RURAL LIFE AND FARMING

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In just the same way as it is impossible to isolate the Celts, so it is to determine a specific kind of agriculture which might be described as 'Celtic'. That agriculture formed the basic economy of Europe and the Mediterranean zone by the first millenium BC is not in question. However, outside the classical world our knowledge of the nature of agriculture is severely restricted by the lack of any significant documentary sources. A few tantalising references occur in the works of Greek and Roman commentators, but they are barely enough to construct any kind of coherent picture. The practice of agriculture, probably more than any other industry, is constrained by the nature of the soil and vicissitudes of climate. It is, therefore, important to recognise that agriculture in Europe and particularly in Britain is quite different to the agriculture of the Mediterranean zones. In consequence the classical works on agriculture cannot be used to provide any kind of generalised insight into what happened in Europe. This applies equally to soil preparation and treatment, and to the particular crops cultivated. Bearing in mind that agriculture in the sense of food production probably began in the latter part of the seventh millenium BC in the fertile crescent at the eastern end of the Mediterranean and gradually spread throughout Europe to include Britain and Ireland by the fourth millenium BC, specific Mediterranean practice would have been adapted and changed quite significiantly as man responded to soil and climate change. Similarly within the Celtic world of the first millenium BC (arguably the land area stretching from the Pyrenees to the Rhine and from Ireland to Romania), contemporary farming practice would have varied quite considerably from one zone to another, with differences being dictated by the varied climatic zones and soil types. Until the quite recent advent of agrochemicals, farmers had been able to grow only those crops which any particular landscape allowed them to cultivate. The ability to influence the natural prevailing conditions was extremely limited.

The construction of a picture of agriculture in the Celtic world has to be based upon the data extracted by archaeological excavation, and inevitably these data are fundamentally inadequate. Agricultural practice and its produce are by definition ephemeral and annual: ephemeral in the sense that agricultural operations are carried out day by day (ploughing, manuring, planting, hoeing and reaping), and annual in the sense that the fruits of farming depend upon the seasons of the year to reach maturation. To isolate an annual event in the archaeological data is virtually impossible. It is also true to say that climatically each year is a unique event having quite specific challenges and responses which normally defy clear identification. The data extracted by archaeology range from pollen grains, impressions of seeds fired into pottery, carbonized seed (more often than not the result of an accident), dessicated and waterlogged plant remains (the former virtually non existent in Europe), traces of ploughing left in underlying rock or subsoil of soil layers identified to the period, ancient fields surviving as monuments in the landscape, occasional tools and implements or fragments thereof, and a limited range of iconography. In fact it is this last type of data which gives some of our best source evidence for agricultural practice in north-west Europe but the majority is to be found in Scandinavia rather than in the limited `Celtic' zone. However, the close similarity of the other surviving data suggests that the agricultural responses were the same then, and it would be foolish to deny such useful evidence simply because it falls marginally beyond the Celtic lands.

In any approach to understanding the remote past it is critically important that the argument or interpretation is directly driven by the archaeological evidence. Where an assumption of a practice which must have occurred to sustain the existing data, every effort must be made to identify such a practice by exploring the processes which might have left physical trace evidence previously unrecognized or unidentified to such a practice. The provision of winter feed for livestock is such an example which is examined below. The following discussion will demonstrate how little is known for this period and how much there is yet to discover.

Agriculture is traditionally divided into two general categories - arable and pastoral farming. There seems little doubt that the great majority of farms, with minor exceptions, practiced a mixture of these two categories with any emphasis on one or the other being dictated by soil and climate. In broad terms Britain can be divided into two agricultural zones - the region south-east of a line from the Bristol Channel to North Yorkshire (but including south-east Scotland) is primarily devoted to arable farming, while north-west of that line pastoral farming is the norm. Given the minimal change in climate between the present day and two thousand years ago, the same constraints would have obtained for the Celtic farmers.

The single most significant element of arable farming is the plough itself. A full understanding of the technology of tillage is regarded as an indicator of successful arable farming. The normal appreciation of Celtic or Iron Age farming falls somewhat short of this state; the plough being discussed simply as a stick ard which does little more than scratch the surface of the soil, and hence the farmers merely scratched a living from the soil.

To compound the issue the assumption has normally been that the soil must also be light and, therefore, relatively poor. From the peat bogs of Denmark a number of these so-called stick ploughs have been recovered which, on close examination, rather bely their dismissive description. One typical example is referred to as the Donneruplund ard, named after its find location. The reason for its deposition in the bog is generally thought to be ritualistic, but since the tool was actually worn out and broken it was most probably dumped there with a curse rather than a blessing. The simple difference between an ard and a plough is that the latter is fitted with a curved mouldboard which inverts the soil. Its probable introduction occurs in the tenth century AD. Nevertheless, it is a complex tool comprising a main share which is in fact a pointed stick, a heart shaped undershare fitted with spigots which hold the main share in position, a curved handle or stilt all of which pass through a mortice joint cut in the foot of the main beam and locked into place with wedges. The wear pattern on the undershare (one side was worn away to the spigot thus causing the ard to be abandoned) strongly suggests that the ard was used in a particular and specific manner. One side was continually in undisturbed soil, the other was in disturbed soil. If this is the case, the ploughman must have ploughed the soil in `lands' or blocks rather than going up and down the field laying one furrow immediately against another one. This sophistication has been enhanced by the construction and testing of a full scale replica. The angle of presentation of the main share, the pointed stick to the soil surface is *c*.29^{o} from the horizontal which ensures it neither bounces along the surface nor digs itself into the ground. Quite simply it holds the implement at a steady level in the body of the soil. The heart-shaped undershare lifts the soil, which as it flows past the foot of the main beam of the ard is thoroughly stirred. In practice it is extremely efficient and is able to cope with a wide range of soils including heavy loams as well as the light rendzinas. A large number of iron socks or sheaths designed to protect the end of the main share from excessive wear have been found on Iron Age sites throughout Europe. Without such a protection (none was found for the Donneruplund ard), the main share wears away at an average rate of *c*.625mm per hectare. Given the ease of adjustment for the main share this hardly represents a problem.

In addition to the actual ard, there are a number of rock carvings primarily in the region of Bohuslan in Sweden, which show such an ard being drawn by a pair of horn-yoked cattle. The great majority of these rock carvings date from the late Bronze Age to the Early Iron Age. Some even show the vertical bar between the main beam and the share suggesting either a method of adjusting the angle of penetration or the presence of a coulter which, in effect, is a vertical knife. In using the Donneruplund replica one major problem encountered was the bulk of vegetation and roots which collected between the angle of the share and the main beam. A coulter would have been a useful addition. An edged iron bar, however, even should it survive out of context is unlikely to be identified as a coulter. Under close examination this so-called stick plough has become an extremely successful and useful implement. So successful in the lighter soils, in fact, that it produced furrows in the ploughsoil up to 300mm deep, which meant that the field area had to be smoothed or levelled out before it became a seed bed.

A second ard of totally different design was recovered from another peat bog in Denmark at Hvorslev. Quite simply the mainbeam is an appropriately curved tree branch and the trunk from which the branch grew was fashioned into a horizontal share. At the rear a mortice joint was cut into which the handle was fixed. This ard, too, was worn out and most probably thrown away. Trials with a full scale replica proved quite disconcerting in that it failed totally as a tillage implement. However, it too is represented on a rock carving scene from Littlesby in Sweden. This depicts as a ritual what can only be a spring sowing scene. Both the ploughman and the bulls are shown with rampant phalluses, a bag the ploughman carries is interpreted as a bag of seed and two underlying horizontal lines are thought to be the furrows waiting to the sown. Changing the nature of the trials with the Hvorslev ard from attempting to plough the soil to drawing seed drills in a previously ploughed soil demonstrated quite clearly that this was its primary function. The furrow it produced averaged just 200mm deep, the ideal depth for seeding in north-west Europe. If such a practise was the norm, first ploughing followed by seed drills, then another major reassessment is necessary. If the seed is sown directly into a prepared drill, the total germinability of the seed, normally in excess of 95%, is enjoyed by the farmer. In other words the input is total as opposed to broadcasting the seed which has a loss rate of up to 75%, as both biblical parable and practical trials confirm, requiring considerable over input to achieve the same end product. Without increasing the input, lower production is the inevitable result.

There remains yet a further problem posed by the archaeological data. These are the plough or ard marks found on prehistoric and later sites in all types of soil. They comprise interrupted score marks in the underlying rock whether that be chalk, clays and or loam. They often indicate multiple ploughing and occasionally cross-ploughing. Repeated trials with the above ards completely failed to produce any kind of comparative evidence. Indeed only when things went terribly wrong with the ard tip burying itself into the soil with commensurate risk and danger to the ploughman did any kind of mark in the subsoil occur.

Unfortunately no physical plough or ard like those above has yet been discovered but further prehistoric rock art scenes perhaps hold the key. There are three particular examples, one from Sweden, one from southern France and one from northern Italy which depict an ard scene with a share set at an extremely steep angle to the ground. None of these could be used as a regular plough to create a tilth because the angle of presentation is such that the implement would bury itself almost immediately. In north-west Spain in the province of Galicia a similar type of plough or ard was in use in this century. In effect it was an oak hook, the point tipped with an iron sheath, the upper curve attached to a straight plough beam fitted at the rear with two grab handles. It was used specifically to break up ground previously uncultivated or which had lain fallow for many years. The manner of use is especially interesting. The implement was attached toa pair of bulls (each district kept such a pair for this purpose as well as the more prosaic reasons of husbandry), a ploughman firmly grasped the handles at the rear of the beam, the point of the hook just locked into the ground surface, two further men armed with goads simultaneously jabbed the bulls rumps. They in turn lunged forward to escape the goads, the hook was driven fiercely through the ground effectively burying itself in uprooted vegetation and soil and the whole ensemble came to a juddering halt after 2 to 4 metres' progress. At this point the hooked share, for such it is, is wrestled out the soil and the operation repeated again and again. The ensuing upheaved clods were broken down with mattock hoes into the semblance of a tilth which was then ploughed with the regular ard. Excavation of this process revealed a typical plough or ard mark in the underlying surface.

Re-examination of the actual prehistoric ard marks indicates the average length to be between 2 and 4 metres, often with an area of greater disturbance at the one end. It would seem that these marks rather correlate with such an action of what can best be described as a rip ard or sod buster. It is most unlikely they are the result of regular ploughing which can occur several times a year since within a relatively short time they would be cancelled out. The implication of the ard marks, however, does not cease with the argument for a rip ard but also supports the idea of fallowing land to allow it to recover.

