Experiment in Iron Age Agriculture

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DURING the season 1965–1966, an attempt was made to complete the full cycle of agricultural practice that would have been undertaken by man in the Early Iron Age. Little enough precise knowledge on the subject is available; that which we have is mainly provided by the archaeologists and references from classical sources, but the remainder is largely hypothesis.

The facts are, therefore, very few. Early Iron Age people did cultivate the ground in field formations; they used a simple plough; they reaped the grain with sickles and flints and they stored the harvest, threshed or unthreshed, dried or undried, in grain pits dug in the ground and possibly in small granaries above ground. The supporting evidence for these statements is quite strong. For the fields we have aerial photographs of celtic fields; a plough, or rather an ard, has been recovered from a peat bog in Denmark, named after the bog, it is called the Donnerupland ard; sickles have been recovered from Iron Age sites, by archaeological excavations. For a long time the pits which we now know to have been used for storage, not only of grain, were wrongly thought to be pit dwellings. Perhaps the most important excavation to date in this field has been that of Professor G. Bersu at Little Woodbury,[1] although some of his findings are being reviewed in the light of later knowledge.

Some experimentation in Iron Age agricultural practices has already been carried out, notably by F. A. Aberg and H. C. Bowen.[2] Also an experiment in grain storage has been carried out by H. C. Bowen and Dr P. D. Wood in 1964–65. But the whole agricultural cycle had not been previously attempted. Consequently some of the results obtained will be of interest used in conjunction with the results obtained from the above experiments.

Through the kindness and generosity of Mr Thurston Holland-Martin, a site was obtained on top of Bredon Hill, Ordnance Survey Sheet 144, Ref. 960400: adjacent to the Iron Age Camp excavated in 1939 by Thalassa Cruso Hencken, F.S.A.[3] Approximately one-sixth of an acre was cultivated.

The object of the experiment is, therefore, twofold. First, to re-create the agricultural cycle from the initial preparation of the ground

[1] Excavations at Little Woodbury, Wiltshire, *P.P.S.*, VI (1940), pp. 30–111.
[2] Ploughing experiments with a reconstructed Donnerupland ard, *Antiquity*, 34, 1960. 144–7.
[3] *Archaeological Journal*, Vol. xcv.

to reaping the harvest, and, during this process, to verify or question the accepted theories as to the real practice of this period. In fact, a considerable deviation from the accepted theories was found to be necessary and is fully explained in the passages following. The method employed is, of course, purely subjective, and experiments must be carried out on different sites involving different soil-types since the soil-type is the particular variable that caused the reappraisal involved.

Secondly, the latter part of the experiment concerning grain storage is designed to answer one or two outstanding questions. Grain pits are known to have been lined with basketwork,[1] even stonework, but it is still not clear whether wet or dried grain stores best. This then is the first part of the storage experiment. Although there is evidence for the lining of grain storage pits, is such lining really necessary? Also can a grain pit be opened during the winter, a supply of grain extracted, and then resealed? These are questions to which this experiment attempts to provide answers. Finally the crop from the plot was stored in the ear in a lined grain pit. Germination tests were run on all the pits and provided some interesting figures which can be seen in the relevant passages.

A plough was constructed similar to the Donnerupland ard.[2] Basically it is a curved birch bough transfixed with a wooden spike which could be tipped with an iron sheath. Its construction and method of traction can be readily seen and understood from the photographs (PLATES V and VI).

Instead of attempting to obtain and train cattle, boy power was used to draw the plough along quite effectively. The ground used in the experiment had been left fallow for two years, previously bearing a cereal crop. Therefore the fibrous top-soil was not as thick as normal, but this in no way detracts from the efficiency of the plough as this same area would have been used for several seasons and the same problems would have arisen. The object of this plough was simply to break up the top-soil and fine it down into a suitable seed bed. However, it was soon obvious that the plough was far too efficient in the light soil on top of Bredon. A furrow 5–6 inches deep was being produced. The area was cross-ploughed to break up the ground thoroughly and turn the soil, and then was levelled down with branches until a relatively flat surface was obtained. The depth of the furrows is clear from the photographs.

