. Modern brewing companies have taken the European Morovian 2- row seed and genetically crossed it with a North American 6-row to form a suitable 2-row variety[4]. The aspects it has is high starch conversion, less chaff, low protein, and the benefit of growing in a two row pod that is less crowded than the 6-row, making the seeds more uniform.

In the U.K. today, the imported North American 6-row is grown for animal feed. It produces many more grains per bushel, and although high in protein, still has a good ability to be mixed with artificial enzymes to produce a quality beer for a much cheaper price than the 2-row variety[5].

In period, Europe was probably using a less sophisticated 2-row than the one created this century. Nonetheless, the properties would be the same. More so, the soil had more to do with the quality of how the grain turned out than did the genetics of the seed. There is no mention of the genetics of the seed in Markham's book, but there is plenty about soil being the determining factor for growing good grain. In fact, the barley was described by the type of soil it was grown in… "the best barley to make malt on…is the clay barley" [1], as opposed to sand or clay/sand mix.

Further, a good grain was described as having "whiteness, greatness, and fullness…and the thickness of the husk" [1], as a resistance to pestilence. Plus, malted grain should always taste "exceedingly sweet, both in smell and taste, and very clean dressed" [1]. These are the other methods in period for selecting a good grain.

I have elected to use wheat grains in this first production run through the malting facility. My reasons being that the grain is readily available from my father who grew the wheat and being a smaller grain is much more apt to germinate in a shorter time frame. I knew that bedding times on the floors would be difficult to determine initially so using wheat was the right answer this time. Also, wheat is a common adjunct in making beer. There is also no husk to worry about having to sieve away and wheat

thereby makes a good demonstration product. The grains are as described, uniform and light in color. The finished malt should be sweet tasting and sweet smelling.

II. Steeping

I washed the grains well, steeped them in clean water for 24 hours. Note that Markham suggests "and for the space of three nights you shall let the corn steep in the water"[1]. I have found that there is more of a chance for microbial contamination due to the longer amount of time and not changing the water regularly. Due to the enormous size of the cisterns in period malt houses of the time, changing the water was probably inefficient.

One of the great things about steeping the grains is that the good grains will absorb moisture to 70% of their original weight. Any bad grains (ones that have dried up) will float to the top and can be poured off, "for much light corn and others will come forth with this drain water"[1]. The end result is a plump grain as opposed to a dried grain. I weighed my grains before steeping and found that indeed after 24 hours, the total weight was 70% more than the original weight.

The best way to make a cistern by Markham:

Now the best way of making these malt cisterns, is to make the bottoms and sides of good tile shards, fixed together with the best lime and sand, and the bottom shall be raised at least a foot and a half higher than the ground, and at one corner in the bottom a fine artificial round hole must be made which being outwardly stopped the maltster may through it drain the cistern dry when she pleaseth and the bottom must be so artificially level and contrived that the water may have a true decent to that hole and not any remain behind when it is opened.

I have opted to purchase a fired clay pot that has been glazed for moisture resistance. I tried to make a cistern using concrete and concrete sealer but found that I could not make it stabile enough. The pottery however is providing a very good cistern and I will probably keep it and later outfit it with a drainage tube. It currently does have a drain spout. (See the first room on the lower floor, just opposite the kiln.) Notice that the garner above has a trap door that can be opened to shovel waiting grains into the cistern.

III. Germination

'Merry malt moved wavily, Through the floor beyond…' - *A 12th Century Irish Poem*

The grains were then let out the bottom of the cistern (which sat a few feet off

the floor) onto the floor in a heaping pile. The floor could have many different material structures, i.e. wood, brick, stone, dirt or the very best, plaster. Plasters being the best for absorbing water and remaining cool and wet. [1]

Decription of the plaster malt floor by Markham:

