TRANSPLANTATION OF GRASSLANDS: II

IMPROVEMENTS IN FIELD PRACTICES AND TECHNIQUES[1]

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Abstract: The ability to manage grazed and cut transplanted grasslands in their traditional manner is critical for the maintenance of their nature conservation value. However, such management has generally not taken place and as a result many transplants have not been as successful as they might have been.

Two principal physical constraints on the grazing and cutting of transplanted grasslands have been identified. These were, uneven surfaces, and holes or gaps between turves.

Variation in turf thickness, collapse of turf edges and disintegration of turves were the most common cause of uneven surfaces. There are a number of field practices which can be adopted to achieve an even surface to the transplanted grassland. These include close supervision, to achieve consistent turf thickness, 'back stowing' of collapsed edges, and the pressing of turves.

Holes or gaps between turves result from collapse of turf edges or failure to tightly abut turves where turves are typically 200mm or thicker. The occurrence of holes can be avoided by adopting the practice of leaving a narrow 100mm gap between the turves and back-filling with subsoil.

Where the above practices have been adopted traditional grazing and cutting of transplanted grasslands has been possible.

Additional Key Words: Grazing and Cutting; Turf Thickness; Holes and Gaps.

Introduction

In our first paper on grassland transplantation (Humphries, Horton & Benyon, 1995) we concluded that the ability to graze and/or cut the transplanted grasslands in their traditional manner was crucial to their long term success. However, from the examples we used and others we have recently described (Horton and Benyon, 1993), it is clear that traditional management has not generally taken place, and as a result many transplants have not been as successful as they might otherwise have been.

Grassland transplantation involves the lifting of the vegetation and the upper soil horizon(s) as an intact turf, and the transportation and relaying of the turves at another site. The purpose of this paper is to identify transplant practices which restrict grazing and cutting, and the techniques developed over the last decade to ensure that grazing and cutting can take place. The basis for our assessment is the unpublished national review we undertook in 1991 (Humphries, Horton & Benyon, 1991) and two schemes at the Bleak House and Selar opencast coal mine sites in the UK which we have been involved in. This approach follows the evaluation methodology recommended by Humphries, Rowell & Leverton (1984), which combines critical literature reviews of past experience with the observation of field practices during their implementation.

Reasons for Grasslands Not Being Grazed or Cut

There is a range of reasons why transplanted grasslands have not been grazed or cut in the past. These include the absence of tenure or management agreement with the land owner, vandalism, change in landuse,

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unavailability of stock or incompatibility with local and current farming practices, the unit of land being too small to manage economically, and physical restrictions (Prigmore, 1987; Byrne, 1990; Humphries et al, 1991). Of these, only those which physically constrain grazing and cutting are determined by transplantation practices and techniques. Three principal physical constraints to grazing and cutting have been reported. These are: soft ground conditions, uneven surfaces and holes between turves (Humphries et al, 1991). At present all the evidence suggests that soft ground conditions arise either from the selection of a receptor site that is too wet, or carrying out the transplantation during the winter or spring, rather than a particular practice or technique per se, whereas unevenness and holes are a result of transplantation practice.

Uneven Surfaces & Holes

The unevenness of relaid turves has been reported to be a feature of the Westhay Heath, Monkspath Meadow-Temple Balsall, Potatopot and Thrislington Plantation sites (Park, 1989; Byrne, 1990; Warwickshire Nature Conservation Trust, undated). However, at other sites like Newhall Reservoir unevenness of the grassland was not a particular feature of the transplant (Byrne, 1990). Uneven surfaces, depending on their degree and amplitude, are likely to constrain cutting by tractor drawn equipment, but not grazing.

Holes between turves have also been reported to be a feature of the transplants at Potatopot and Monkspath Meadow-Temple Balsall, but not at other sites such as Brocks Farm and Thrislington Plantation (Park, 1989; Byrne, 1990). Holes, depending on their depth and frequency, can cause injury to stock, be focal points for turf deterioration through trampling by stock and trafficking by agricultural machines, and may also prevent cutting by standard mowing machines. Holes, are therefore likely to constrain both cutting and grazing.