Finally with regard to ards and ploughing, if the evidence of the rock art is admissible, then a remarkable ploughing scene from Krokholmen in Bohuslan discovered in 1971 but previously unpublished gives even more insight into agricultural practice. The scene clearly shows a double team of cattle, undoubtedly cows, pulling an ard with a ploughman at the rear holding the stilt of the ard and another figure midway between the teams seemingly in close attendance to help steer the cattle. The major importance of this scene is the use of a double team of cattle, in effect increasing the traction power presumably to cope with a heavier soil. Apart from this one example to date, the increasing of the cattle to two or more spans is thought not to occur until the Middle Ages. The evidence is quite clear that a panoply of ploughs or ards existed in the Celtic period raising the level of tillage technology far above that implied by the description of a stick ard. Given this level of equipment and skill there is clearly no particular landscape or soil type which could not be tackled successfully.

There is an abundance of evidence for prehistoric fields and field systems to be found in Britain. As a general rule they have survived as field monuments on hill slopes delineated by the low banks and lychets which formed through soil creep at the lower side of the field, during their use. Abandonment has allowed them to become stabilised by vegetation, and subsequent grazing means that the majority are under grass. Unfortunately the agrochemical revolution of the past forty years has seen great swathes of these fields destroyed by the plough. Many can still be seen outlined by soil marks where once the lynchets stood but even these are disappearing at a depressing rate. Ironically, the prehistoric fields had survived on the poor light soils primarily in Wessex and Yorkshire, and without chemical boosting of these soils they would survive still. The fact that Iron Age farmers were cultivating the poor soils themselves raises a question over the extent of land under cultivation at that time. The distribution of Iron Age sites across all soil types in all regions clearly denies that the fields which survive as monuments were the only areas cultivated. Undoubtedly the whole landscape was under intensive and necessarily diverse use. Because these fields have survived on the poor soils rather implies that during the Iron Age pressure on cultivable ground was greater than at any other time until the present century.

The fields themselves tend to be square rather than rectangular in shape, and given the ard marks described above were probably cross-ploughed as a rule. Certainly a better tilth is gained by cross ploughing, the clods of earth being attacked from two directions. Also because the organic content in the soil is high, the roots and plant material tend to be streamed in the direction of the plough. Turning at right angles to the stream does break the material down more successfully and in addition brings persistent root masses to the surface allowing them to be pulled out more easily. One of the greatest enemies to the farmer, a great colonizer of cereal fields, is couch grass (*Agropyron repens*) which needs continuous rooting out if the cereals are to thrive. The field sizes range in extent from 0.16 to 0.25 hectares and broadly represent an agricultural days work. Such an area can be ploughed, sown, hoed and reaped within a working day. There is seemingly no other reason to offer for their size since technologically the farmers were fully equipped to make much larger fields. The larger fields of the Roman period, for example, were cultivated with exactly similar equipment.

Very few fields have been examined archaeologically and evidence for field boundaries is extremely slight. Some fields have been edged with a continuous wattle fence. Perhaps hedges were set between the fields. Recent evidence supports the possibility of hedges on top of enclosure banks around settlement sites. Perhaps the cultivated fields were simply left without specific physical boundaries like those to be seen in Galicia in north-west Spain. Alternatively, blocks of fields may have been fenced in. By the same token if the fields were fenced, no clear evidence of gateways has yet come to light.

Our knowledge of the crops cultivated in the latter part of the first millenium BC comes almost exclusively from carbonised seed, seed accidentally burned and turned into charcoal within the settlement zone, except for representations on the reverse of some Celtic coinage. In this latter case a stylised ear of cereal is shown which is most probably Emmer wheat rather than the more usual interpretation of barley. Both being bearded cereals the confusion is easily understood. If the representation is to indicate wealth or even to advertise a product like the representation of vines on Roman coins, the likelihood of it being Emmer wheat is reinforced given Caesar's comment that this was a major export from Britain to the Continent. The seed evidence, however, is comparatively slight and gives at best only a presence and absence listing. The critical point is that carbonised seed is invariably recovered from the settlement zone, and therefore, has had to have been moved from the production zone, the fields, into the settlement area probably during harvesting before it can suffer the accident which led to its carbonization. That representatives of all the plants was within the cultivated areas being brought back into the settlement is extremely unlikely.

The list of cereals available to the Celtic farmer differs little from that of today. There were four types of wheat, four types of barley, oats, rye and probably millet.

Wheat:	Emmer	*Triticum dicoccum*
	Spelt	*Tr. spelta*
	Club	*Tr .aestivo-compactum*
	Bread	*Tr. aestivum*
Barley:	Two-row naked	*Hordeum distichum var.nudum*
	Six-row naked	*H. hexastichum var.nudum*
	Two-row hulled	*H. distichum*
	Six-row hulled	*H. hexastichum*

Other	Oats	*Avena sativa*
	Rye	*Secale cereale*
	Millet	*Panicum miliacum*

The finds argue predominantly for wheat and barley as the normal crops. Their presence and diversity, however, give no insight into how they were actually cultivated nor is there any documentary evidence. Britain has a distinctly different climate even to the near Continent and undoubtedly this would have been exploited to the full. Caesar describes our winters as less severe (*remissioribus frigoribus*) and the humid temperate climate, driven as it always has been by low pressure from the Atlantic provide ideal conditions for cereal production. The principle of autumn sowing is traditional in the Mediterranean zones and presumably with the arrival of the first farmers to Britain in the Neolithic this practise was continued. However, because the winter here tends to be over by early March and summer is considerably less severe and barely arrives until late June or even July, spring sowing of cereals is a positive option. The advantages of two sowing seasons are not inconsiderable since the harvesting time is staggered, the winter sown crops being ready before the spring ones; the work load similarly is spread and - of economic interest - the yield from autumn sown crops (because of winter frosts checking growth and subsequently increased tillering by the plants) is greater. In addition some cereals like millet are frost sensitive and can only be sown in the spring. Specifically, it allows for greater areas of land to be cultivated and therefore greater returns.

The evidence of the seed drill ard discussed above emphasises the probability that seed potential was maximised but it gives no real indication of seed input. The fundamental assumption must be that an adequate seeding rate had evolved in the sense of minimum expedient input to perceived maximum output. Research into prehistoric crop yields at Butser Ancient Farm spanning more than twenty years has been based upon this premise. The minimum input assumed in the research programme is a mere 50 kilos per hectare, approximately a quarter of the modern sowing rate. The other issue of paramount interest with regard to crop yields is whether fields were manured or not. The general assumption is that manuring was practised from the Bronze Age onwards, based upon abraded sherds of pottery being recovered from field areas. Tantalizingly, however, very little evidence has been found for the presence of middens or manure heaps within enclosures, though present research into the trace evidence of lipids may alter this in the future. The difficulty lies in the very organic nature of the material and its rapid dissolution and disappearance. Inconsequence the Ancient Farm research programme has examined a range of treatments including manuring and non-manuring practice. The results averaged across two decades suggest surprisingly good yields of both Emmer and Spelt for manured fields of 3.5 tonnes per hectare and non-manured fields of 1.7 tonnes per hectare for autumn sown fields and slightly less for spring sown fields. These figures correlate favourably with modern yields prior to the introduction of chemicals. All of which suggests that surplus production was well within the grasp of the Celtic farmer, especially because the results quoted are gained from a worst option since the trials were conducted on the poorest of soils, a friable rendzina over middle chalk on a north facing hillslope. Given a good soil in a protected river valley the results would have been commensurately improved. In addition to the cereals, the evidence from carbonised seed indicates the presence of several legumes in the late Iron Age. Primarily the Celtic or tic bean (*Vicia faba minor*) is represented along with vetch (*Vicia sativa*) and with the very occasional pea (*Pisum sativum*). Conditions for the accidental carbonisation of vegetables are seemingly more rare. The presence of these leguminous crops, well attested, of course, in subsequent periods, rather complicate the treatment options open to the prehistoric farmer. Crop rotation must be regarded as a likely treatment with the legume crop fixing nitrogen in the soil to the advantage of a following cereal crop. Results from this treatment at the Ancient Farm suggest a regular cereal return year on year of 2.6 tonnes perhectare. A third option is also not unlikely, that being the growing of beans particularly inter-rowed with the cereal. The major benefit from this is not only the simultaneous deposit and utilisation of nitrogen after the first year but also the stouter stalks of the bean plants literally holding up the cereals in bad weather conditions and preventing lodging. This symbiosis of crops can be extended to include both vetch (*Vicia sativa*) and tufted vetch (*Vicia cracca*), though if the growth of the vetch is excessive it can actually cause lodging. Traditionally rye (*Secale cereale*) and vetch (*Vicia sativa*) have been grown together but primarily in recent time as a fodder crop for livestock.

Besides the major food crops, evidence abounds for the growing of flax (*Linum usitatissimum*). Whether this was specifically for the stem fibres to manufacture into linen or for the oil which was obtained by crushing the seeds is difficult to assess, since there is virtually no surviving evidence in Britain for the post harvest processing. In all probability flax was grown for both purposes. Another oil producing plant, gold of pleasure (*Camelina sativa*), is also evidenced though it may have been a weed of the flax crop itself.

One particular plant, fat hen (*Chenopodium album*), occurs very regularly in the seed evidence from Iron Age sites. Today it is universally regarded as a weed but in times past it has been used when young as a vegetable like spinach for human consumption; the mature can be treated like hay for winter animal fodder and the seeds can be ground up into a flour for bread making. Its frequency suggests it could well have been a serious crop plant in prehistory, especially with regard to its germination time and short life cycle. It normally germinates in early June and can be harvested in early September. Given its diversity of use it could have been employed as a catch crop being planted when a cereal crop had failed. Alternatively it could have held its place as a cropping plant in its own right.

The wealth of cereals, legumes and other plants clearly indicates that the Celtic farmer had a wide variety of choice. In addition, given the knowledge of the micro-climate and soil types available to him, there can be no doubt that land was used to its maximum benefit. It requires but little experience not to plant specific crops where they will not thrive.