[1] Excavation of Conderton Camp, Worcs., *P.P.S.* xxv (1959), p. 275.

[2] I wish to thank Mr Jewell of Reading University who kindly allowed me to examine the reconstruction of the Donnerupland ard in the Museum of Rural Science at the University.

This presented the first problem. The position reached is quite clear. The ground has been ploughed and smoothed out into a seed bed. How did Iron Age man sow seed? The accepted view, supported by mediterranean and mediaeval evidence, is that the seed was broadcast. The Roman practice also was to sow seed from a basket (*satoria*), scattering it by hand, and, that it might be done evenly, the hand aways moved in time with the foot. They either sowed above furrow (*in lira*), or under furrow (*sub sulco*) more frequently in the latter way. They sowed the seed on a plain surface and then ploughed, so that it rose in furrows and allowed hoeing. Sometimes it was covered with rakes and harrows (*rastris/crate dentata*). This agrees with mediaeval practice in this country.

Archaeology has provided us with an ard and sickles, but as yet with no harrows or rakes. Documentary evidence is slight and inconclusive. The Iron Age way remains a matter for conjecture. One can be certain that seed was in short supply and proportionately precious. To sow seed in furrows 5–6 inches deep would be to throw away the harvest. To smooth the furrows out and then broadcast the seed would be no less wasteful. It would simply present the birds, no less voracious then than now, with an unexpected feast. The Roman method presupposes a ploughshare and a sophisticated cycle of agriculture and, of course, offends 'ad tempus'.

The Donnerupland ard is accepted as being a progression of the Bronze Age digging stick but due to its efficiency this seems hardly enough. Therefore, one conclusion that may be reached is that a seed furrow was made some 2 inches deep and the seed carefully sown in this. In the experiment a curved stick, similar to the main beam of the plough, was employed for this purpose (PLATE VII). Farmers of any period are extremely conservative in their practices and it would seem logical that the digging stick of the Bronze Age would be retained in some form although the plough itself was a progression of the digging stick. For it to become a sowing stick is but a simple step. In all probability it was used as such before the plough ever appeared.

The seed planted was unfortunately modern seed, dressed and undressed rika barley. It is virtually impossible to obtain an ancient strain of seed. One type that perhaps might give comparative figures for yield would be April Bearded, a wheat of the *Triticum Vulgare* variety which appears to have evolved directly from the Iron Age. However, even this is extremely difficult to obtain.

The crop eventually grew and ripened despite the English summer. Taking a statement from Strabo that the Celts reaped grain by cutting the straw just below the ear, the harvest was gathered in this way, using reconstructed sickles in conjunction with knapped flints. In practice the flints proved to be far more efficient than the sickles and were much favoured by the reapers. The resultant harvest, a poor yield due to the ravages of the weather and the attention of many starving but discerning hares, was laid in the sun to dry.

From this first part of the experiment, it can be seen that empirical experiments may reveal flaws in long accepted theories but the answers suggested above should in no way be taken as fact but rather as more practical suggestions as to the actual practice of Early Iron Age farmers.

Grain Storage

This part of the experiment is perhaps the most interesting and the most important. It has been suggested that the Iron Age population could be computed from information obtained from storage pits. This would be done on a basis of average quantity of grain consumed *per capita* put against the size, and number of proven grain pits on a given site. The third fact that would be necessary is the average life of a grain pit, how long it would remain in a suitable state for grain storage. This last part can only be discovered by empirical means.

This experiment, however, was divided into three separate parts. The first to ascertain the comparative benefits of storing wet or dried grain in pits lined with basketwork; the second to discover how grain stored in an unlined pit would react, and to ascertain whether a pit could be opened, some grain removed and then re-sealed, and third, how grain, albeit modern grain, sown and reaped by Iron Age methods would store in the ear in a lined pit. There are, therefore, many cross references that can be drawn from the results of each part.

The site for the grain pits was due south of the Iron Age Camp in a level area some 10 yards square. There was a heavy fibrous top layer of some 9 inches in depth beneath which lay a layer of sandy loam. This layer shelved sharply from the east where it was only 6 inches deep, to the west, where it dropped to some 2 feet 6 inches–3 feet deep. Beneath this layer was the friable oolitic limestone common to the Cotswold Edge and Bredon, the hill being an outlier of the Cotswold range.

