

A ROOF OVER YOUR HEAD

The way to keep a round house dry.

David Freeman 2018

A Roof Over Your Head

These are the observations of half a life-time of building, dismantling, working with, and sleeping in, constructs of British iron-age round houses. The focus is strictly on how the roofs work, and does not cover the construction of the building, nor the roof frame. Some of the houses were fancies of peoples needs, whilst others were serious attempts to construct the house as close as possible to the methods used in the iron age period.

A roof Over Your Head

Without a doubt, the most important part of any house (in Northern Europe) is the roof. It covers and protects everything in the house, from the sun, wind, and the rain. The roof of a roundhouse was (most of them) covered with a thatch of some description. The Romans comment that the Britons "...live in round, thatched houses...".

When building roundhouses in modern times, we are just beginning to get to grips with a technology that had been in use in Britain for over three thousand years, developed in late Neolithic, and phased out during the Romans. The following information is gathered from my own experience (over the course of forty years) of building and using roundhouses, following the prehistoric style.

Materials

Materials that can be used for covering a roof are:

Straw (the ripe dry stalks of wheat, rye, barley, oats)

Reed (*Phragmites australis*)

Heather (*Calluna vulgaris*)

Bracken (*Pteridium*)

Sedge (*Cladium mariscus*.)

Eel Grass (*Zostera angustifolia* (Hornem.) Rchb.)

Wooden shakes (commonly called shingles).

Turf (grass with roots).

Raw Hide (untreated animal skins, cow in particular)

Angle of Roof Slope

When rain falls on a roof, thatch has one major task to fulfil, and that is to help the water to run down, and fall off, the roof. Ideally, the raindrops hit the roof, and the water runs down the length of the thatch. At the worst, the rain penetrates under the top layer of thatch, and saturates the whole roof. There is narrow design range of slope on the roof to help the thatch work correctly and efficiently. The highest angle that thatch needs to be is around fifty degrees from horizontal. This helps run-off where the house is in the areas of highest rainfall. The higher angle speeds up the water flow, and minimises water absorption. Any higher, and it results in a very tall roof, taking a greater quantity of materials to build, with no added advantage. The lowest angle that works is forty two degrees from horizontal. At this angle the slope is shallow, the water absorption is higher, and it is only recommended in drier areas, or in a specialised area of a roof, such as a porch (extension over a doorway). The optimum slope is forty-five degrees from horizontal. This gives the best compromise of water run-off, and minimal materials in the build.

Straw or Reed

Most roofs are thatched with either Long Straw (*Triticale*), or Norfolk Reed (*Phragmites australis*). Norfolk Reed grows on the margins of water, and requires no processing other than cutting and bundling. Long Straw is a wheat, harvested whilst still just green, and tied into sheaves. The sheaves are stooked (stood up) in the field, until dry; transported to storage; threshed (the grain beaten out of the head); then tied back into sheaves ready for use. On a roundhouse, straw has a life span of up to twenty years (usually ten to fifteen being the normal), whilst reed can last up to thirty years plus. An average iron-age farm had fifteen to twenty acres under the plough, but not all of it every year, and not all of it down to wheat. This could produce, perhaps, a ton of straw per year. So

with a 10m diameter house taking between 1 ton – 1.5 ton to thatch, two years of straw would be needed, per roof. A compromise could be reached by working with the surrounding farms, and take turns trading or supplying straw to neighbours when required – particularly if your house was a larger diameter, it could take the straw from five or six farms. Reed, on the other hand, is easier to come by, if you are living near a river or lake. If reed beds were well maintained, reed can be cut in large amounts every year. Both reed and straw stalks are tapered along their length, so it important to use it the right way up when thatching. It is sealed at the top, with an open end at the base. Get it the wrong way up, and the rain will penetrate the stalks and speed up rot.

Thick or Thin

Modern thatching methods (professional thatchers) tend to lay the thatch on almost horizontal, with just the butt end of the thatch showing, resulting in a roof so thick (anywhere between 30cm-45cm) that there is little airflow through the thatch. Smoke penetration of thick thatch has been observed at Butser Ancient Farm, through tar colouration of the straw, and fixing pegs, and it can be seen quite clearly that the smoke does not make it all the way through. A number of round house constructions across Britain have been thatched this way, all with the result that when a fire is lit inside, there is a build up of smoke within the house, and breathing conditions become difficult. This problem can be avoided if the thatcher is instructed to use a ‘half-coat’. For best results, and to use the minimum of thatch, it is best to follow the slope of the roof.

It can be said: -

- A thatch that looks thick, is not necessarily a good thatch.
- A thatch that looks thin, is not necessarily a bad thatch.