The harvesting of crops, especially cereals presents a number of options in that the resources a crop offers are quite considerable. One particular reference by Strabo which describes the Celtic practice of specifically harvesting the ears of the cereals rather focuses attention upon the problem. No doubt Strabo mentions the practice simply because it was so different to the Roman harvesting methods. If he was correct in his observation and the subsequent Celtic invention of the harvesting machine (*vallus*) in the second century AD which strips the heads off the cereals supports him, then the direct result substantiated by experiment is a virtually pure harvest of the cereal in question. When both Emmer and Spelt wheats are ripe and ready to harvest, the joint between the cereal stem and ear, the rachis internode, becomes extremely brittle and breaks off very easily. So easily, in fact, that the use of a sickle is made redundant since the ears literally come off in the hand. Impurities in the crop are represented primarily by black bindweed (*Polygonum bilderdykia*) and common cleavers (*Galium aparine*) which entwine themselves around the cereal and its ears and during harvesting are extremely difficult to separate. These too are found with carbonised cereal grains. Common cleavers is particularly interesting since it might well be an indicator of the autumn sowing of cereals. It rarely appears as a weed of a spring sown crop.

The obvious second crop of a cereal field is the straw itself. In the case of barley straw, the crop is a significant source of winter fodder while the wheat straw, less palatable to livestock, is important for thatching, animal bedding, perhaps for matting and even basket making. But there is potentially a third crop to be considered. Inevitably the fields were infested with arable weeds even if the spaces between the rows were carefully hoed during the growing season. A common ratio of arable weed to cereals even in a managed field, as revealed by experiment, is 2:3. Of these arable weeds, all of whose strategy involves germination after sowing and fruition before harvest, quite a percentage are food plants. The vetches, cleavers, oraches, bindweeds and fat hen amongst others are all worth collecting as storable food supplies. It is not unreasonable, therefore, since all these seeds are found in the carbonised seed record, to suppose a triple harvesting, first for the `sport' food plants, second for the cereal itself and finally for the straw.

The harvest, whether it was double or triple, spanned most of August and September and involved its transfer from the fields into the settlement area. Bearing in mind that the focus of archaeological attention is invariably upon the settlement, only that plant material which is transferred from the fields has any chance of being represented in excavated data. The incompleteness of that data is emphasised when one examines a harvested field after the removal of the crop. A large range of low growing arable weeds are present but are unrepresented in the harvest itself. Typical examples include the corn pansy (*Viola arvensis*) and scarlet pimpernel (*Anagallis arvensis*). In fact, the overall view of a harvested field immediately suggests its value as animal fodder, especially as the grass only grows poorly at this time of year. The principle of turning livestock out into the stubble, both to clean the fields and manure it at the same time, is very easy to understand. The other alternative of burning the stubble is a real possibility but to prove it further work needs to be done in examining surviving and undisturbed prehistoric fields.

Similarly it is, as yet, impossible to identify the methods or zones of treatment of the harvest itself. The critical process is the preparation of the cereals in particular for storage. All the cereals in question are bearded and for practicable storage it is necessary to remove the beards or awns to reduce the bulk. The beards may have been singed off or alternatively beaten or flailed off. The presence of the flail is argued as early as the Neolithic in Switzerland. The former system might well lead to carbonised seed as the result of too enthusiastic processing and certainly leaves the ears entire which means a second breaking down process into seeds or spikelets. The second and more likely system, certainly if the traditional treatment of cereals has its beginning in prehistory, achieves both ends in one process. The cereal is heaped up and beaten with flails or even sticks and subsequently winnowed. Thereafter it can be stored. The archaeological evidence for storage is of two major types. For the middle Iron Age in particular there is an abundance of pits determined to be grain storage pits. These are generally cylindrical or beehive shaped with a diameter of c.1.50m and a depth between 1.0m and 2.0m. Exceptionally, pits deeper than 3.0m have been found. Long series of experiments have demonstrated that storing grain in such pits is extremely successful. The practise is referred to by both Tacitus and Pliny. Quite simply the pit is filled with grain and the mouth is sealed with clay or even dung and covered with soil. The clay or dung, provided it is kept damp, makes an hermetic seal for the pit. The grain immediately adjacent to the seal and the walls of the pit begins to germinate, using up the oxygen and giving off carbon dioxide. Within the space of three weeks the atmosphere within the pit has become loaded with carbon dioxide which inhibits any further germination in the bulk of the grain. The loading by volume can reach as much as 20% (in air the normal carbon dioxide content is 0.006% by volume). The germinated grain dies and forms a thin skin against the pit surface representing a loss rate of less than 2% of the quantity stored. Provided the seal remains intact, grain can be stored in this way for long periods. However, in all probability it was stored only for the winter period. Again experiment has shown that grain stored in this way retains its germinability quite remarkably at levels over 90%. In consequence these storage pits require careful consideration. The average pit volume holds approximately 1.5 tonnes of grain. That grain can be either food grain, enough to feed at the least thirty people eating a mixed diet or seed grain, enough at the assumed sowing rate above, to seed 25 hectares. What is certain is that the whole contents of the pit have to be removed once the pit is opened since resealing is impossible. These pits, therefore, may represent the safe warehousing of grain, probably seed grain, for the export to which Caesar refers. Major sites like Danebury hill-fort, where great numbers of pits were found, could represent collection centres, although most minor sites of this period have one or more such pits. More mundanely, the major sites could be controlling grain supplies in the sense of collection and redistribution. Whatever the management might have been, the pits clearly represent the storage of grain surplus to the immediate requirements of the ensuring winter and underline the success of arable farming.

It has been argued that the other system of storage comprised small granaries set on large posts above ground very much like the small buildings set on staddle stones still to be seen in the modern landscape. The primary purpose of these buildings is to allow air circulation all around the structures and secondly to inhibit access to rodents. In all practical terms these buildings are likely to have been storage sheds not only for grain but also for other materials. The average size of these buildings is some 2m x 2.5m giving a potential capacity of over 7 cubic metres, which is virtually impossible to exploit fully by reason of access and management. It is also likely that any grain stored in such buildings was kept in sacks or bins. With regard to the grain needed for human consumption, half a tonne is small enough to keep within the domestic house, the grain being ground into flour as required.

Livestock was without doubt important to the Celts but it is virtually impossible to quantify that importance. The documentary evidence is slight and devolves primarily upon Caesars comments that grain and leather were two principal exports. Britain lends itself to both cereal production in the south-east and pastoralism or stock raising in the north-west. Perhaps it is not beyond the realms of possibility that in Celtic Britain prior to the Roman conquest cattle drives were made from the northern regions to the south-east ports. If for leather only it is much easier to move on the hoof and process at the latest possible stage. Perhaps the return trade was in cereals, needed but difficult to produce in the north-west. Leather, of course, need not only imply cattle. Sheep and goatskins are equally of value and wool would have been another logical trading item.

Archaeological evidence is restricted to the usual principal sources: bones, coprolites, representations like rock carvings and figurines. Occasional discoveries of hoof prints have been made but these are more curiosities rather than specific evidences. The bone evidence itself, discovered during site excavations, is not unexpectedly relatively sparse. In fact, it is suprising that any does survive, given the ways in which all parts of an animal carcass can be put to good use. Though quantification of bone evidence is carried out with painstaking care and skill, it is difficult to relate the actual evidence itself with the organised running of an agricultural unit. Since it is virtually impossible to date the bone assemblages to a particular century, let alone any contemporaneity within the assemblage itself, it is important to remember that a decade in farming, like a week in politics, is a long time. Certainly long enough to see shifts of emphasis in a farms livestock holding - whether by choice or by external constraint like disease or extreme climatic conditions or a combination of both. In recent cool humid summers in the nineties farmers have lost 50% and more of a flock to fly strike. Other fatal diseases, not yet eradicated, could well have been present in the Iron Age. Lung worm and liver fluke were certainly present and if unchecked will debilitate sheep to the point of death. Less dramatic in terms of maintaining livestock numbers is the sheer necessity of providing winter fodder. If the summer harvest of grass and leaf hay is inadequate then stock numbers most certainly would have been reduced in the autumn. There is little point in eating an animal which has starved to death rather than culling it at its prime in the early autumn.

If the bones cannot give a realistic idea of proportions of stock, at least they tell us what kind of stock was kept. That it was ultimately kept for food is shown by the occasional discovery of butchery marks.

The cattle were by modern standards relatively small. The medium-legged Dexter cattle are the modern equivalent of the Celtic shorthorn. The Dexter, bred in the nineteenth century from the Kerry cattle of Ireland and the Welsh Black cattle, themselves probably descendants of the Celtic cattle, has a number of characteristics likely to have been present in its remote ancestor. It is a tough powerful animal capable of thriving on relatively poor pasture in challenging conditions. Experience in training Dexters to the yoke ard to ploughing with replicated Iron Age ards has shown them quite capable of ploughing a fifth of a hectare a day. Cattle management can only be guessed at in the context of the prehistoric period. From the many rock carvings it can be seen both bull and cow were horned, which, while useful for yoking, leads to difficulties in winter housing. On the Continent the long-houses indicate the use of individual stalls. In Britain evidence of indoor overwintering is inconclusive. The reason for separating cattle when in close proximity is the dominance fact. In every herd of cattle or any other group of farm livestock there is a strict order of dominance, with usually a lead cow. Even with a yoked pair of cattle, one of the pair will dominate the other, a fact exploited by the ploughman by putting the dominator on the land side of the work. The working pair of cattle undoubtedly received different treatment to the general breeding herd. They were probably housed within the farmstead, specially fed and watered and, most importantly, they were tame. They represented the power unit of the farm. The remainder were kept for milk, beef and hides. Cows mature at about two and a half years old at which time they can be put in calf and subsequently provide milk. The gestation period is some nine months and most cows will calve annually if managed in that way. To obtain all the dairy products some kind of organised management must have taken place. Critically, those animals deemed to be worth keeping, as opposed to culling as calves, had to be kept as unproductive animals for over two years. It is likely that the working pair, probably cows rather than bulls or steers, were selected from the herd at five or six years old to maximise their value. It is interesting that in the Celtic legends of a thousand years later, cattle were regarded to be at their prime at seven years of age. Gourmet connoisseurs of today bemoan the modern tendency to describe 3-year old cattle as beef and indeed 3-year old sheep as mutton. It would seem neither beef nor mutton grace the modern table as they surely did the Celtic feast.