The next floor to this of earth is that which is made of plaster or plaster of paris, being burned in a seasonable time, and kept from wet, till the time of shooting, and then smoothly laid, and well leveled, the imperfection of the plaster floor is only the extreme coldness thereof, which in frosty and cold seasons so bindeth in the heart of thegrain that it cannot sprout, for which cause it behoveth every maltster that is compelled to these floors to look well into the seasons of the year, and when he findeth either the frosts, northern blasts, or other nipping storms to rage too violently, then to make his first couches or beds, when the grain cometh newly out of the cistern, much thicker and rounder than otherwise he would do, and as the cold abateth, or the corn increaseth in sprouting so to make the couches or beds thinner and thinner; for the thicker and closer the grain is couched and laid together, the warmer it lieth; and so catching the heat, the sooner it sprouteth and the thinner it lieth the cooler it is; and so much the floor in sprouting. This floor if the windows be close and guard of the sun sufficiently, will (if necessity compel) serve for the making of the malt ten months in the year, only in July and August which contain the dog days it would not be employed, nor in the time of any frost, without any great care or circumspection.

I have poured floors out of plaster of paris and have heaped the grain onto the first floor where it is couched. My intent was to have a cold floor so that I could still malt during the hot days of summer. Also the plaster of paris is very good at adsorbing moisture. It also stores moisture, providing it to the grain as needed but not allowing the grains to stand in wetness.

The grain was let to germinate, rotating the outer surface grains to the inner part of the pile every so often. In this type of malt house, just the transfer of the grains from floor to floor was sufficient turning for the day[1]. Putting grains into a large pile is harmful to it if not turned, for heat is allowed to build up inside the pile and the sprouting can occur at different rates. The grains will have inconsistent modification, "and so catching heat, the sooner it sprouteth" [1]. I have spread my grains to evenly fill the floors to approximately three inches deep. Markham suggests to spread the sprouting grains evenly on the floor "not above a handful thick." [1]

The process of converting starch to sugar begins with the formation of the rootlets at the base of the seed. This occurs during the first three days of germination. Immediately thereafter, the acrospire (or soon to be stem) is stretching out away from the roots to the other end of the seed. Gervase Markham described it as "it come or sprout at both ends, which husbands call akerspyerd" [1]. (note that one could be misled from this statement that the sprout begins at the opposite end of the seed from the rootlets, but I believe Markham's intent was to describe the *full modification* as having

concluded once the sprout reached the end of the seed and appeared out from underneath the husk.) Once the acrospire reaches the end of the seed, the term "modified" is described. The grain has at this point converted all its starch to sugar. From this point on, the seed will use its store of sugar to further grow the acrospire into a stem.

In the malt house present, the wheat was transferred to a new floor once per day. This allowed for the necessary turning. When the grains reached the final floor they were fully modified and ready to be dried in the kiln.

IV. Kilning

As soon as the seeds were fully modified, the grains were piled onto the rafter floor above the kiln. The warmth of the fire slowly dried the malt. Plus it was stirred often to aid in complete drying. Kilns in period varied vastly. The most beneficial of kilns were the type that were like a bread oven, having a brick floor over the small fire that was then covered with a type of thin straw mat. The malt was then spread out on a layer of hair-cloth on to of the mat. The heated straw would dissipate sweetness and flavor into the malt. The smoke in these types of kilns was diverted using a damper out the back. In this manner, the malt did not take on the flavor of the smoke. In addition, the mat was then used later to sift the now loose rootlets and husks off of the grains. (see the diagram of this type of kiln, attached). [6]

The kiln and drying floor as described by Markham:

Now over against the kiln hole or furnace (which is evermore intended to be on the ground) should a convenient place be made to pile the fuel for the kiln, whether it be straw, bracken, furze, wood, coal, or other fuel; but sweet straw is of all other the best and neatest. Now it is intended that it is intended that this malt house be made two stories in height, but no higher; over your cisterns shall be made the garners wherein to keep your barley before it be steeped; in the bottoms of these garners standing directly over the cisterns shall be convenient holes made to open and shut at your pleasure through which shall run down the barley into the cistern. Over the bed of the kiln can be nothing but the place for the hair-cloth, and a spacious roof open every way that the smoke have free passage and with the least air be carried from the kiln, which maketh the malt sweet and pleasant. Over that place where the fuel is piled and is next of all to the bed of the kiln would likewise be other spacious garners made, some to receive the malt as soon as it is dried with the come and kiln dust, in which it may be to mellow and ripen; and others to receive the malt after it is screened and dressed up;

There is a kiln now of general use in this kingdom, which is called a French kiln, being framed of brick, ashlar, or other fire stone, according to the nature of the soil in which husbands and housewives live; and this French kiln is ever safe and secure from fire, and whether the maltster wakes or sleeps without extreme willful negligence there can no danger come to the kiln; and in these kilns may be burned any kind of fuel whatsoever, and neither nor the smoke offend or breed ill taste in the

malt, nor yet discolor it, as many times it doth in open kilns.