Thatching

As you work up the roof, each layer of thatch is fastened onto a horizontal rod of wood, that is fastened onto the rafters. (These rods are called purlins). The purlins are stepped horizontally, in parallel, up the roof. Reed is longer than straw (on average up to twice the length), so spacing between each layer of thatching is different. As an average, straw can be spaced vertically at around 20-25cm per step, reed at around 45cm. As a roundhouse will have a fire lit inside, the thatch will need to be thin enough to breath, that is, to allow the smoke to percolate through the roof covering. The thickness of the layer of thatch also varies, with straw at around 20-25cm, and reed as little as 15cm (reed does not absorb as much water). Thatching is always started at the bottom of the area to be covered, and continues upward, layer after layer. Each layer must overlap the lower layer, and cover any method of fastening that is used. The vertical overlap is between 50-75% of the lower layer. It can benefit the shape of the roof, as well as prolonging the wear, by starting with a ‘kick layer’ at the base, making the bottom edge of the roof a little thicker. The second layer is place directly on top of the kick layer, The final shape of the rim, either to a point, or flat and square, does not seem to make any difference to the wear. The reason for this is the bottom of the roof has the greatest run of water over it - and is the area that is touched and handled the most. The overall surface of the roof can be a dressed slope, or stepped rings. Both wear at a similar rate, but with a slight advantage with rings. It is quicker (no time needed to dress the thatch into a slope), and uses less thatching material. Convention favours a slope, but only because of usage and familiarity. Ethnic peoples around the world favour stepped rings.

The Danger of a Second Coat

In time, the thatch is exposed to the weather and sunlight; and it breaks it down and makes it fragile. As bits break off the butt ends of the thatch, it gets shorter, and thinner. Eventually this leads to the need to re-thatch, or repair. A mistake easily made is to put a second coat of thatch onto the

roof. This can be a disaster - if you wish to continue to use a fire in the house. As the new coating of thatch is put on the roof, the old coat crumbles and becomes compressed. This stops the airflow through the roof, and hence the smoke cannot escape. Examples of this problem have been observed at New Barn Field Centre, Dorchester; Butser Ancient Farm, Hampshire. It is better to strip the old thatch off, and put a new coat on the roof.

Wooden Tiles

In some areas it may be easier to cover the roof with tiles. For the longest lasting tiles, oak should be used. The tiles have two names, depending on how they are made, "Shakes" are split, "shingles" are sawn, (the later is unlikely to be seen in archaeology). The wooden tiles are split from lengths of tree trunk approximately 45-50cm long, and follow the grain of the wood. The tiles will all be the same length, but will be varying widths. Each tile will need to have a hole drilled through the top edge, to take a wooden peg. This needs to be a tight fit so that it holds in place. The projecting end of the peg underneath the tile, is then used to hang it by hooking over the purlins. There is a risk of them blowing off in a very high wind. A good overlap, both sideways and vertically, is needed to ensure a waterproof roof, and there is no problem with smoke escaping between the tiles.

Turf

Turf is grass that has been lifted in sections, complete with the roots attached. It can be lifted in long strips, and rolled up for ease of handling. The weight will be high, and will double when wet. The house frame will need beefing up. Do not attempt this unless the archaeology of the house you are building, shows heavier than usual posts. Even on a modest house it will run to tens of tons.

An under-layer will be needed on the roof first, to stop the turf falling between the rafters and the purlins. This can be woven matting, bracken, reeds, straw, or in the extreme, a layer of skins. At least two layers of turf will be needed. The first layer must be put on green side down, and second layer is put on green side up. As the outer layer continues to grow, the roots will bind the turf together. You must leave a hole at the top of the roof, around the rafters, to let the smoke out. Turf does not breath. Do not use commercial turf, grown to be laid as a lawn. This is far too thin, unless you are prepared to put five or six layers on. It will leak when it rains hard, and die in dry weather. When you are cutting your own turf, be prepared to lose many, many square metres of good pasture. (If you are setting up an area for crops, de-turfing may be the answer)

Smoke Ceiling

When a fire is lit inside a house, and the building comes up to temperature, a stable smoke ceiling is maintained. This is completely flat at the base, and the height of this layer, from the floor, is determined by a balance between the amount of smoke generated by the fire, and the volume and speed that the smoke that filters out of the roof. Mixed with the smoke layer is the burned gas from the fire, most of this gas is carbon dioxide, and contains very little oxygen. This mixture fills the upper volume of the roof, and results in a low oxygen buffer that extinguishes any sparks that rise from the fire. The height of the smoke ceiling can be designed into the house, by varying the thickness of the thatching as you get further up the roof. (The upper half of the roof can be thatched thinner).

Eaves (Soffits)

When building a house, it is advisable to seal the gap between the top of the wall, and the thatch. This stops air movement around the eaves internally, and will help the smoke settle in the

roof without disturbance.