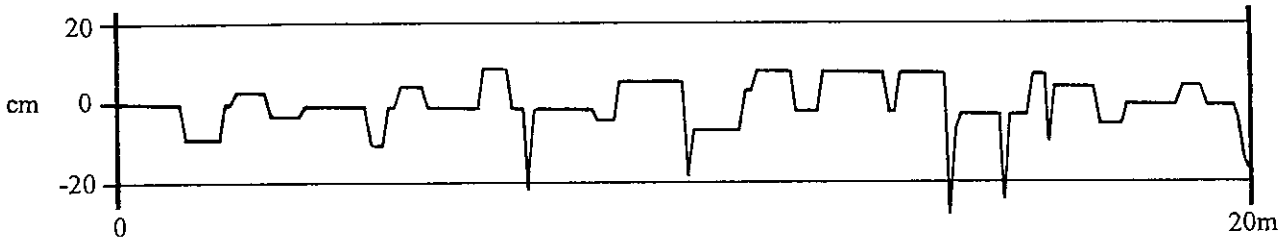
Uneven Surfaces

The unevenness of relaid turves most commonly takes the form of an abrupt 'step like' change between the edges of turves. At Thrislington, a difference of up to 150mm in level between edges was reported (Park, 1989). This was attributed to the variation in turf thickness arising from a variable soil profile and physical difficulties of lifting turves with a rubber tyred machine in wet winter conditions. However, at this site the problem only seems to have been local in extent as the unevenness of the grassland surface does not appear to have been sufficient to prevent management of the general area by mowing. In contrast, in addition to the wetness of the soil, the unevenness at Monkspath Meadow-Temple Balsall had prevented cutting by conventional agricultural mowing equipment (Hill, 1989). Here, uneven turf thickness was a particular feature (Fig. 1a). The matter seems to have been made worse at this site by the small sized turves (500 x 400mm) transplanted, this resulted in a very high ratio of edges to area of turf. The unevenness also appears to have partly arisen as a consequence of the exceptionally wet and muddy conditions at the time of relaying the turves. This view is supported by eveness of the turves laid at the Shelly Green part of the Monkspath Meadow transplantation where the ground conditions were much drier during laying (Byrne, 1990). Another contributing factor was the tussocky nature of the grassland vegetation at the time of transfer which resulted in considerable variation in turf thickness owing to difficulties in undercutting the turf. However, unevenness in the final ground surface was also recorded at other sites, for example Potatopot and Blackwater Valley (Figs. 1b & 1c).

The most common reasons for uneven relaid turf surfaces appears to be variation in turf thickness, collapse of turf edges and disintegration of the turf (particularly with very stony or dry soils). However, a problem for subsequent agricultural use only seems to arise with turves thicker than about 100-150 mm, and turves cut from rank unmanaged grassland.

(a) Monkspath Meadow - Temple Balsall

(b) Potatopot



(c) Blackwater Valley

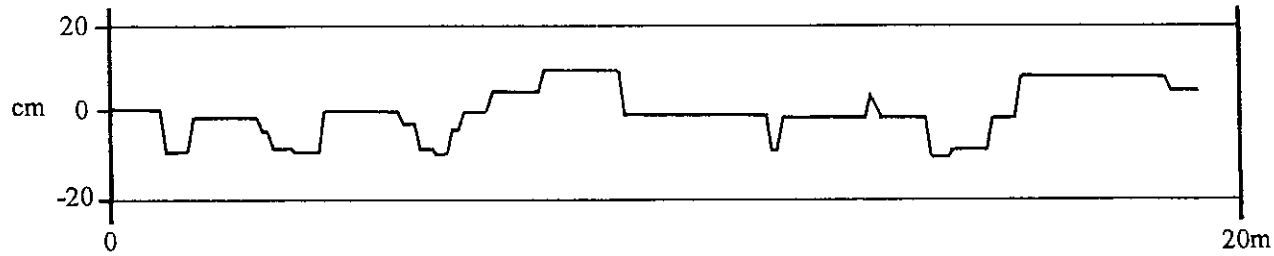


Figure 1. Topographic cross-section of transplanted grasslands.

