Cereal conservation systems in the British Isles, prehistoric to modern times – a summary

Introduction

Three historical grain conservation systems will be described. These pre-date the current grain conservation system which was adopted generally in arable farming areas of the British Isles in the 1960s. It is characterised by combine harvesters, on-farm grain dryers and facilities for the bulk storage of grain, and can be recognised as a mechanised version of the Late Roman one described below. The use of grain dryers for malt conservation (part of the process of brewing beer) may be regarded as an associated activity in cereal farming and will only be mentioned in passing here.

Two distinct farming zones can be defined in the British Isles. These are the northern and western parts of the British Isles and the lowlands of southern and eastern England; they can be distinguished by the different balance in their arable and pastoral regimes and the types of cereal crops which predominated in each zone. These are defined in terms of how crops were conserved for winter storage - whether crops could be air dried in the harvest field or had to be dried artificially (high-drying / grain drying kilns). It should be noted that grain driers represented a significant add-on cost and would only be built if they were essential for the cereal conservation process involved.

The conservation of cereals in the north and west of the British Isles, prehistoric to modern times

This has involved the artificial drying (high-drying) of cereal crops since prehistoric times. It can be regarded as a practical response to the wetter and cooler climate which has generally prevailed in these regions over the centuries (Wales, Scotland, Ireland and the Welsh borders and the north midlands, north-west and northern borderlands of England). It is necessary to high-dry cereal crops in these regions: the moisture content of the grain has to be reduced so that it can be safely conserved for winter storage, and not become rotten and ferment.

Grain could be dried on the domestic hearth. However, free-standing drying kilns were an important innovation as they allowed this function to be taken out of the domestic situation. The earliest known example has been excavated in Co. Tipperary, Ireland, and dates from about 1600 BC. High-drying also formed an essential part of preparing ‘hulled’ grains for human consumption. This is because oats, generally the most viable crop for cultivation in these regions, is a hooded grain. This means that it has a characteristic hard and indigestible shell / hull / glume / husk which has to be high-dried and de-husked before it can be ground into meal - otherwise the husks would cause havoc in the human digestive system. It is a convenient happenstance that high-drying also makes the husks brittle, which facilitates this process. This is described in the archaeological world as the ‘parching’ of hulled grain varieties. De-husking could be achieved by beating the dried oats with a wooden mallet or a stamping tool called a hummeler, and sieving the product by hand to get rid of the husks. The grain kernels could then be ground into meal with a hand-operated quern.

Water powered grain mills were introduced in these regions in the early 7th century. These had either horizontal or vertical waterwheels. Such mills were important in this farming system in that they offered the labour-saving option of working two processes with the same machinery. Firstly, the millstones could be used de-husk the high-dried grain; the runner stone was set to a height of 4-5 mm above the fixed bed stone so that the husks were rubbed off the grain as it made its way from the eye to the periphery of the millstones. The husks could then be sieved off by hand. Secondly, the runner stone could then be lowered to 2-3 mm above the bed stone to mill the grain. The latter is called ‘single-pass’ milling, or ‘low grinding’. When the two processes are combined it is called ‘double-pass’ milling because the shelled grain has to pass twice through the millstones. Such double-pass milling with oats remained normal practice in most of these regions up until the 1960s. Since then the emphasis has shifted to the production of flaked oats to make porridge, a different process.

The Late Roman high capital input cereal conservation system, 1st to late 4th centuries AD

This was developed to exploit the markets provided by the establishment of the Roman colony in Britain in the first century AD. Grain in bulk was required to supply and support a permanent army of occupation. The system came to an end in the late 4th and early 5th centuries: the infrastructure of the Roman colony collapsed and the sophisticated market economy for agricultural produce ceased to exist.

The system featured large estates centring on well-appointed farmhouses, or ‘villa rustica’, and was concentrated in the fertile arable regions of southern and eastern England. It was characterised by a

significant investment in buildings for grain conservation and storage. There is also evidence for the use of water power in this farming economy, which is perhaps to be expected given the nature of the capital investment in the system. For example, a grain mill complex at Fullerton, Hampshire Downs, had two vertical waterwheels located in tandem, each of which worked a set of millstones; the mill was active in the 3rd and 4th centuries.