Part 1

Two large pits were excavated on the site on 18 and 19 September 1965. They were modelled on the size of the pits discovered by Professor G. Bersu in his excavation of Little Woodbury. Both pits were dug to a depth of 4 feet 6 inches below the surface, and 4 feet wide at the mouth.

The object of these two large pits was to compare the storage properties of wet and dried grain in lined pits dug in limestone and to compare the germinating quality of the resultant grain. Tests were taken at approximately fortnightly intervals to assess the concentration of carbon dioxide within the pits.

Pit A was extremely difficult to dig because, after an initial layer of 5 inches of clay, friable limestone was encountered. The pit was cylindrical in shape and had a volume of approximately 50 cubic feet. At the bottom of the pit, a natural fissure in the rock was discovered which appeared to drop right into the hill. A 12-foot bar failed to reach a bottom. An attempt was made to fill this crack with rocks and clay, but a complete seal was impossible due to the nature of the limestone. This fissure appears to have been more important than was thought at the time of digging and possibly it accounts for the lower readings of carbon dioxide obtained for this pit.

A basket made from willow withies had been constructed during the summer months (PLATE VIII). The weaving was extremely simple and yet effective. Its shape was cylindrical with a slight narrowing at the neck. This was placed in the pit and proved to be an excellent fit. There was a gap of an inch or two between the sides of the pit and the basket. This gap was filled with blue lias clay obtained from further down the hillside (PLATE IX).

A batten was placed across the top of the pit, carrying two copper pipes, one reaching 15 inches into the pit, the other 30 inches. Gauze was taped at the lower ends to prevent the pipes becoming choked with grain. Glass taps were fixed in the upper ends of the tubes and made fast with Bostik cement.

The bottom of the pit was covered with a layer of chopped straw to a depth of 18 inches and the whole was then filled flush to the surface with 16½ cwts. of tail barley at a moisture content of 22 per cent. This then was the wet pit.

A plyboard covered the top of the pit and was completely covered with moist clay. The clay dome extended beyond the edges of the pit for about 6 inches. The rubble of shale and soil was then heaped upon the clay seal and made an appreciable mound 120 inches across and 24 inches high, leaving only the glass taps on the copper pipes exposed (FIG. 1).

The object of the pipes was to draw off a sample of the gas in the pits at regular intervals. It is a known fact that grain respires, using up oxygen and giving off carbon dioxide in the process. If the grain is stored in a sealed container it will continue to respire until there is insufficient oxygen in the gas to admit the normal rate of respiration.