Holes

Holes most commonly take the form of 'gaps' between turves. Holes were of frequent occurrence at Potatopot where we have recorded depths up to 43cm (Fig. 1b). Although the holes have not prevented the grazing by sheep at low densities, they were considered by the tenant farmer to be deep and frequent enough to be a hazard for cattle and prevent mowing by agricultural equipment. Holes were also a feature of the turf at the Monkspath Meadow-Temple Balsall transplantation (Fig. 1a) and, in addition to wetness and unevenness, were of sufficient depth and frequency to prevent both grazing by cattle and cutting by agricultural machinery (Hill, 1989).

Gaps between turves laid by machine occur during tipping of the turf from the bucket. Where turves were laid with machinery at Potatopot and Westhay Heath the general practice was to push the turves tightly together. Turves relaid by hand labour at Monkspath Meadow-Temple Balsall and in parts at Westhay Heath were also placed tightly together. It is clear from the subsequent occurrence of holes in these examples that the practice of placing turves tightly together does not reliably prevent their development over time.

The most common reasons for holes to occur at the gaps between turves are the collapse of the turf edges, either as a result of undercut edges or as a zone of structural weakness. The problem seems to be mainly associated with turves that are 200mm or thicker. Holes do not seem to be a problem where the turves are relatively thin (ie 100-150mm), as was the case at Newhall Reservoir. However, even with thin turves, significant holes can develop if laid on soft ground as was the case at Monkspath Meadow-Temple Balsall.

Practices & Techniques to Avoid & Minimise Unevenness & Holes

Unevenness

Our involvement in turf transplantation at the Bleak House opencast coal site in 1993 provided an opportunity to establish which field practices could avoid or minimise uneven turves. The specification of turf thickness proved to be critical. From our experiences at Bleak House and subsequently at the Selar opencast coal site in 1994, the specified thickness of turves being lifted needs to be constantly monitored if eveness of the transplanted grassland surface is to be achieved. Another important part of the field operation is to determine on-site, and as the work progresses, the thickness of turf to be lifted, and whether the specified thickness should be revised in view of field conditions. For example, turf thicknesses of about 300mm should ensure that the upper and often important part of the soil-biological part of the system is transferred, along with sufficient root-stocks of deeper rooting species for regeneration to take place. We assessed this to be about 250mm at the Bleak House and 300mm at Selar sites. However, very stony soil profiles tend to collapse or disintegrate. It is not unusual for the upper 150-200mm of mesotrophic grassland soils to be markedly less stony and therefore less prone to collapse. In these situations it has proved better, as at Selar, to transfer the upper 200mm as intact turf and the remainder of the profile to be transferred as excavated soil, and relay them sequentially as the full 300mm profile.

There are other practices which can significantly assist in the minimisation of uneven surfaces, principally by ensuring a consistent turf thickness at lifting. Turf size is also important and clearly large turves (1 x 2m) are an advantage but require the employment of machines. Turf buckets should be used; these completely under-cut the turf as part of an integrated operation with lifting, and the use of turf forks (which tear the horizons apart) must be avoided. The turf buckets must be attached and operated in a 'front-acting' mode, and not in the conventional 'back-acting' excavation mode. The buckets must be pushed into the profile and parallel to the surface without any digging action. The turves should be lifted along a demarcated strip, advancing a strip at a time. This practice has been used at the Bleak House and Selar sites and has several benefits, including the provision of a 'shelf', which should be kept during the lifting of the next row; this greatly assists with the guidance of the bucket and significantly improves the achievement of a consistent turf thickness. It is particularly important that the ground surface in front of the turf being lifted is level and parallel

to the surface of the turf (Park, 1989). Where this practice was deviated from at Selar, the turf thickness was particularly variable.

Finally, a short turf is essential for even thickness turves. The grassland must be cut or grazed immediately prior to transplantation, especially where the grassland has become tussocky through neglect as at Bleak House. Even though the grassland had been managed at Selar it was cut by strimming one to two weeks before transfer began in 1994.