The difficulty of distinguishing sheep and goat bones has led to a strange hybrid referred to in specialist reports as a caprovid. However, sufficient evidence has been recovered to identify both Bronze Age and Iron Age sheep. The typical sheep of the Bronze Age was the Soay, a breed which has survived in the Hebrides. Finds of both wool and bone identify it accurately. It is a small but athletic animal, both female and male usually horned, and the wool is plucked or rooed in the early summer. Wool colour ranges from dark brown to oatmeal with occasional white. In the Iron Age the sheep were slightly heavier boned and larger. The probable breeds were the Hebridean and the Manx Loughton, survivors respectively in the Hebrides and the Isle of Man. Both breeds occasionally have four horns in male and female. The wool colour of the

Hebridean is normally dark brown and for the Manx a fawn; their fleeces, a longer staple than that of the Soay are shorn, their arrival coinciding with finds of sheep shears. At the end of the first millenium BC the Shetland sheep is identified. A much longer stapled wool ranging in colour from white to moorit. While it is neat to docket each breed into a specific time slot the reality was probably entirely otherwise. A flock of sheep at the end of the Iron Age would have been a mixture of all three breeds, some characteristic of just one type, others crosses between the breeds.

Their primary value is for meat and wool, though they might have been milked as well. In terms of bone survival it is quite remarkable that any escape the omnivorous attentions of self-respecting dogs. Breeding maturity for sheep is normally reached in the second year, along with the first fleece. Like cattle, sheep need to be foddered over winter and the same considerations apply for them.

The probable descendant of the prehistoric goat is the breed known as the Old English Goat. Relatively small and tough, the goat undoubtedly had its place in the Celtic farmstead. Far less fussy than cattle or sheep, the goat will eat almost anything. In addition, having kidded, it will continue to produce milk well beyond the kids' weaning time.

The management of sheep and goats is difficult to assess with any accuracy. There is a need to excavate areas beyond settlements in order to attempt to discover the presence or absence of grazing paddocks. It would seem from the abundance of settlement sites and their close juxtapositions, along with the focus upon cereal production, especially in the south, that open grazing areas where flocks of sheep and herds of goats might happily browse were at a premium. The normal imagined system is for the shepherd or goatherd to wander about the landscape with his charges, perhaps playing a note or two on the pipe, returning into the fold each evening: the sort of thing to be seen to this day in the mediterranean where the maquis abounds. In temperate Europe, however, there is no maquis. By the same token sheep and goats must be kept off cereal fields and, indeed, freshly coppiced woodland where they will, if given the opportunity, destroy tree shoots with relish. The question focuses upon the nature of the landscape. Was it ordered and totally managed or was it farmed in tiny pockets surrounded by rough uncultivated land? The evidence to date indicates the former. In consequence, it is likely that cattle, goats and sheep were kept in some form of paddock system which in turn led to grazing management regimes.

The pig, both domestic and wild, was equally important in the Celtic world. A large number of figurines of the wild boar have been found, including its use as a shield emblem. There is no doubt that it was revered for its ferocious fighting characteristics as well as it wondrous feasting qualities. The later legends of boar hunts suggest that the chase was an important element of the boars status. Perhaps the wild boar was particularly important because the hunt for it represents a major leisure activity, a time within the welter of farming when a man could choose a particularly dangerous way to prove his manhood. The domesticated version of the wild boar was undoubtedly kept but exactly how remains a problem for archaeologists to solve. Pig bones are regularly well represented in assemblages, but evidence for housing or control is at present lacking.

Bone evidence for poultry is meagre. Caesar remarks that geese were kept for pleasure (*animi causa*) but makes no reference to chickens. Since chickens were widespread throughout the Mediterranean countries, their presence in Britain warranted no special mention. Geese, however, held a special place in what for Caesar was contemporary Roman history. Exactly what is meant by *animi causa* is difficult to interpret since the real meaning is about spiritual pleasure. Our knowledge of the importance of birds in the Celtic spiritual world barely ranks the goose as especially significant. Nonetheless, the image of a Celtic farmyard must be populated by free range chickens and geese. As for specific types it is attractive to think of the chickens as being Old English Game Fowl. These birds have a long tradition of hardiness and aggression. The cocks have been much sought after as fighting birds. It is interesting to speculate if some of the circular buildings were not houses but cock pits. This would, indeed, have been *animi causa* and fits into a long tradition of the sport. The geese could well have been the grey lag, an elegant, medium sized bird also given to a degree of territorial agression but not against its own kind as in the case of fighting cocks.

Poultry management is an area of pure speculation. The basic requisite is protection from predators, particularly the fox. Perhaps they were rounded up each evening and housed safely. Interestingly, in contrast to modern poultry which lay virtually all the year round, these early types lay eggs only in the spring. Egg collection lengthens the laying period slightly but not enough to include eggs in the Celtic diet as other than a seasonal luxury. The approach might well have been not to collect eggs but allow the hens to sit and produce more birds.

Finally with regard to livestock mention must be made of the horse. There is no doubt that the horse played an important role in the Celtic world especially with regard to the warrior aristocracy. It is most unlikely to have been an agricultural animal in the sense that it worked on a farm. Caesar refers in his battles with Cassivellaunus to being faced by 4,000 chariots. Numbers are always to be treated with a degree of suspicion, especially when referring to battles won and lost. However, given the size of the Caesarian legion, this figure is not unreasonable. The implication is for 8,000 trained war horses. To keep such a number in the field at least another 8,000 are in reserve in the sense of breeding stock, foals and animals in training. And this specifically in south-east England. The raising of horses, therefore, must have been a not insignificant agricultural operation. The infrastructure needed to produce such numbers argues for specialist ranches with all the problems of grazing, winter foddering, housing and perhaps breaking in and training. That they were status animals and were held in high esteem is evidenced at the very least by the chariot burials both in Britain and Europe. The animal itself was probably very similar to the Exmoor pony, a tough uncompromising beast capable of carrying a man all day across rough country.

Mention was made above of coprolites or faeces as an important source of archaeological evidence for livestock. The analysis of the faeces allows insight into feeding regimes. It has proved possible, for example, to prove that both hay and leaf foddering, including twigs of hazel and alder, were used as early as the Neolithic in Switzerland. This kind of evidence has great implications for the way in which the total landscape was employed.

Farming is, by definition, a system devised to produce a reliable and organised food supply throughout the year. With regard to plants it involves the growing of essentially storable foodstuffs, fruits which can be dried and kept in reasonable condition for at least a year. For human consumption these broadly comprise cereals, pulses and legumes. The maintenance of livestock for food as well as other products requires similar attention for the provision of fodder with virtually the same rules. The material must be capable of being dried and stored successfully this time for a minimum of six winter months, ie. hay, some cereals, straw (especially barley and oat straw) and leaf fodder. Given all the archaeological evidence for the prehistoric Celtic period, it is certain that the Celtic farmer not only grew all these products and maintained a healthy herd of livestock, he did it remarkably successfully. One suspects the real economic reason for the Roman conquest of Britain in the first century AD was the agricultural wealth of the country.

Celtic farmsteads and farmhouses present us with yet more difficulties inasmuch as what could be described the average, the typical for any region has yet to be established. A considerable number of enclosures have been excavated in Britain ranging in size from great hillforts or hilltowns of many hectares to small banjo shaped enclosures of less than a hectare. These latter, the small enclosures, are the target sites in that the few that have been examined carefully are usually associated with traces of field systems and often though not invariably contain elements of what one might expect of a farmstead. The problem lies in the size of the sample which is so small not to allow generalisations. Ironically, in 1993 at Lavant in West Sussex, in the shadow of the Trundle hill-fort a totally unenclosed group of several Iron Age round houses, and four- and six-post structures was discovered prior to the extension of a reservoir. The site extends beyond the limit of the excavated area so further research is planned. The nature of the evidence, in fact, comprised the bases of postholes, arguing for an overburden of some 450mm of topsoil and therefore the greatest percentage of the evidence with be earthfast. The disturbing aspect of this particular site lies first in the lack of an enclosure ditch, a feature that is likely to be picked up in aerial photographs, and second, that the evidence lay in the soil overburden. Identification of such sites by present prospection methods is virtually impossible. A major area survey of the region around the Danebury hill-fort in Hampshire is currently in train following the intensive excavations of the hill-fort itself. The objective is to determine the nature of the feeder landscape for the hill-fort where considerable provision for grain storage in the form of pits and four-post granaries were indentified. If the typical feeder farms were unenclosed sites like that of Lavant, the difficulties of executing such a survey so that it has real significance have been immediately compounded if not made insurmountable. Logic would suggest that within the purview of a major powerful site like the Danebury hill-fort farmers might well have dispensed with any enclosure ditches and even perhaps have initiated an early farm of monoculture in response to supply and demand, some perhaps specialising in cereal production where enclosure ditches were not needed, while others concentrated upon livestock where ditches and banks provide valuable stock control elements. The normal enclosure ditch is usually 1.50m wide and 1.50m deep with a `V' section. The bank is made from the upcast material and most likely surmounted by a wattle or living fence. Such a ditch can hardly be regarded as a significant military defence of any kind, and is best regarded as a system of livestock control which has even survivied as a recommended system into the nineteenth century.

Although it is virtually impossible to identify archaeologically the typical farmstead, there is an abundance of evidence for Celtic houses. In contrast to the prehistoric longhouse found on the Continent, the Celtic houses of Britain and Ireland are traditionally round. This particular feature, a round house with a conical thatched roof, has unfortunately led to the rather dismissive description of such dwellings as `huts', and given the normal walling material of wattle and daub the description worsens to `mud huts', a definition which is belied by the sheer scale and intricacy of some of the houses. Construction materials, in fact, vary considerably according to the region and range from dry stone walled houses from Cornwall, Wales, the Cotswolds and Scotland to plank walls and wattle and daub in other areas, and even chalk walls in southern England. However, the reality of such houses needs to be fully appreciated if the description of mere `hut' is to be dispelled.

In general terms there are three basics forms of house construction as revealed by excavation and, indeed, tested by empirical constructs. The evidence with rare exceptions is normally in negative form in that all that is found are the stake holes, postholes and foundation layers of stones or chalk blocks. The simplest form of roundhouse is evidenced by a single ring of stake holes, the doorway only being distinguished by a pair of postholes. The regular occurrence of daub fragments, occasionally burned and thus preserving the impressions of wattles argues that such houses were made of a wicker wall in the form of a circular basket, the break for the doorway comprising two major posts surmounted by a lintel morticed and tenoned into place. The doorway, in fact, has to be substantial to counteract the outward thrust exerted by the interwoven wall. The height of the walls of such houses is to a large extent conjectural although an experimental construct of the second type of house discussed below indicated a height of 1.50m. The waterlogged remains of an Early Christian round-house in Northern Ireland supports this estimate. In practical terms such a height obviates unneccesary stooping within the building. Of particular note is the sheer strength of this type of wall, especially when newly built.