PLATE V

PLATE VI

facing p. 64

PLATE VII

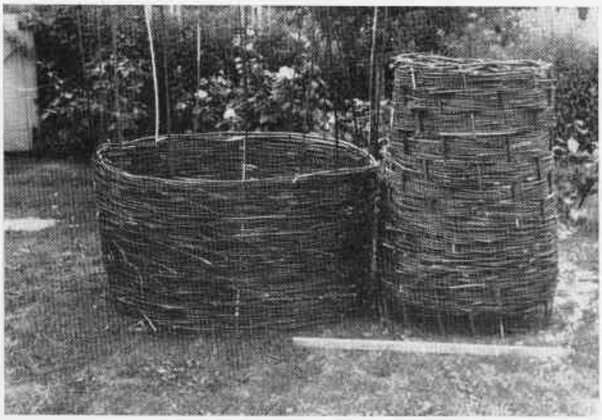

PLATE VIII

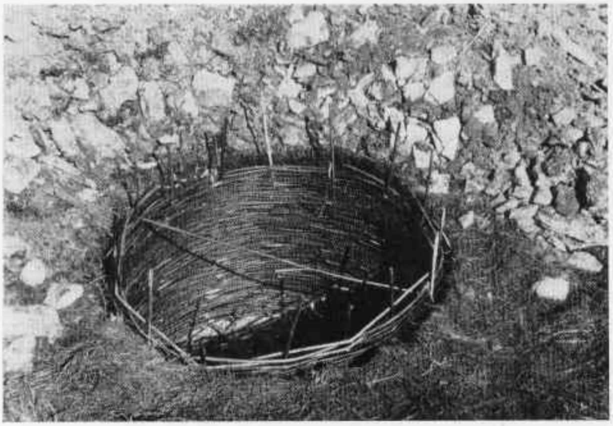

PLATE IX

PLATE X

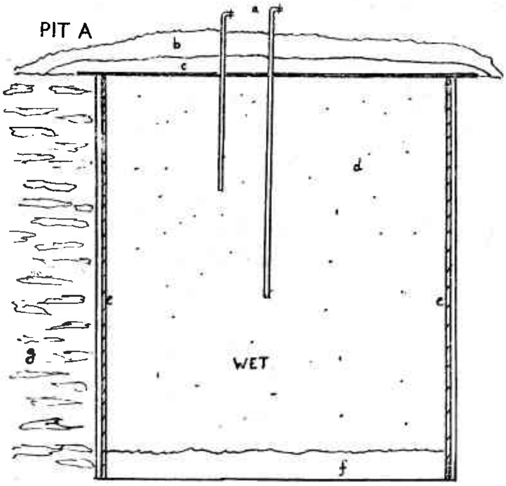

Fig. 1

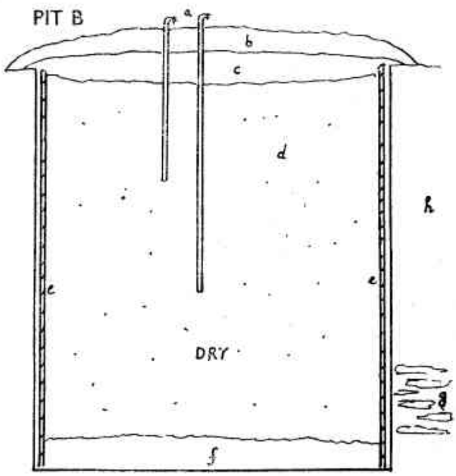

Fig. 2

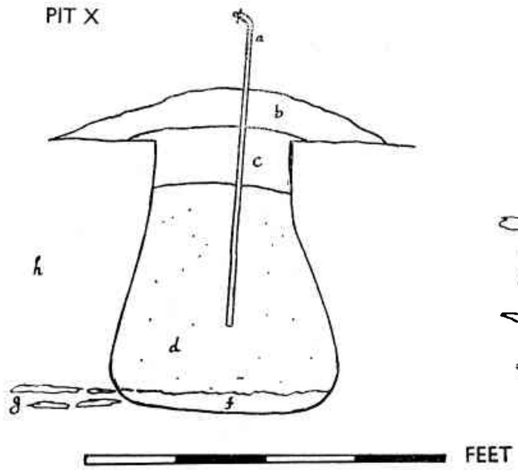

Fig. 3

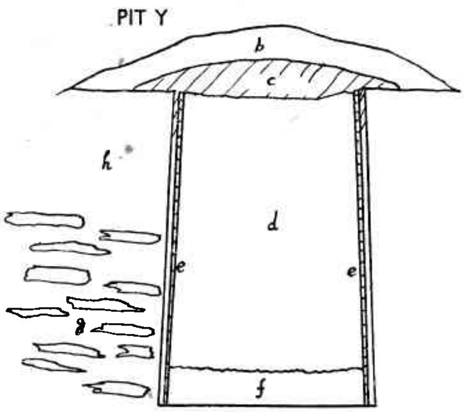

Fig. 4

a. — copper pipes. c. — clay. e. — basket. g. — limestone.
b. — soil mound. d. — grain. f. — chopped straw. h. — sandy loam.

CROSS SECTIONS OF GRAIN PITS

Consequently the rate of respiration will decrease and the grain will become virtually dormant. The tests, therefore, were to determine if carbon dioxide builds up inside the pit, and if so, how much. A further factor would seem to have some bearing on the respiration rate, that of heat. Each time the gas was aspirated, the ground temperature was recorded and the interaction of these two factors can be seen on the relevant tables.