Practices which can significantly assist at the relaying of the turves include the back-stowing of material under broken or collapsed sides as the turves are laid, the backfilling of the gaps between turves (see below), and the sequential pressing of the relaid turves, particularly the edges, to achieve a level surface. All these have been adopted at the Bleak House and Selar sites. The pressing of the turves needs some care and is only intended that excessively proud turves are pressed to any extent, and should only be done with the turf bucket. Under no circumstances should the turves be run over by the turfing machines. The rolling with agricultural equipment after laying has been used at some sites, Brocks Farm and Monkspath Meadow-Shelly Green (Byrne, 1990; Warwickshire Nature Conservation Trust, undated), but needs some caution as a general practice as it may cause damage in wet or soft ground conditions. Rolling is probably better left to later in the post-transfer management programme. Both the pressing of the turves and the backfilling under broken and undercut turves need careful attention, and in our experience these need to be closely and constantly supervised if the necessary standards are to be achieved.

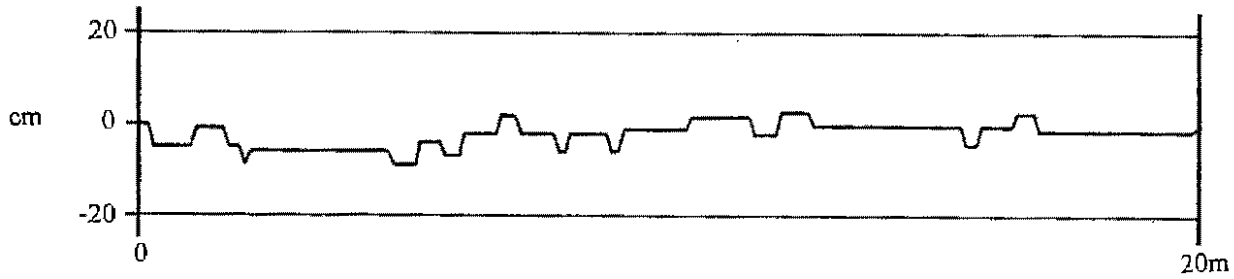
Hill (1989) was of the opinion that soft ground conditions was of significance in achieving a satisfactory even grassland surface. We have also come to the same conclusion from our field observations at the Bleak House and Selar sites. Turves should not be laid in wet weather and on soft ground. Firstly the operation should be suspended until conditions are suitable, and secondly, if appropriate, the soft ground should be dug out and replaced by dry material. Also, we have come to the opinion that the placement of the turves onto an unconsolidated layer of 100mm or more results in a more even surface on pressing. This view was arrived at during the placement of some turves onto a 100mm thick layer of transferred loose subsoil material and others directly onto the exposed in situ subsoil at the Selar site. The turves with the underlying unconsolidated material were more easy to 'bed-in' without undue compression. In the previous transplant at Bleak House, because of the need to modify the physical conditions of the receiving site, all the turves had been laid onto a placed subsoil layer of about 350mm. The result has been a particularly even surface (Fig. 2a).

Where these lifting and laying practices were rigorously adhered to at the Bleak House and Selar sites excessive unevenness was avoided, but where the contractor failed to adhere to them at the Selar site significant unevenness occurred. The practices have certainly resulted in a more even surface than achieved at Potatopot and Monkspath Meadow-Temple Balsall where they were not adopted (Figs. 1a and 1b). At Brock's Farm excessive unevenness has also been largely avoided (Fig. 2b) by the adoption of these practices; ie the levelling of the stripped ground surface in front of the turf strip being lifted, and the pressing of the proud turves with the turf bucket (Byrne, 1990).

Holes & Gaps

Park (1989) reported that gaps typically 200-300mm occurred at the laying of the turves at Thrislington. It was considered that the pushing of turves together was potentially damaging and could not be relied upon to prevent holes between the turves. To overcome the potential problem of holes, the gaps were backfilled with soil, a mixture of overburden and topsoil to minimise the establishment of weed species. The same practice was adopted at Brock's Farm (Byrne, 1990) and was supposed to have been adopted at Potatopot, although it was not implemented in full (Humphries et al, 1991).