Although the component elements are themselves relatively weak, the stakes average some 80-100mm while the hazel rods or willow withies at the thickest point are no more than 25mm in diameter; once woven into place the opposing tensions create an extremely powerful structure. Over time the wattles dry, become brittle and lose their strength but the power of the wall now lies in the brittle strength of the daub which is plastered into the wattles both inside and out. Daub itself is a specific amalgam of 30% clay, 60% earth and 10% of straw, grass, hair or any other fibrous material. Initially it is mixed with water to apply to the walls. Gradually it dries out and provided the mixture is correct there is little cracking and ultimately the fibres both hold it together and reinforce it. It is not unlikely that a lime wash was finally applied to give a waterproof and incidentally an attractive finish. The rooves of such houses described by Caesar as thatched perforce have to have been conical. The other alternative of a domed roof, inspired by the native houses of Swaziland in South Africa, is most unlikely given the average rainfall in Britain. The Swazi houses leak abominably when it rains. There is unfortunately no archaeological evidence for roof construction but a cone presents only a limited number of variables. The greatest problem is offered by the peak or point of the cone in that only a certain number of rafters can actually form it. If too many meet at the apex the point of the roof is lost in a jumble of timber and becomes impossible to thatch. In addition, because a thatched roof has to have a minimum pitch of 45^{o} and a maximum pitch of 55^{o}, then there is a tendency for the rafters to sag along their length under the weight of the thatch. A device which is critical to counteract any potential sag is a ring-beam made of hazel rods set one third down the slant height of the roof. This also serves to support the supplementary rafters which make up the rest of the cone. All the rafters are secured in place by concetric rings of hazel rods tied to each rafter. These are correctly determined as purlins, since they are contructional and physically hold the cone together. An equally strong alternative is to interweave the rafters with hazel rods creating a conical basket. The final effect is to convert any lateral thrust exterted by the rafters on the wall stakes, to which they are simply notched, into vertical thrust. All the weight of the roof including the thatch is directly downwards onto the wall. This type of house has, therefore, the same life expectancy as the walls of the house. Once the wall deteriorates the building will collapse. How long that should be is difficult to determine. There is no real reason why such a building should not last many decades provided the thatch is replaced at regular intervals. The type of thatch rather dictates its own life span: wheat straw, for example, lasts usually for fifteen years or so before it needs either to be replaced or another layer applied; river reed commonly known as Norfolk reed can last as long as eighty years, and ling or heather forty years or more. In none of the excavated examples to date is there a central post to hold up the roof. Where one would comfortably be is the normal location of the hearth. The size of this type of house ranges from 4m to 9m in diameter. However, to put this into a more comprehensible context, the floor areas range from 12.6 square metres to 63.6 square metres. An average modern house has a ground floor area of c.54 square metres. There are many perfectly adequate houses with smaller floor areas.

The second major type of Celtic round house is widened by a double ring, an outer ring of close set stake holes and an inner ring of more widely set substantial postholes. Usually in the south-eastern quadrant is an arrangement of postholes suggesting the presence of a porch, the width of the doorway being twice the depth of the porch. This suggests a pair of doors which swing back into the porch flat against the walls. These houses range in size from 10 metres to over 15 metres in diameter, with respective floor areas excluding the porch of 78 square metres to over 180 square metres. The latter would accommodate one and a half average modern houses houses!

The construction of these houses can be conjectured in that, like the single wall buildings, the number of variables of a round wall and a cone shaped roof are limited. The writer has, in fact, built several constructs based upon specific excavated plans of double ring houses. The construction depends very largely upon the inner ring of posts. The postholes invariably indicate individual posts of 300mm or greater in diameter. These are veritable tree trunks averaging in the case of oak trees an age of sixty plus years, for ash trees forty five years. In simple terms, they are columns which must be turned into a powerful cylinder by having a horizontal rail of timber morticed and tenoned on to their tops, the individual components of the ring each spanning a pair of posts. Once completed this cylinder looks rather like Stonehenge and utilises exactly similar joinery techniques. The outer wall of stakes is directly equivalent to the single wall houses being made of wattle and daub. At this stage the building is the form of a double cylinder with a break in the outer wall for a four-post rectangular structure which will become the porch. The greatest problem lies in establishing the height of the outer wall and the inner ring and spanning the roof with a cone of timbers. Given the need for a 45^{o} pitch these roof timbers were also fullscale trees some 11m long.

One particular excavation of a great round-house at Pimperne Down in Dorset afforded the answer to this particular problem. Beyond the outer wall at the same distance as the inner ring from the outer ring was a series of six curving slots set at regular intervals around the building. With an angle of 45^{o} were the butts of the principal rafters set into a slot. The reason for using a slot rather than a hole emerge later. The outer wall height is the same distance between the ring and the slot, in effect a height of 1.50m. The inner ring height in this case being exactly twice that. With six approximately straight ash trees set in position, the apex of the roof had to be exactly over the centre of the building. In order to make this adjustment the butts of the main rafters had to be moved by main force, the moving of which replicated almost exactly the archaeological evidence of curved slots. Thereafter these rafters were notched onto the outer wall, seated and attached with a wooden peg onto the inner ring and lashed together at the apex. The need for a ring beam a third of the way down the slant height of the roof became immediately obvious because even at this stage the sag was noticeable. With six principal rafters, a hexagonal ring beam was lashed into place and subsequently cross-braced. All the supplementary rafters were attached to the outer wall, the inner ring and the ring beam. None of these actually reached the apex.

There is, of course, no evidence for such a ring beam at all other than the building itself. It is the simple argument of `without which then nothing'. Such a device or similar is fundamental to such a roof. Incidentally all subsequent roof trusses on rectagular houses are similarly stressed. As in the single ring houses, concentric rings of hazel rods were tied to the rafters as functional purlins. Once complete, all the considerable lateral thrust of the component timbers in the roof was converted to vertical thrust and sustained primarily by the inner ring of timbers. At this stage and subsequently it is possible to remove and replace the outer wall. Similarly, the principal rafters no longer depend upon having the butts on the ground and can be sawn off at the eave level along with the other rafters.

The porch is in essence a straightforward rectangular building with a pitched roof attached to the round-house. The primary observation is that the pitch of the porch roof is dictated by the joint between it and the main house roof having to subtend an angle of 45^{o}. This inevitably leads to a steeper pitch for the porch of some 55 degrees. Details of doors are virtually non-existant but there is little doubt but that such a structure would have had a fine pair of doors to complete its external appearance.

The reason for dwelling upon the detail of such a conjectured building lies in its forbidding complexity. The materials alone for such a house comprise over 200 trees, nearly one hectare of coppiced hazel, over 10 tonnes of clay and twice that of soil, 15 to 20 tonnes of thatching straw, a kilometre or so of binding and lashing material. Such houses are not round huts lived in by rude natives struggling to survive until history catches up with them. In architectural engineering concept, they are more complex than the average Greek or Roman temple which only comprise stone blocks laid upon one another. Furthermore, to have such a house built, since surely such complexity argues for service industries of builders, joiners and thatchers, implies great wealth and status. How such houses were fitted out we have little or no real idea other than those glimpses afforded by the Celtic legends. If these can be used as a guide, the interior would have been richly adorned with brightly coloured hanging brocades shot through with silver and gold. Chairs, settles and low tables, a great bronze cauldron hanging on chain over a central hearth, the broth bubbling over great joints of beef, mutton and pork, withdrawing rooms set opposite the porch and beyond the `great hall', for such it must have been. Above these rooms maybe there was a gallery for bard and minstrel. Such a house lends itself to the legendary Celtic feasting, the chieftain opposite the great doors, the champions and guests seated in descending order of rank in a circle around the central hearth. These images are dealt with more expertly elsewhere but at least the archaeology provides real evidence for great houses. Having actually built constructs based upon the archaeological data and handled the materials, especially the straight stemmed trees, it is easy to understand the Celtic love of overstatement, `great wooden pillars beyond the compass of a man's arms and heavy enough to make the strongest champion grunt under the strain'.

The life expectancy of these housesis often regarded as extremely short. In fact, the reverse would seem to be the case. During the dismantling of the Pimperne house several interesting features came to light. The outer wall stakes had virtually rotted away to ground level and beneath the wattle and daub wall, still in perfectly good condition after fifteen years, a gully had been created by rodents. The gully itself penetrated deeper than the original stake-holes and thus removed all trace of them. In addition, directly below the edge of the roof eave, the expected location for the drip gully, the opposite had occurred. In practice, because no one walks there, a special little habitat is afforded which in time creates a humic lump which encircles the house. Only when there is bare earth, a difficult state to achieve in the British climate, will a drip gully be found.

Of greater specific interest were the posts and postholes which formed the inner ring and upon which the whole house depends. In all cases the pith wood had rotted away below the ground surface and in most cases the heart wood had started to rot. The ensuing cavities formed between stone packing and the remains of the heart wood had begun to fill with debris from the house floor, primarily soil dust but including ring-pulls from beer cans, a 10p piece dated 1974, a hair grip and a plastic toy soldier - an American GI. They are, of course, the direct equivalent of prehistoric bronze and gold brooches and pins, and would that they had been. In one particular case, the whole post butt had powdered away leaving a cavity directly beneath a seemingly perfectly good post above ground. The logical deduction to be made from this discovery is that if, as the timber rots in its posthole, the cavity is carefully filled, ultimately the post will be standing on the ground surface at which time rotting will cease. Because the weight thrust of the building is vertical it will remain perfectly stable. In effect, the building will outlive its foundation postholes and material found within those post holes will necessarily be coeval with the building rather than marking the time after its destruction.

That there was a good knowledge of how timber posts rot in the ground is attested by the regular renewal of the two outer porch posts. These particular postholes invariably show great disturbance with even evidence of levers being used to prize old stumps from the post hole. The experience of the construct showed the average life of these posts to be no more than eight or nine years before they had to be replaced. This was achieved by raising the lintel of the porch free of the tenons, replacing the uprights and lowering the lintel back into position.