Pit B was treated in a similar manner to Pit A. Its shape was cylindrical, 4 feet 6 inches deep and 4 feet across the neck. It was far easier to dig as the limestone shale was not encountered until the pit was 2 feet 6 inches to 3 feet deep. The pit was lined with another basket woven from willow withies and the resulting gaps round the edges were filled with clay. The capacity of this pit was slightly larger than Pit A, due to the disparity in the size of the baskets. Pit B had a capacity of approximately 56 cubic feet. The batten holding the copper aspiration pipes was placed across the top of the pit before filling. The pipes reached 15 inches and 30 inches respectively into the pit. A layer of chopped straw was placed in the bottom of the pit to a depth of 18 inches. The grain, 19½ cwts. of tail barley, was then poured into the pit until it was flush with the surface. In this pit, the dry pit, the grain had been dried in a modern grain drier to a moisture content of 14 per cent.

The seal on this pit was probably nearer to Iron Age practice. Clay was bonded together directly on to the top of the grain. A dome of clay was built up which extended well over the edges of the pit. This dome was, in turn, covered with the limestone rubble and soil making a large mound 88 inches across, 18 inches high, leaving only the top of the copper pipes with the glass taps exposed (FIG. 2).

The recovery of the grain from Pits A and B took place on 2 April 1966. The weather was very dull and overcast: a day that would not have been chosen by Iron Age man to recover his food supplies from the earth. Pit B was opened in the morning, the air temperature at 9° C. and the ground temperature at 7.5° C. The weather rapidly deteriorated through the morning until a heavy mist completely shrouded the top of the hill.

However, once begun, the operation had to be completed. A last aspiration was taken from all the pits prior to the opening. The results are shown in the tables. The mound was removed carefully to expose the clay seal. This was relatively warm at 8.5° C. The seal itself was 6 inches thick, bonded straight onto the surface of the grain. The grain was very wet immediately beneath the seal but thereafter quite dry and in excellent condition. There was very little sprouting to be seen at all. The temperature of the grain at the surface was 10° C. and at 2 feet 6 inches deep in the centre of the pit, 11° C. The moisture content of the grain had risen from 14 per cent to 18.5 per cent and it was quite warm and dry to the touch.

Mould samples were taken from the top of the pit and proved to be a combination of *Penicillium sp.*, *Epicoccum Nigrum*, *Fusarium sp.*, and *Coniosporium.*[1] There appeared to be very little mould visible to the naked eye at all. The grain was a good colour with only a slight musty smell.

The chopped straw at the bottom of the pit was considerably compressed, but it too was quite dry except for the actual point of contact with the floor of the pit. The basketwork throughout was in excellent condition and quite dry.

Of the 19½ cwts. of grain put into Pit B, 19 cwts. were recovered in very good condition. Germination samples were taken and the figures can be seen in the germination results table.

Pit A on the other hand proved to be quite different. This was opened in the afternoon when the ground temperature had dropped to 4° C. and the air temperature to a very crisp 1° C. The mound was carefully removed only to disclose a deep fissure between the basket edge and the pit wall on the north side. The side of the pit had crumbled in badly and had apparently acted as a water chute. This fall coincided with the fissure discovered when the pit was dug.

The clay seal over the plyboard was very moist and cold, 4° C. The top of the pit had sunk at an angle, from 4 inches on the south to 18 inches on the north. When the clay and plyboard had been removed, a terrible smell of rotting vegetation considerably hampered the proceedings. As the smell was bad, so the colours were attractive. The whole of the grain surface was a mass of mould and rotting grain. It was divided into three segments; to the north, a vivid wet red brown, to the south, drier and green, and to the west, a grey pink. The fungi present were identified as follows: the red brown was the result of contamination by an unidentified mould with considerable bacterial breakdown. The green proved to be a combination of *Penicillium sp.*; the grey pink, *Fusarium sp.*, *Coniosporium*, *Sacc. Stysanus*, *Corda*. The temperature of this mass was a very warm 18° C.

This layer, which extended to a depth of 18 inches, was removed. Thereafter the grain was dry but generally discoloured. The temperature at the centre was 11° C. Its moisture content was almost the same as when it was originally stored, 21.5 per cent–22 per cent.