(a) Bleak House



(b) Brocks Farm

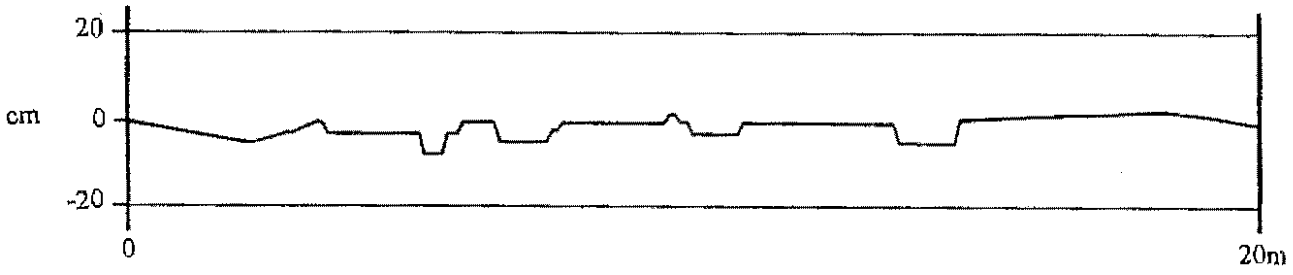


Figure 2. Topographic cross-section of transplanted grasslands.

The practice of backfilling the gaps was also adopted to good effect at Bleak House and more recently at the Selar site. In both cases a 100mm gap was specifically left between each turf. The gaps were progressively backfilled up to the ground surface and edge of the adjacent turves. Three to five rows of turves were laid and filled before further rows were placed. Selected dry subsoil has to be used as backfill and was placed by hand shovels into the gap. This was progressively firmed by foot pressure to ensure that there were no voids which could become holes on settlement or on wetting. The backfilling was followed by pressing with the turf bucket before the next batch of rows of turf were laid.

To achieve the necessary standard of work it is necessary to adopt the following. Infilling must only be undertaken in dry conditions and must be suspended in rain. It is essential that dry subsoil is used and that the turves are not trampled too much. Retrospective filling must not be allowed, and the use of wheelbarrows to achieve this is strictly taboo. During rainy periods or heavy dew the turves being backfilled must be protected from 'soiling' and trampling by covering with boards, but not plastic sheeting. The achievement of consistent gaps between turves is dependent on the turves being laid in rows with the leading edge kept straight and the turves being a consistent width. This was achieved at the Bleak House and Selar sites by close regulation of the width of turves lifted, by demarcating each row at lifting with a rope line, and constant monitoring and supervision of the contractor.

When fully and properly implemented the above practices have prevented the development of holes and have resulted in a more even final ground surface at Bleak House and Brock's Farm (Figs. 2a & 2b). However, although the practices are very simple, they do significantly slow the operations and without constant supervision there is usually a tendency for contractors to speed the operations and for the quality of the work to

become unsatisfactory. Constant supervision is therefore essential to ensure that the necessary standards are met and maintained.

Discussion & Conclusions

It is evident from past experience, and that gained from the transplants at the Bleak House and Selar sites, the physical constraints of uneven surfaces and holes on the grazing and cutting of transplanted grasslands can be avoided, or at least minimised through adopting the field practices we have described.

A key element is the necessity to supervise and monitor the work being undertaken to ensure that the required standards and specifications are met and maintained throughout the work. The other key practices are as follows. Where it is necessary to transplant thick turves (ie >100-150mm), the thickness must be closely monitored and tightly controlled, relayed turves should be carefully pressed, regular gaps between turves must be left and carefully backfilled. Where these measures are fully implemented, traditional grazing and cutting management should be possible (Humphries et al, 1995). It should therefore be possible to maintain the nature conservation value of transplanted pastures and meadows.

However, whether or not the transplant will ultimately be managed in a traditional manner can be dependent on other factors. These include tenure, management agreements, availability of stock, and size of land. All of these must be satisfactorily resolved if the transplantation is to be successful.

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