The third type of Celtic house, still a round house, is one with a solid wall of stone. Remains of these houses can still be seen in the classic stone country of Cornwall, Wales and Scotland. With the exception of Chysauster in Cornwall where the walls survive to a considerable height, the remainder survive as barely discernible circles of stone rubble. This type of house hardly challenges the great double-ring houses for size and splendour. Rather they perhaps reflect the poverty of their landscape in so far as they have to use stone simply because the traditional timber building materials are in extremely short supply. Nevertheless, these houses still hold a deep fascination, surviving as they do in the final romantic Celtic landscapes. One particular house, the evidence for which was excavated on Conderton Hill in Gloucestershire, an outlier of the Cotswolds, has been built as a construct on two seperate occasions by the writer. The evidence comprised just the foundation layers of the stone wall, its width being just under 1.0m. The external diameter of the house was just over 7 metres. Experiments during the excavation led to a conjectured wall height of about 1.0 m. The doorway was a mere 600mm wide. The actual construction of this type of house wall is relatively straight forward in that it is a standard dry stone wall with an inner and outer face. The only observation to be made is that in the original and in normal practice the inner part of the wall is not rubble filled. Each and every stone is carefully positioned. What was remarkable was the sheer quantity of stone needed to build a relatively modest structure. On both occasions the wall absorbed in excess of 80 tonnes of stone.

The real challenge, however, lay in erecting a cone shaped roof on top of a dry stone wall. The lateral thrust of each rafter butt during building was enough to dislodge the upper courses of stonework. Again, one has to use the argument of `without which, then nothing', the only obvious way was to use a wall plate around the inner edge of the wall to spread the thrust, each rafter being simply notched into place onto the wall plate. The roof construction follows exactly the same sequence as the single-wall houses described above. For each of the two constructs a different method of thatching the eaves was employed. The first made the thatch protrude over the edge of the wall by some 200mm, the other started the thatch over the centre of the wall but with an under layer of sloping flat stones to shoot the rainwater to the edge of the wall. This latter type of eave thatching is traditional in both west Wales and the highlands of Scotland. The final aspect makes the houses look dramatically different: the former with its thatched eaves looks wide and comfortable while the latter appears narrow and quite prim. Which is the more accurate is a matter of debate; perhaps they both are and reflect regional difference which survive even into the present. The longevity of such a house is incalculable and, provided the roof is kept in good order, it makes a snug and comfortable dwelling against whatever extreme the climate chooses to provide.

Finally, with regard to solid walled Celtic houses there is every likelihood, though conclusive evidence has yet to be found, that the houses could have been built of turf walls. Traditionally turf houses or soddies are known from Wales and Ireland and were even taken to the prairies of America. But what traces would structures like these leave? A scatter of pottery, enhanced phosphate and magnetic susceptibility zones would be the most likely if only one knew where to look. Indeed it is this last point which is significant for the future. Although we do have a considerable body of disparate archaeological evidence, perhaps this is all it will ever be, increased of course but always disparate and disjointed. With the exception of the third category of house described above, all the other types of houses, including the great double ring houses, can be perfectly well built with just earthfast timbers. Given a considerable overburden of topsoil of 600mm, there is absolutely no need whatsover for a builder of a round-house to penetrate further into the subsoil and thus leave foundation traces as potential archaeological evidence. To underline this observation the Pimperne house posts, except for an arc of seven, were all earthfast. To hypothesize such a structure from such little evidence would be a not inconsiderable challenge to credibility.

What should be our image of a Celtic farm? Should it be like the Celtic village constructed by the author for the National Museum of Wales at St Fagans? There the overall view of three houses, one from each category, along with with ancillary buildings nestling within an enclosure, makes it an unlikely candidate. Alternatively, should it be like the Butser Ancient Farm site, where the enclosure is dominated by a great round-house over 15m in diameter with lesser round-houses, granaries and haystacks around its skirts. Without the enclosure are fields and paddocks where Celtic crops and livestock are raised. In a sense both are extremely useful but because they are so isolated they serve to reinforce the disparity of the archaeological data and the popular perception of pockets of population in the Celtic period. It is the translation of these images into the *creberrima aedificia* of Caesar in his description of south-east England: `there are buildings everywhere' or `the landscape bristles with buildings' and, therefore, Celts.

In concluding this paper on prehistoric agriculture it is perhaps worth considering the nature of the farming year in the light of the archaeological evidence we have. The general view held of the rural life is idyllic in any age; the shepherd tending his flocks, white fleecy clouds in an azure sky, the harvesters nearly always depicted drawing a jar of cider or some other inspiring liquid with a backdrop of sun drenched golden fields, the farmer leaning on a gate contentedly puffing on his pipe, and no doubt thinking beautiful thoughts gazing at cows happily grazing on the green green grass. These are the pictures of the countryside and farming that are most commonly held, reinforced of course by artist and poet. Would that it were true today, in the recent or even remote past! The real picture of agriculture is one of pressure, stress and tension, an ongoing battle against weather and nature with all the odds stacked against the farmer. It is ironic that, when most people think of prehistory in general, their instant thought is that of pouring rain, a state which has perhaps been engendered by all those reconstruction drawings in which the dark clouds and pouring rain seem to mask the things we do not understand. Yet this first thought is quickly abandoned when farming becomes the focus of attention. Similarly, since the rural landscape is least visited during the winter this should be the starting point of an analysis of the farming year.

The depths of winter are a critical time for the farmer of the past. It is now that foundations are laid not only for the coming growing season, but also for seasons, even generations into the future. The primary tasks of this period lie in the woodland. There is, of course, the need to provide kindling and stores of firewood for the domestic hearth. In order to avoid living in a continually smoky atmosphere it was critical to collect and store fuel not for the current winter but the one following, and preferably the one or two winters away. That wood stocks were a common feature in any homestead has to be a truism. Obvious places for their storage are between the ubiquitous four post settings. Alternatively the fuel can be stacked beneath the projecting eaves of the round-houses where it can be kept dry and also provide greater insulation and protection for the daubed walls. Wood stocks are notorious for the harbouring of rodents. On several occasions, on the dismantling of roundhouse constructs, beneath the line of the wall a gully has been formed by the activities of these fellow travellers. Where wood has been stacked against the outside of the wall the gully is most pronounced, often going beneath the stakes of the wall itself, literally removing all archaeological trace of their presence. This gully, without clear evidence of any wall structure, has been regularly observed. Its presence, however, does not undermine the wall in such a way that it will fracture; the daub and the wattle work it protects holds the wall firmly in place even on houses which do not depend upon an inner construction ring.

The provision of fuel, however, one suspects is a side product from the real work in the woodlands. This work can be divided into two major elements: the provision of timber for building and the provision of working wood. In the case of the farmer, we know from excavations of the gargantuan appetite of Iron Age man for specific types of timber. Any general analysis of the post-hole evidence will show three broad categories of post normally used; a diameter of 0.30m and greater, a diameter of 0.20m and a diameter of 0.10m. In order to create the structures we believe they built, their need was for straight lengths of timber of at least 3m and occasionally 6 or 7m in length; in other words, trees grown in a carefully managed plantation where judicious thinning and felling are critical. An oak tree with a diameter of 0.30m given this type of plantation which today is extremely rare, can range in age from fifty to ninety years old. An ash tree can reach the same girth in slightly less time, but certainly a time spanning at least three if not four generations. The logic, therefore, suggests that the timber woodland being managed was an investment for future generations, just as the trees felled were an investment from generations in the past. Given the spread of agriculture from the Neolithic through the Bronze Age, and the land clearance we know to have taken place, the presence of any `wildwood' to which our Celtic farmer may have had resource is clearly unlikely if not impossible. In any event, the `wildwood' would be unlikely to provide the kind of timber required and which we know was used. For the lesser timbers of 0.10m to 0.20m in diameter it is not unreasonable to believe that the typical hardwoods (oak, ash and elm) were coppiced. This process involves the cutting out of the main stem, allowing suckers to form into stout stems. From one tree coppiced in this way it is possible to obtain from three to seven good timbers. Virgil, a Roman poet of the first century BC, speaks of living tree boughs and stems being trained into specific shapes for the manufacture of ploughs. This is, of course, one further aspect of woodland management. While the coppicing of ash trees particularly can produce by accident the right curved shape for a plough beam, it is far easier to train just a stem for the future - in this particular instance at least 20 years.

The fact that woodland has been managed, of course, does not necessarily give any sense of timber quality, or of how many trees were required at a time. A large roundhouse of double ring construction required more than 200 trees in its construction. Of these at least thirty 15-16m in diameter belong to the largest category. Even a more modest home of 9-10m in diameter needs over 100 trees. If one were to consider the construction of a timber-faced or box rampart, the requirement for such trees reaches quite remarkable proportions. A simple blockhouse or log cabin structure uses several hundred trees while a simple four-post structure will use at least a dozen trees. Whatever may have been the requirements in any one year, even in the unlikely event of not at all, the woodland would still have to be tended. In normal conditions, the assumption must be that timber was felled, cleaned, the brush and logwood set aside for fuel, the timber cut to length and then hauled back to the settlement where again it would have to be stocked against its future use.

One annual requirement would undoubtedly have been fencing stakes which average a diameter of 0.10m. Farm fences require regular replacement and refurbishment especially for the control of stock. The average length of time a post or stake will last in the ground is some 10 to 12 years. In passing, hardening the points of stakes with fire has no effect whatsoever in lengthening the life of a stake in the ground; if anything, it hastens the rotting process because its moisture content has been radically reduced and in consequence it accepts humidity all the quicker. From the archaeological evidence, scant though it is, for fence lines, stakes seem to have been set slightly less than 1m apart. Thus given a normal replacement of fences on a settled farm it would not be unreasonable to hypothesise a programme of some 500m of new fencing a year. This would need in excess of 600 stakes, plus one for the end, or a minimum of 300 trees probably of ash. These, too, would have to be cut, trimmed, sharpened and hauled from the woodland to the appropriate location. It is most likely that the fences would actually be built during the winter, the task of obtaining the materials and building being regarded as one.