[1] Mould samples identified by C. L. J. Ryan, Plant Pathologist, Ministry of Agriculture, Fisheries and Food.

Approximately 9 cwts. of this better grain, out of 18 cwts. stored, were eventually recovered. Germination tests from this grain gave a nil return.

The basketwork was in a very poor condition at the top of the pit, wet and rotted. Lower down it was quite good except for the area to the north and where it made contact with the floor of the pit.

The conclusions that can be drawn from this experiment are basically quite simple. Threshed grain can be stored in the ground quite successfully. The major problem is to provide a pit with firm walls and a good seal. Pit B was dug in such a manner with only a foot at the bottom of limestone shale. The gap between the basket and the earth wall was well caulked with clay and the whole completely sealed in. Pit A was dug almost entirely in friable limestone and it proved exceedingly difficult to make a firm solid wall. The fissure at the pit bottom proved to be the fatal flaw and probably was a water escape before. This caused the rock to cave in and was responsible for the rotting of the basket and spoiling of the grain. The seal itself was equally as good as Pit B, so the water found its way under the surface. The CO_2 table for Pit A indicated that something had gone wrong. Originally it was thought that the first fissure was responsible for the large disparity between the pits, but the continued low readings intimated a more serious condition.

Comparison between the pits, therefore, is to some extent invalidated. The dry grain stored excellently and almost total recovery was made. The grain was in good condition and quite edible—a pleasing sight for Iron Age man indeed. Pit A, the wet grain, was spoiled, only half of it being recovered, but nevertheless it has its point. Iron Age man obviously avoided digging his pits in loose limestone where there could be an underground water conduit. It is true to say that some grain pits have been discovered that were lined with drystone walling and this is probably the answer to this problem. The carbon dioxide readings are extremely interesting with regard to the physical results from the pits. The readings when plotted on graphs appeared to show a direct correlation with the ground temperature and the CO_2 concentration. An increase in ground temperature probably increased the rate of respiration which in turn caused the presence of more carbon dioxide. A concentration level of between 2 per cent and 4 per cent of CO_2 would seem to be the most effective storage agent.

The CO_2 table from Pit A, however, is fairly consistently below this level, probably, if not certainly, due to the passage of water through the side of the pit introducing more oxygen and facilitating

Carbon Dioxide Concentration Tables

PIT A

Ground temp.	Date	15 inches gms/litre	Volume per cent	30 inches gms/litre	Volume per cent
3.2°C.	29. 9.65	—	—	.025	1.25
4.9°C.	13.10.65	.1292	6.65	.0554	2.8
6.5°C.	28.10.65	.079	3.95	.061	3.05
5.2°C.	10.11.65	.046	3.2	.017	0.85
—4.5°C.	24.11.65	.009	0.45	.017	0.85
—7.8°C.	8.12.65	.000733	0.036	.0033	0.165
—1.0°C.	20.12.65	.0033	0.165	.0029	0.145
—2.0°C.	13. 1.66	.00293	0.151	.00257	0.1285
1.3°C.	26. 1.66	.033	1.65	.0242	1.1
4.0°C.	9. 2.66	.0059	0.295	.0048	0.24
5.0°C.	23. 2.66	.022	1.1	.0158	0.8
9.0°C.	9. 3.66	.0073	0.365	.0092	0.46
9.0°C.	23. 3.66	.0051	0.255	.0041	0.205
7.5°C.	2. 4.66	.066	3.3	.029	1.45

PIT B

Ground temp.	Date	15 inches gms/litre	Volume per cent	30 inches gms/litre	Volume per cent
3.2°C.	29. 9.65	—	—	.09	4.5
4.9°C.	13.10.65	.1254	6.4	.1364	6.9
6.5°C.	28.10.65	.115	5.75	.121	5.05
5.2°C.	10.11.65	.125	6.25	.121	5.05
—4.5°C.	24.11.65	.041	2.05	.046	3.20
—7.8°C.	8.12.65	—	—	.054	2.7
—1.0°C.	20.12.65	.0684	3.420	.069	3.45
—2.0°C.	13. 1.66	.0253	1,265	.03	1.5
1.3°C.	26. 1.66	.0453	2.2	.054	2.7
4.0°C.	9. 2.66	.083	4.15	.0666	3.3
5.0°C.	23. 2.66	.0561	2.8	.051	2.6
9.0°C.	9. 3.66	.085	4.25	.085	4.25
9.0°C.	23. 3.66	.071	3.55	.07	3.5
7.5°C.	2. 4.66	.050	2.5	.063	3.15