Hole in the Top

Many people think that a roundhouse has a hole in the roof. This myth seems to persist through illustrations that still show the rafters exposed, and smoke escaping. Even archaeological illustrations show ALL the smoke coming out at the top, even if they have thatch at the peak. If you observe a roundhouse that has a fire inside, you will see the smoke escaping over the whole surface of the roof (above wall height), with the majority of it coming out on the lee side of the roof. It is best seen on a damp day. If you were to leave a hole at the top of the roof to let the smoke out, you could potentially create a number of problems. First, and most obvious, all the heat would leave the house, and it would be difficult to keep warm. Then there is the problem of the ends of the rafters being exposed to the weather. They would suffer from rot, and the rope lashing that holds the primary rafters together would be at risk. Finally, the burnt gas from the fire (that should be trapped in the roof), no longer protects the thatch from rising sparks. An up-draught may be created with the rising heat, and the gas would accelerate as it leaves the house through the small hole at the top. This could allow sparks from the fire to rise into the thatch, and could cause an increased risk of fire. (This last reason has yet to be tested to destruction).

Please note: By observation, the Glastonbury House M74 (at Butser Ancient Farm) was used almost daily, over a number of months, had excessive damage to the top of the thatch resulting in open gaps.. The fire that was lit every day in the house did NOT result in setting fire to the house.

Preservation

Without a fire, a large population of assorted insects take up residence. Flies over-winter in great numbers, and this attracts spiders, and birds. Spiders do no harm, but birds can hear the flies, and will pull the thatch apart in an effort to get a meal. The side effect of maintaining a fire inside a roundhouse (safely), is the preservation of the thatch and as the smoke seeps out of the thatch, it keeps insects and fungus at bay. A coating of wood tar builds up inside the roof, helping to preserve the timber frame of the roof. This also reduces the risk of setting fire to the roof. For the best-prolonged results, a fire should be kept burning twenty-four hours a day. One useful side effect of the smoke in the roof space is that it is an ideal place to hang food to be smoked and preserved.

Re-Thatch

When a house needs a re-thatch, there are a few things to keep in mind. As an experiment, it must be remembered that the house would probably have remained occupied during the re-thatch. The amount of thatch available in any year might have meant that a total roof re-thatch may not have been possible in the larger houses. It is possible to work a section at a time, maintaining the integrity of the house. A triangular work area probably works the best, stripping a small width (2m) of thatch at a time, and replacing with new material. To maintain a waterproof roof on an overnight break, skins can be used to bridge between the old thatch (put under) and the new thatch (put over).

Please Note. This method was used successfully to repair and re-thatch two houses at Butser Ancient Farm, Glastonbury M59 and M74.

Second Floors

In the face of a growing opinion that some round houses may have had an upper floor, here are some of the requirements that would have to be fulfilled. Remember, if you do not intend to

have a fire in the house, the lifespan of the building will be much reduced.

Diameter	This determines the area of the upper floor
Height of walls	This determines how much vertical space you have for an 'upstairs'.
Smoke	This determines if you can breathe!
Smoke ceiling	This determines that you will die if you are in the gas from the fire.
Evidence	The evidence for this idea has yet to be found.
Roof slope	There is no room to stand up around the edge of the upper floor. (2m wide)

Snow on the Roof

The weight of snow is not a problem, unless it is extreme. The insulation of the thatch allows snow to lay on the lower slopes, whilst the upper slopes will stay clear as the heat seeps through the roof. The melt point on the slope on the outside matches the level of the smoke ceiling on the inside. This only works if the fire is on during the snow fall! Otherwise the roof stops breathing.

Hurricane

Lastly, an observation gained during the UK hurricane of 1987. The author was in a roundhouse as the storm hit, in the Chiltern Open Air Museum, Buckinghamshire. It was noted that as a gust of wind hit the house, it created a low air pressure inside the house because the thatch allowed the air to be sucked out of the house faster than it was coming in the door. It was so extreme the low pressure made your ears 'pop', and the movement of the structure gave the impression that the house attempted to 'squat down' closer to the ground. During the very high-speed gusts it was observed that the rafters in the roof rippled under the pressure, and there-by displaced the rush of air.

The conclusion? It is almost impossible to blow a roundhouse down!

Addendum

Twice the author has observed that the wind is a risk to the structure of a round house. At Butser Ancient Farm, in 2002, a whirlwind (mini tornado) was observed to severely damage the Longbridge Deverell house, by getting into the front of the house, and blowing apart the porch from the inside. Some years later, in 2006, the same house was structurally damaged in a storm, when the whole house frame was pushed out of vertical as the internal posts lost traction in the post-holes.

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