The second element, the provision of working wood, essentially refers to coppicing hazel for wattling of fences and walls. Like many agricultural processes, it has a specific rotation. It takes an average of 7 years for a hazel stool to produce good usable wattles of sufficient length and strength. The use of such wattles is, of course, attested as early as the Neolithic in the Somerset trackways and elsewhere. Some 4,000 years and a huge increase in the population later, one has to assume that large tracts of land were set aside for hazel coppice. Given the natural growth pattern, each coppice area would have been divided into sevenths, yielding an annual winter crop. Just as with timber, it is but practise to cut when the leaves are off and the sap down. Cutting at other times of year is possible but damaging to the rootstock. Again, it is interesting to calculate the scale of the annual requirement. Above, a 500m length of fencing was hypothesised; if this were closely wattled to a height of 1.5 metres, approximately 12,000 wattles would be needed - the average product of one hectare of woodland. It is unwise to calculate the time it would take to harvest this quantity, but it can be seen that a modest product in terms of fencing required a considerable input of man time and investment in land management.

There are alternatives to hazel which were also exploited, and in a probably similar manner. Osier beds and pollarded willows also provided materials for wattling. There are too the myriad of baskets and mats for which materials like reeds, rushes and sedges, as well as young osiers and willow wands had to be collected.

One further winter harvest evidenced in the archaeological record was river reeds which were used as a better alternative to straw for thatching rooves. A roof thatched with reed has a life span approximately three times that of wheat straw. Given that the river valleys were considerably wetter than they are today, the water fringes would have naturally sustained considerable reed beds providing, in the sense that the farmer neither had to plant it nor manage it, a free harvest. However, a regularly cut reed bed invariably provides a better harvest. The normal time for harvesting reed is the most unpleasant months of January and February. Again it is significant to consider the quantities of material required to thatch a roof; a modest round-house of 7m in diameter needs well over a tonne of reed to thatch the roof. Increase the diameter, and the weight increases proportionally. A roundhouse of 15m in diameter needs nearly 15 tonnes.

Timber, wattle, fuel and reed, all attested in the archaeological record, spell a long hard winter of toil. Far from the settlement being idle, by the arrival of spring, the ploughing and sowing of the fields would have seemed a welcome release. As a final postscript to this winter work, not the least of the tasks, was the loading and hauling of the materials back to the settlement. The ephemeral traces recovered in the archaeological record do little justice to what must have been a harsh reality.

The spring is a time of gradual awakening of the plant world. By the time one actually realises it has arrived it is too late for the farmer. Cereals sown late barely cope with the vigorous and hostile growth of the arable weeds. How exactly the prehistoric farmer recognised the time to plant, whether he used the stars in the night sky or measured the lengthening days, we have no certain knowledge. Nevertheless, the real gamble of farming lies in the spring time; the recognition of the moment when the soil conditions and weather are right (and every spring there is such a moment), followed by the decision to plough the land and prepare the seed bed. The plough or ards he had were ideally suited to the preparation of the soil, and it must be assumed that on a settled farm the fields would have been well worked and, therefore, tractable. The actual process of ploughing does depend upon the ground being neither too wet nor too dry. The evidence suggests that fields were cross-ploughed (hence their square rather than rectangular shape), and that the fields were ploughed in lands, the most economical method of manoeuvring cattle around the headlands. Field sizes range from about a quarter to half an acre, the sort of area on which all agricultural operations can be completed within a working day. Again we have no real insight into the number of fields a farmer might cultivate, but given the experimental results of approximately one ton per acre achieved from cropping trials a planned yield of between 7 to 10 tonnes would not be an unreasonable estimate. Given capacities of storage pits and four-post granaries, at a total expected yield of 14 tonnes from both autumn and spring sowing would allow for food supplies for human and animal, seed resources and trade surplus. If these suppositions are correct an area of some 7 or 14 acres to have ploughed and cultivated in the spring. Two weeks of solid work followed by a further week of planting. Not even then is the ploughing at an end. The planting of the more frost susceptable crops must be prepared for in advance. Peas and flax and even spring beans are likely to be severely damaged if not destroyed by frost. It is important to realise also that planting of fields is not quite as simple as it sounds. The Celtic farmer had at his disposal at least ten different types of cereals, and doubtless the proportions of each type planted depended upon the overall requirements of the farm and its stock, both human and animal. In addition the exact field in which each type of crop to be planted depended upon the farmer's understanding of the micro-climate of his land. Barley will prosper where wheat will struggle; beans and other legumes as well as flax are best planted away from a frost hollow in case of a late cold spell in April or May. The permutations are not endless but everything needs to be taken into account. Once the fields are planted in late

March and early April, attention invariably switches to the livestock. At this time the grass begins to grow vigorously. The cattle, apart from the plough team which in all probability received specialist treatment at all times, need to be turned out to pasture. Whether they were taken daily and herded back each evening or left out in field enclosures we have yet to prove. The basic question is relatively straight forward. Were the crop fields fenced or were the stock fields fenced? The evidence, sparse though it is, suggests the latter. In which case careful rotation of such paddocks would have been necessary to avoid poaching of the grass. The benefit of bringing stock back to the farmstead each evening lies in the steady acquisition of manure and of course the tractibility of the animals. Cattle defecate normally each evening and morning. Along with the midden acquired over the winter while all the stock are contained and fed, this nightly increase would be invaluable come the following autumn. The sheep and goats were undoubtedly kept together and treated in a similar way if only to obtain the milk during the appropriate times. Cattle, sheep and goats only provide milk for a limited period after parturition. Management undoubtedly varied during the year as options changed but the spring time was the major time of change.

Lambing, kidding and calving are also the hallmarks of spring. In the case of cattle this has to be carefully arranged since mating has to occur the previous June. In normal conditions with the hardy breeds in question there are few problems, but inevitably there are problems and it is the task of the farmer to be on hand to help the process. Failure can lead to the loss of both dam and progeny and, therefore, of measurable wealth. Towards the end of spring the crops have begun to grow and now require urgent attention. If the interpretation of the ploughing implements are correct and that the crops are sown in drills for subsequent management, now is the time for that management. The timing of planting is arranged quite critically to give the crops a favourable advantage over the arable weeds. For that advantage to be maintained especially against pernicious weeds like charlock, hoeing is the order of the day. Given the average size of the fields at half an acre, inter-row hoeing with a mattock hoe represents one man day. The hypothesis of a gross produce yield of 14 tonnes implies twenty-eight fields and, therefore, twenty-eight man days. No doubt all able bodied members of the farmstead were brought into action for this task. It is normally necessary to hoe through the crops twice, once in late April to take out the early competitors, and once in mid to late May to take out the secondary growth. After this time hoeing probably ceased for fear of damaging the rootstock of the crops. One interesting aspect of hoeing concerns the method of dealing with hoed weeds. Were they left where they were cut in the rows, thus shielding the soil from moisture loss though evaporation and adding to the fibre content of the soil and enriching it, or were the weeds cast onto the field edges, contributing toward the lynchet formation? The former is probably the case.

Early June is the time for shearing the sheep and dealing with the harvest of wool. Given the different breeds of sheep evidenced by the bones from archaeological excavations, some like the Soay were plucked or combed while others like the Manx Loughton, Hebridean and Shetland were sheared. Sheep shears make their appearance in the middle of the first millenium BC. The processing of the wool was undoubtedly the role of the distaff side of the settlement and probably carried on throughout the year. Even today it is a common sight in peasant economies to see the women spinning wool on a drop spindle even as they walk along. No doubt any excess wool represented a trading resource.

With the completion of shearing there might have been a brief period of rest and relaxation. Perhaps the only one in the farming calender because in late June and early July comes the time for haymaking. In a very real sense the major purpose of farming is to provide during the growing months food supplied for those months when nothing grows. This truism involves grassland as well. Normally grass grows vigorously in the spring flushing the landscapes with a healthy green coat. However, come July the growth radically slows as seeding takes place and only begins again with a late flourish at the end of August to the first frost in late September and early October. Grazing of livestock in restricted areas can severely damage and even destroy grassland after this time. The actual process of poaching the grass down to root level allows the mosses to take hold and thereafter dominate. Getting rid of moss is an extremely difficult process whether now or 2000 years ago. The best approach is to avoid it happening. In consequence haymaking for winter fodder for livestock has to have been a priority. Again our knowledge is slight. Single postholes within a circular depression of 2 or 3m in diameter may well have been haystacks. Experimental trials support this interpretation, and there is a wealth of ethnographic evidence for such haystacks in this country and the near continent. The source of the hay, however, is a subject for considerable conjecture. Perhaps areas of grassland were specifically set aside and with an average yield of a tonne or so per acre the area would be dominated by the stock held on the farm. A mature cow needs approximately one tonne of hay per winter to maintain condition. A tonne will feed perhaps five sheep. Given a herd of half a dozen cattle including the plough team, perhaps thirty to forty sheep and goats, the hay provision must approach 14 to 15 tonnes! Within the farmyard this means as many as five or six circular haystacks. An alternative and in more recent times a traditional source of hay was the water meadows, the grassland which flourishes within the flooding zones of rivers and streams. Those areas are too much at risk of flash floods to cultivate for cereals, too wet to graze in the early part of the year for stock with the potential of foot rot on the one hand and liver fluke on the other. Not that this would have been necessarily recognised other than by trial and disaster. Sheep especially if grazed on low lying wet ground can die mysteriously! Folk lore will take care of the reason. Nevertheless, these areas provide lush growth and an ideal resource for haymaking at the ideal time of year when the grass and other herbs are about to seed. The cutting of hay in sufficient quantities, its drying in the sun and its subsequent carting back to the farm and stacking into ricks must have been a major work programme involving all the able bodied labour available. It would have taken at least a month to six weeks to complete the harvest. The culmination of haymaking is the thatching of the stacks to protect them from rainfall. During winter as the stacks are used they take on the unusual appearance of an apple core. Of course, once the hay is off the water meadows they become ideal grazing areas to cover the non-growing period in the normal grazing paddocks.

One other probable winter fodder that may have been collected almost immediately after the haymaking were tree leaves. Traditionally in north-west Europe leaves of ash and elm trees were cut in high summer, sun dried on racks and stored in barns or sheds. Many of the pairs of postholes excavated on Iron Age farms may represent drying racks for leaf fodder. The appeal of dried leaves as a fodder for stock is beyond question. Trials with cattle, goats and sheep when offered an uncomplicated choice between prime hay and dried tree leaves have shown a marked preference for the dried leaves. In reality this should only be expected since all are naturally browsers rather than grazers. Any tree in a regular pasture shows evidence of heavy browsing of those boughs within reach and it is not an uncommon sight to see cattle straining on their hind legs to reach those unattainable boughs. This alternative fodder means an ongoing task for the farmer this time around the woodland fringes where leaf growth is greatest and most accessible. It may well be that trees scheduled for felling the following winter were systematically stripped of their leaves the preceding summer. There is little doubt that stripping a tree of its leaves does not enhance the appearance or the expected life span of the tree. The process of cutting, bundling, hauling, drying on racks and final storage of the leaf harvest neatly fills the time until the cereal and legume harvest is ready.