Normal CO_2 concentration is .0006 gms/litre
.03 by volume per cent

the bacterial breakdown at the grain surface. The winter was extremely wet, some 15.68 inches of rain falling on the site in less than 23 weeks. If it had been an extremely dry winter, it is conceivable that this pit would have survived.

The table plotting the results of CO_2 concentration tests on Pit X (see Part 2), shows a remarkably similarity to Pits A and B, giving an overall picture that, provided that a certain level of CO_2 is present, would indicate the successful storage of the grain. The Pit X table, however, does show higher concentrations but this is undoubtedly due to the opening of the pit and the warmer temperatures experienced since January.

The germination properties of the grain are also extremely interesting. From the dry pit, despite the fact that the grain was artificially dried, an average of 67.5 per cent germination was obtained, a fact that would seem to indicate the supposed above-ground granaries were dispensable. The wet pit, on the other hand, recorded a nil return although the grain was still edible. This result was not unexpected in the circumstances but is a powerful argument for the insurance of above-ground granaries.

From these two pits, therefore, it can be seen that food grain, and, from Pit B, seed grain can be stored quite successfully. The moisture content of the grain seems to have little bearing on its storing capacity. Chemically the wet pit should have stored better, its greater warmth encouraging respiration and producing a greater concentration of CO_2, and consequently a better storage unit. In this case, water interfered and spoiled careful calculations.

PART 2

Pit X

This pit was much smaller than the other three pits, being 3 feet deep and only 18 inches across at the neck. It was dug in a bell shape with a narrow neck. At its widest point, 2 feet 6 inches down, it was 2 feet 6 inches across, having a capacity of approximately 5 cubic feet. In this pit, limestone shale was not encountered until the last few inches, the soil strata being mainly sandy loam.

Chopped straw was placed in the bottom to a depth of a foot and dried grain, at a moisture content of 15 per cent, was poured in until flush with the top of the neck. In fact, 3 cwts. of grain filled the pit exactly. The neck was sealed with a reed lid thoroughly caulked with clay and a mound raised above this. This was, in turn, covered with a 2-inch layer of clay, making a mound some 2 feet high and 4 feet across. This pit was dug and filled in on 18 September 1965 (FIG. 3).

The object of this smaller pit is twofold. First, to determine if grain will store in an unlined pit, and secondly to ascertain whether a pit can be opened during the winter and then re-sealed—a point of considerable interest to Iron Age man, who would find it much more convenient to open his store, extract the quantity he wanted, and then reseal the store, rather than having to open up the pit and use all the contents.

On 29 January 1966, therefore, on a dry dull day, this pit was opened up. The air temperature was 10° C. and the ground temperature was 6° C. On opening the pit the reed lid was destroyed. The clay was fairly moist and malleable. When the clay and reed lid were removed from the neck, the grain appeared to be in reasonable condition. There was a certain amount of mould and sprouting at the surface but only to a depth of 1½ inches. The temperature at the grain surface, now 6 inches inside the neck, was 5.5° C. At 18 inches down from the grain surface, the temperature was 8° C. Three samples of fungi were taken, one from the destroyed reed lid, one from the centre of the grain surface, and one from the edge of the grain surface. These were analysed and proved to be predominantly *Penicillium*, with *Epicoccum nigrum* on many grains, and *Alternaria* and *Fusarium sp.* on a few grains. Only the last, *Fusarium sp.*, can cause disease in a growing crop, and was very rare.

The grain itself was in remarkably good condition, dry and firm. Samples were taken from 18 inches down from the centre and the edge for germination tests. These proved to be quite reasonable, as the following table indicates. Approximately ½ cwt. of grain was then removed.