The cereal conservation process was similar to that used in the north and west of the British Isles – it was simply adopted on a commercial scale. This allowed the large scale cultivation of hooded cereal varieties. Spelt wheat was particularly favoured and had been grown generally in England since the beginning of the Iron Age, c 500 BC. It was a useful multi-purpose crop that contained the protein needed to make raised bread, and could also be brewed to make a palatable beer. It was not high yielding, but generally offered a reliable yield: the protective hull sheltered the grain from fungal attack and meant that the grain was unlikely to shed when ripe. It also had a wide cultivation range; a viable crop was possible in wetter areas which had poor quality (fairly acidic) soils.

There is abundant archaeological evidence for the grain dryers that were a crucial part of the system. All wheat crops destined for the market were conserved with the aim of putting the grain into dry storage before the worsening weather of autumn. The crops were threshed more or less straight away after reaping, and grain dryers were used to reduce the moisture content from 17-20% (what it would be in the field) to 13-14%. It was crucial that moisture content be reduced to this percentage in order to stabilise the grain and stop it fermenting and spoiling when bulk-stored in open bins or compartmented granaries.

The low capital input cereal conservation system

This replaced the Late Roman system in the lowlands of southern and eastern England, and was based on the practice of air drying crops in the harvest field. It probably represents the revival of a traditional system as there appears to be no evidence for grain driers in these regions before the establishment of the Roman colony. The system was also characterised by its longevity, lasting from the 5th century until the 'combine harvester revolution' in the 1960s. It began as part of a survival package practiced by subsistence farmers, but also offered flexibility - the system was readily adapted for market economies. Crucially, the system did not depend on a significant investment in non-domestic farm buildings. Water powered grain mills were the only significant capital input in the system in the Anglo-Saxon period; they were introduced generally from the 10th century as a response to the development of a sophisticated internal market economy – hand milling with the quern was slow and labour intensive and had become a serious blockage in the supply train. Major developments in harvesting technology (eg the development of the threshing drum) did not begin until the 1780s.

The viability of the system depended on the climate in these regions; the weather was usually warm and dry enough in late summer to allow crops to be air-dried in the fields where they were harvested. The crops were reaped, bound into sheaves and built into stooks in the harvest field. The stooks were then dried in the sun and the breeze until the moisture content of the grain had been reduced to 15-16%. This was just dry enough to allow the crop to be stored medium-term in the sheaf and the threshed grain to be kept short-term in the sack. Above this percentage the sheaves might ferment and catch fire in storage. The sheaves were usually built into temporary free-standing ricks which were then thatched to make them weather-proof for the winter; these were dismantled when the sheaves were needed for threshing. The sheaves could be threshed, sacked off and milled more or less simultaneously – from start to finish without the need for intermediate storage facilities. Also, storing grain in the sheaf offered flexibility as the sheaves could be threshed during the autumn and winter as and when the need arose or the market price for the grain became favourable.

There was also a shift to the cultivation of 'naked' rather than 'hulled' wheat varieties in the lowlands of southern and eastern England in the Early Anglo-Saxon period. This is because naked wheat varieties do not have the protective shell / glume / husk of hulled grains – they did not need to be high-dried and de-husked and only required single-pass milling. The shift can be recognised as a trade-off; the advantages of cultivating hulled wheats were outweighed by the cost and effort of processing them for human consumption.

It follows that grain dryers were unusual in this lowland cereal farming system. In fact, they were only built when needed for specific local needs and conditions. For example, the malt kiln excavated at Higham Ferrers, North Northamptonshire, dated to the late 8th – early 9th century, functioned as part of a supply chain that provided beer for a Mercian royal estate based just a short distance away at Irthlingborough. Another example is the grain dryer excavated in the Anglo-Saxon settlement of Sherburn, Vale of Pickering, North Yorkshire. It was in use during the 7th century and its function was

to high-dry rye, the principal cereal crop grown in the area. Rye is a hooded grain which means that it must be high-dried as part of the process of making it safe for human consumption.

Finally, it should be noted that grain dryers continued to be needed in the border areas between the northern and western and the southern and eastern farming zones that are defined in the Introduction. An example of this is the preserved Stainsby Mill on the Hardwick Estate, Derbyshire. Although rebuilt in the 1850s, it still illustrates the issues faced by millers in these border areas. It has both a grain drier and oatmeal milling machinery and a completely separate set of machinery for grinding wheat and dressing flour. The wheat crop was normally air-dried in the region; it only had to be high-dried in the kiln during an exceptionally wet harvest time.

The above summary has been developed from a paper lodged in the Mills Archive Library, Reading:

Practical agriculture and archaeological data: an analysis of cereal farming systems in the British Isles