The early cereal types all require a slightly longer growing season than the modern hybrid cereals. In consequence the autumn cereals are currently ready in mid-August and the spring cereals in late August and early September. Of all the tasks of the farmer, this is the most critical and labour intensive. Exactly how the harvesting was achieved we have little real evidence. The Roman historian Strabo refers to the Celtic practise of cutting off the heads of the cereals which has led to an abundance of representations of one hand grasping a bunch of straws, the other poised with a sickle about to deliver in one smooth movement a fistfull of ears. Would that it were so. Countless experiments in grasping the prehistoric cereals have delivered a different reality. Because the prehistoric cereals are stable hybrids each ear bearing stalk does not grow to the same height. In fact some can grow as tall as 1.80m while others grow to a mere 0.40m. Regularly the disparity in height over the whole crop is over 1m. The second natural element which denies the above picture is that the grasping hand often comes away with the ears which break off from the stem without even a glancing blow from the sickle. In fact when the cereal is ripe the internode between the ear and straw stalk becomes very brittle and snaps off easily. It is, of course, the natural way in which the plant distributes its own seed. The other aspect, of course, equally does not work too well. If the straw is sickled off close to the ground and bundled into sheaves a considerable number of ears are lost in the process. Perhaps Strabo is right in his observations, but the translation should rather be `picks the ears of the cereals'. While tedious, this has proved experimentally to be far the best harvesting system and leads to a virtually pure harvest. Very few arable weeds manage to find their way into the harvesters sacks. The notable exception is the black bindweed, itself harmless and in subsequent periods recorded as a food plant.

If this was the system, then transport of the crop back to the farmyard is relatively straightforward. The obvious problem thereafter is a field full of standing straw, itself a valuable commodity for thatching, fodder supplement and bedding. Sickling, bundling and cutting, and then stacking in the farmyard represents an investment of many man hours. The straw could not be left in the field simply to rot down and be ploughed in. The major difficulty is the length of time straw takes to rot, usually many months, and the impossible conditions it would provide for the ard which is not necessarily fitted with a coulter to cut through the fibrous material. An abundance of chickweed left behind in the stubble of the crop can bring an ard to a grinding halt. Harvesting, therefore, would seem to be a twofold process, but there might even have been a third harvest which preceded the other two. Many of the so-called arable weeds are, in fact, food plants, and from the carbonised seed evidence their presence on sites is attested which clearly indicates they were either deliberately or accidentally brought into the farmstead; if deliberately then the ideal time to collect them is just prior to the harvest itself. Plants like the wild vetches, common orache and bindweeds all make an excellent contribution to and variation of diet. If they were brought accidentally then it must be assumed these plants made their way into the settlement amongst the straw harvest and became separated out in the later processing of straw, perhaps in its preparation for thatching.

Of all the crops for which we have evidence, the most difficult for the prehistoric farmer must have been the flax crops. This plant provides a double yield; oil from the seeds when crushed, and fibres from the stems when they are retted. The crop had to be cut just before the seed pods were completely ripe, put into bundles and probably taken back to the farmstead. It could be left for final ripening and treating in the field, but the risk of rain spoiling the crop was hardly worth taking. Once the pods were completely ripe the seed was crushed to extract the linseed oil. For the fibres to be stripped off the stems, the bundles have to be steeped in water for several days to loosen the fibre threads. Then the stems are raked down their length with combs to pull away the fibres which can subsequently be washed, teased and then spun into linen thread.

Harvesting includes the legumes as well. No doubt quantities of these were picked during the season for immediate consumption, but the bulk of the crop would no doubt have been left until the seeds were hard and dry. The legumes included the field bean, pea and the vetch. Probably these were harvested by picking the pods which would be further processed prior to storage. If left in the pod, all legumes tend to deteriorate through dampness and the inevitable presence of the bean weavil whose appetite knows no bounds. Because ripening time for legumes is not consistent, unlike that for cereals, the legume harvest could well have meant at least two pickings if not more. To leave it to a single harvest would have meant losing a fair proportion of the harvest because when ripe the pods burst open and spill the seeds onto the ground.

One usual crop which may have been grown is fat hen (*Chenopodium album*). Several quantities of pure seed have been recovered from excavations suggesting that it was either deliberately collected from wild plants, perhaps the third harvest mentioned above, or that it was a standard crop. The plant itself has many good qualities: when young the leaves can be eaten like spinach; when mature the whole plant can be cut and sun dried as fodder for livestock; and when the seeds are ripe can be harvested and ground into a fine flour for breadmaking. It has one further major benefit beyond these important qualities. Its primary germination period is in June with fruiting in mid to late September. In the event of crop failure this plant could be sown late on in the season and provide a useful fail-safe harvest. If it was, in fact, grown, then the harvest would have stretched on for at least a further two weeks to the end of September.

Once the crops were off the fields, there would be a mess of stubble and arable weeds, some beginning to grow quite quickly with the competition removed. Doubtless all the livestock of the farm were turned out into the stubble where there would be plenty to eat for several days. The beneficial side-effect would be the natural dunging of the fields at this time.

With the harvest in, the attention would focus upon the farmyard and the inevitable processing of the crops for their safe storage. The cereals share a common characteristic in that all of them without exception are bearded cereals. For storage, the minimum treatment needed is the removal of the beards so that the bulk is reduced and the chance of moisture penetration is reduced. This can be achieved either by beating the ears with a flail or similar tool or alternatively by the judicious use of fire. The awns or beard will quickly flame off leaving the ear untouched by the fire, but the risk of conflageration is ever present. The former method is the safer and in some ways better because it reduced the ear to spikelet form. To reduce it still further to the naked seed is necessary only for food preparation, a process which in all likelihood was essentially domestic and on a `need only' basis.

This raises the whole question of storage methods, and in what proportions the cereals were divided. A standard method of grain storage through a major part of the Iron Age was in underground silos or pits. The average holding capacity of the pit was some 1.5 or 2 tonnes. The only drawback to pit storage was that the complete contents of a pit had to be used immediately once the seal was broken. This rather suggests the pit was entirely set aside for bulk storage either for seed grain or trade or for both. Food grain would have to be stored separately. No doubt the cereal types were also kept separate from one another in bulk storage. Given the variety of crops and expected tonnage, maybe as many as five storage pits would be in use in any one winter. For successful storage, experiment has shown that the removal of the awns from the ears is quite critical and, therefore, we can be sure that the harvest was processed more or less as soon as it reached the farmstead from the fields. The filling and sealing of the pits with dung or clay is quite straightforward, and removes the physical problem of surface storage. Food grain was undoubtedly stored above ground, perhaps in one of the ubiquitous four-post structures which are normally interpreted as granaries. However, the actual bulk of food grain in comparison to the pits is quite small. Given the average annual consumption of flour in a mixed diet at 60 kilos, supplies for ten people, would occupy just over a cubic metre. Ideally such a small quantity would best be kept within the kitchen area where it could be under constant surveillance against deterioration. Also it would be far less tedious to reduce to pure seed form from the spikelets only as much as was needed each day. Seed grain, of course, can be planted in spikelet form.

Within the context of the harvest there was no doubt the autumn cull of livestock, the very old and the very young being the most likely victims. Not that a wholesale slaughter was in any way necessary or desirable. The stock to be carried through the winter would be dictated by the success of the hay, straw and leaf harvests. Those that were slaughtered would have been carefully jointed and salted down, or hung from the rafters and gently smoked above the domestic hearth. Nothing would be wasted. Hides and skins being cured, sinews kept for binding, and bones used for pins, combs and toggles.

The successful gathering in of the harvest was naturally celebrated at the Festival of Lughnasa. Probably the very next day, thick of head, the preparation of autumn sowing began with the carting of the midden, so carefully collected throughout the previous winter and now nicely matured, out to the autumn fields and then spread evenly over the ground. Then the autumn round of ploughing would begin in earnest. Concentration would focus upon the fields to be sown, but the ambition undoubtedly would be to plough all the arable land to open it up and allow the frost to do its work in breaking down the soil and killing off any build up of microbes. It is unlikely that this was recognised, but experience taught that ensuing crops were better after a number of heavy frosts had got to the soil. By the same token it would have been experience which dictated the autumn was but finished by mid-October.

And so the agricultural year comes full circle. There are a myriad of jobs around the farm and the fields not included in this conjectural review, like the refurbishment of ploughing tackle, mending barns and byres, repairing ravaged thatch; the list is endless. On a farm of any time or place there are always jobs to be done outside the normal flow of the seasonal work. That some jobs never get done indicates the nature of the work load. All the above and much more in a sense `must have happened' for us to have the archaeological evidence we do. All that is conjectured here is the deductive story behind the carbonised seed, the bone pins, empty pits and patterns of pos-holes. It is a simple, perhaps simplistic, attempt to understand the agricultural round of the Celtic year in the late first millenium BC.

FURTHER READING

Bowen, H.C. (1961) *Ancient Fields*, London: British Association for the Advancement of Science.

Clarke, A. (1990) *Seeing Beneath the Soil*, London: Batsford.

Fowler, P.J. (1983) *The Farming of Prehistoric Britain*, Cambridge: Cambridge University Press.

Glob, P.V. (1951) *Ard og Plov*, Aarhus Eniversitetsforlaget. Jysk Arkaeologisk, Selskabs Skrifter, vol. 1.

Green, M.G. (1992) *Animals in Celtic Life and Myth*, London: Routledge, 5-43.

Harding, D.W., Blake, I.M., and Reynolds, P.J. (1993) *An Iron Age Settlement in Dorset: excavation and reconstruction*, Edinburgh: University of Edinburgh, Dept of Archaeology Monograph Series 1.

Meniel, P. (1987) *Chasse et elevage chez les Gaulois (450-2 av J.-C)*, Paris: Errance.

Reynolds, P.J. (1978) *`The experimental storage of grain in underground silos'*, Ph.D. thesis, Leicester University.

------ (1979) *Iron Age Farm*, London: British Museum.

------ (1987) *Ancient Farming*, Princes Risborough: Shire Archaeology, no. 50.

------ (1988) *`Arquelogia experimental. Una perspectiva de futur'*, Euro Editorial, Universitaria de Vic, Catalonia.