	Sample from Edge	Sample from Centre
TEST 1	67 per cent	72 per cent
TEST 2	68 per cent	64 per cent
TEST 3	77 per cent	75 per cent

Control 98 per cent

A glass tube, the end protected with gauze, was inserted into the grain, in order to take gas samples of the reaction of the grain inside the pit after opening. These results can be seen in the relevant table. The pit was then resealed with moist clay and the mound replaced.

The pit was finally opened on 4 April 1966. The weather was dull and cold, but dry. Ground temperature was 1° C., and the air temperature 3° C. The mound and clay seal were carefully removed and the grain exposed. Directly beneath the clay seal the grain had sprouted a little but only to a depth of 2 inches. The temperature at grain surface was 8° C. and at 2 feet 6 inches deep, 10° C. Thereafter the grain was in good condition. The moisture content had increased from 15 per cent to 24 per cent. Of the 3 cwts. stored, almost 2 cwts. were recovered in excellent condition to add to the ½ cwt. recovered in January. The germination tests gave an average result of 60 per cent, indicating little difference from the results obtained in January. Very little mould was visible. Samples were taken and the fungi present were as before.

The straw at the bottom of the pit was compressed but quite dry except for where it came into contact with the pit floor. Even here it was only damp and no rotting had taken place at all.

The walls of the pit provided the greatest interest. The grain had stuck to the damp walls and made a second skin almost 2 inches thick. The grain next to the earth wall was wet and rotten but gradually the build-up towards the centre became drier and drier until the interior surface was quite dry (PLATE X).

The table plotting the result from the CO_2 tests is similar to the larger pits showing an initial heavy concentration gradually reducing to a steady level.

The implications that can be drawn from this pit are quite important. First it proves that threshed grain can be stored successfully in an unlined pit. This is a fact that will supplement the results obtained from the experiments conducted by H. C. Bowen, M.A., F.S.A., and P. D. Wood, M.A., PH.D., at Broad Chalk, near Salisbury, Wilts, reported in *Antiquity*. The second implication is that a pit can be opened, some grain removed, and then re-sealed quite successfully. The results from the germination tests also indicate that seed grain as well as food grain, can be stored quite effectively in an unlined pit.

PIT X CARBON DIOXIDE CONCENTRATION TABLE

Ground temp.	Date	Gms/litre	Volume per cent
4.0°C.	9.2.66	.129	6.45
5.0°C.	23.2.66	.0738	3.7
9.0°C.	9.3.66	.142	7.1
9.0°C.	23.3.66	.101	5.05
7.5°C.	2.4.66	.083	4.15

PART 3

Pit Y

This pit was dug late in July and lined with basketwork. Basically cylindrical in shape, it narrowed slightly towards the neck. With the basket inside, its capacity was approximately 13 cubic feet, being 3 feet 6 inches deep and 2 feet 2 inches across at the neck.

During the months of August and September, the pit was covered with a ply board. On inspection in September, the basketwork was still sound, only a very few minute specks of mould appearing, and the walls of the pit, though still damp, were in good condition.

On the 18 September, 3 cwts. of grain, the harvest from the barley plots, were put onto a layer of straw inside the pit. The grain was stored in the ear at a moisture content of 18 per cent. The gaps round the basket were caulked with clay and a ply board fixed into position over the top of the pit. No provision was made for aspiration at all. Clay was moulded over the ply board and a mound of earth raised over the top (FIG. 4).

Pit Y was opened at the same time as Pit X. The seal had been extremely good and the grain, in the ear, was in excellent condition. The temperature at the grain surface was 7° C. The straw at the bottom of the pit was dry except for the point of contact with the earth floor. The germination tests showed a 70 per cent resultant which might indicate that grain stores better in the ear with regard to possible re-sowing.

It is interesting to note that 3 cwt. of grain stored in the ear needed a capacity of 8 cubic feet against the 5 cubic feet required by threshed grain. However, much more experimentation is necessary before any figures can be arrived at to be reliable in the computation of Iron Age population. It was also possible to thresh the grain immediately on recovery from the pit, the moisture content being only 19 per cent, one per cent more than when it was stored.

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