But now for the matter or substance whereof this bedding should be made, the best, neatest, and sweetest, is clean, long, rye straw with the ears only cut off and the ends laid even together, not one longer than another, and so spread upon the rafters of the kiln as even and thin as may be. There be others which bed the kiln with mat; and it is not much to be misliked, if the mat be made of rye straw sewed and woven together according to the manner of the Indian mats.

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Also, the hotter the fire, the darker or more burned the grains will become. Straw is the best fuel for making light colored malt… "soft fire makes sweet malt". Scorched malt was known as "firefanged" and this is what the dark beers are made from, although Markham states that this malt is now "good for little or no purpose" [1].

I have elected to use a variable wattage light bulb (100-200-300 Watts) as my heat source instead of fire. It will provide the necessary heat range enable me to add variety to the color of malts I make, without any ill tastes from smoke or chemicals. Pasteurization is also possible by roasting the final malt product to 175 degrees for three hours and then a minute at 212 degrees to destroy any mold or microbial contamination.[7] Plus of course, it was the only feasible and safe manner to provide heat in such a small area without the danger of burning down the house.

V. Storage

When the malt is dried and ready to store, it is transferred to the garner located in the rooms next to the drying area. Here it is safe from moisture due to the warm drying effects of the air from the kiln, and kept cool by the plaster floors, thereby keeping away vermin and worms.

The garners as described by Markham:

The best garner then that can be made both for safety and profit, is to made either of broken tile-shard or broken bricks, cunningly and evenly laid, and bound together with plaster of paris, or our ordinary English plaster, or burnt alabaster, and then covered all over both within and without, in the bottom and on every side, at least three fingers thick with the same plaster, so as no brick or tile shard may by any means be seen, or come near to touch the corn; and these garners you may make as big, or as little as you please, according to the frame of your house, or places of most convenience for the purpose, which indeed would ever be as near the kiln as may be that the air of the fire in the days of drying may come unto the same, or else near the backs or sides of chimneys, where the air thereof may correct the extreme coldness of the plaster which of all things that are bred in the earth is the coldest thing that may be, and yet most dry, and not apt to sweat, or take moisture but by some violent extremity, neither will any worm or vermin come near it, because the great coldness

thereof is a mortal enemy to their natures; and so the safest and longest these garners of plaster keep all kind of grain and pulse in best perfection.

My garners at this time are unfinished. Plans are to pour the plaster walls and then also be able to fit these walls with tile caps.

V1. Conclusion

The malt house has proven to be a very labor saving device. I have had to do minimal work in producing this wheat malt, turning the grain only once or twice per day (transferring to the next floor included). In a manner of one week's time I have managed to nearly effortlessly produce 15 pounds of wheat malt, enough for three, 5 gallon batches of wheat beer. Malting times will vary for different types of grain.

Special thanks to my sponsor, Osrik, who's inspiration and support over the years have helped me to continue to seek more brewing knowledge. Also I owe the construction of this project to my husband, Kaz, without his guidance and helpfulness, this project would still be at ground zero.

Notes:

1. Markham, Gervase, The English Housewife, 1568-1637, Chapter VII.

2. Watkins, George, Complete English Brewer, London, 1747. p. 72

3. Sambrook, Pamela, Country House Brewing in England 1500-1900, The Hambledon Press, London and Rio Grande, 1996, p.p. 202 and 276.

4. Letter from Coors Brewery (see attached)

5. The Biotechnology of Brewing and Malting, Cambridge Univ. Press 1985, p.p. 8-19.

6. Lohberg, Rolf, Das grose Lexikon vom Bier, Scripta Verlags, p.p. 221.

7. Jay, James, M., Modern Food Microbiology,